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*NIST Special Publication 305
Supplement 22*

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of Standards and
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1990 Catalog**

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National Institute of Standards and Technology

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Ernestine T. Gladden, Editor

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CATALOG STRUCTURE AND USE

Full bibliographic citations including keywords and abstracts for National Institute of Standards and Technology (NIST) (formerly National Bureau of Standards (NBS)) papers published and entered into the National Technical Information Service (NTIS) collection are cited in the "NIST Publications Announcements" section of this catalog. (Also included are papers published prior to 1990 but not reported in previous supplements of this annual catalog.) Entries are arranged by NTIS subject classifications which consist of 38 broad subject categories (see back cover) and over 350 subcategories. Within a subcategory, entries are listed alphanumerically by NTIS order number.

Four indexes are included to allow the user to identify papers by personal author, keywords, title, and NTIS order/report number. Each entry lists the appropriate title, the NTIS order number, and the abstract number.

Papers may also be identified by searching the NTIS database either online via commercially available systems such as DIALOG, or in the issues of NTIS's *Government Reports Announcements and Index* and its *Government Reports Annual Index*.

AVAILABILITY AND ORDERING INFORMATION

The highest quality and least expensive copies of NIST publications published as Government documents are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Publications cited with stock numbers (SN) should be ordered by these numbers. GPO will accept payment by check, money order, VISA, MasterCard, or deposit account. For availability and price, write to the GPO or telephone (202) 783-3238. Should an NIST publication be out of print at the GPO, its continued availability is assured at NTIS which sells publications in microfiche or paper copy reproduced from microfiche.

If an entry has a price code, such as PC A04/MF A01, the publication may be ordered from NTIS in paper copy (PC) or microfiche (MF) or both if both codes are given. Order from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A copy of the latest price code schedule is available from NTIS. NTIS will accept payment by check, money order, VISA, American Express, MasterCard, or deposit account. NTIS is the sole source of Federal Information Processing Standards (FIPS), Interagency Reports (IRs), and Grant/Contract Reports (GCRs). For more information call (703) 487-4650.

Papers noted "Not Available NTIS" may be obtained directly from the author or from the external publisher

cited. Such papers are not for sale by either the GPO or NTIS.

Two other sources for NIST publications are depository libraries (libraries designated to receive Government publications) and Department of Commerce District Offices. The depository libraries listed in Appendix A receive selected NIST publications (see inside back cover for a description of the various NIST publication series). While not every Government publication is sent to all depository libraries, certain depositories designated as Regional Depositories receive and retain one copy of all Government publications made available. Contact the depository library in your area to obtain information on what is available and where.

Department of Commerce District Offices listed in Appendix B provide ready access at the local level to publications, statistical data and summaries, and surveys. Each District Office serves as an official sales agency of the Superintendent of Documents, U.S. Government Printing Office. A wide range of Government publications can be purchased from these offices. In addition, the reference library of each District Office contains review copies of many Government publications.

NIST PUBLICATIONS ANNOUNCEMENTS

SAMPLE ENTRY

MILITARY SCIENCES

Antimissile Defense Systems

001,374

PB91-107607

PC A05/MF A01

National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

**Metrology for Space Power: Metrology Development
and Survey of Space-Based Measurements.** Interim Report.

G. J. FitzPatrick, J. K. Olthoff, E. D. Simmon, and
C. P. Fenimore, Sep 90, 76 p

NISTIR-4422

Contract F-000000

Key words: *Antimissile defense, *Metrology, Aerospace engineering, Fiber optics, Electrooptics, Magneto-optics, Electric current meters, Reliability, Measurement, *Ballistic missile defense, Space based, Sensors.

The report documents the technical progress in the three investigations which make up the project 'SDI Measurement Techniques' funded by the Strategic Defense Initiative Office.

NTIS Subject Category

NTIS Subcategory

Abstract Number

NTIS order number

Availability

Price Codes

Corporate or performing organization

Report Title

Personal authors

Report date

Page count

Report Number

Contract or grant number

Keywords: * indicates keyword index entry

Abstract

ADMINISTRATION & MANAGEMENT

Management Information Systems

000,001

PB91-120162

PC A05/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Methodology for Certifying Sensitive Computer Applications.

E. Roback. Nov 90, 85p NISTIR-4451

Keywords: *Management, *Data processing security, *Information systems, Information resource management, Methodology, National government, Government policies, Standards, *Computer security, *Computer application certification, *Certification, Office automation, Government agencies, Federal automated information systems security programs.

The Methodology for Certifying Sensitive Computer Applications defines and describes a standard certification methodology employed by the U.S. Department of Commerce to (a) ensure that sensitive applications meet applicable federal policies, regulations, and standards and (b) demonstrate that installed security safeguards are adequate for the sensitivity or criticality of the data processed, as required by OMB Circular A-130. The methodology takes the reader through the certification process step-by-step, including determining whether an application requires certification, defining functional security requirements, defining system security specifications, reviewing system security features design, testing those features, accepting the test results for a certification decision, and the final decision to implement and operate the application. The document also describes how audits, internal control reviews and risk analyses fit into the certification process.

Management Practice

000,002

PB90-162108

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.

Data Model Development and Validation for Product Data Exchange.

M. J. Mitchell, Y. Yang, S. Ryan, and B. Martin. Feb 90, 17p NISTIR-90/4241

Keywords: *Product development, *Data bases, Manufacturing, Information systems, Proving, Testing, Methodology, Specifications, *Product Data Exchange Specification, Data model.

The paper describes some strategic and technical issues which directly impact the effort. Experience with actual validation activities identified the need to develop additional requirements documentation. The paper serves as the background for a series of papers which will describe the actual methods and processes used in the requirements specification activity. Three types of results came out of the requirements activity. The form of the project deliverables changed considerably. Insights on conducting requirements activities were identified. New issues on the relationship of the work to portions of the specification were identified.

000,003

PB91-107615

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Management Practice

Development Plan Configuration Management Systems and Services.

S. Ressler, and S. Katz. Sep 90, 26p NISTIR-4413
Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Project management, *Management, Objectives, Standards, Manufacturing, Documents, Personnel, Equipment, Computer software, Standard for the Exchange of Product model data, *Product data exchange, *Configuration management, *National Institute of Standards and Technology, Computer aided acquisition and logistics support, Goals, Software engineering.

The paper outlines the development plan for a configuration management system at NIST. This system will control both document and software development for four organizations: the International Organization for Standardization (ISO), the IGES/PDES Organization (IPO), PDES, Inc., and the National PDES Testbed (NPT). The primary goal of configuration management is to provide an orderly framework within which the development of the STEP standard can take place. The paper provides an overview of configuration management, describes the procedural and technical issues that must be handled in developing a system, outlines the steps that will be taken to reach the goal and defines the deliverables and the resources needed.

Personnel Management, Labor Relations & Manpower Studies

000,004

PB90-193244 Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Mfg. Engineering.
Workforce of U.S. Manufacturing in the Post-Industrial Era.

Final rept.
D. A. Swyt. 1988, 21p
Pub. in Technological Forecasting and Social Change 34, p231-251 1988.

Keywords: *Manufacturing, *United States, *Personnel, Forecasting, Personnel development, Vocational guidance, Analyzing, Reprints, *Labor force, Occupations, Training.

United States manufacturing is moving on a well-established trajectory of increased knowledge intensity represented by the rise in the proportion of its workforce in technical-professional occupations. Based on BLS data and a new analytical tool, the paper shows an 80-year linear trend in the evolution of the total workforce; establishes characteristic ages for 20 manufacturing sectors, including 1910 for autos and 2015 for computer equipment; and projects a rise of technical-professional workers in the next century to 50% of the workforce.

Productivity

000,005

PB90-218082 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD.
Malcolm Baldrige National Quality Improvement Award.

Final rept.
C. W. Reimann. 1988, 3p
Pub. in Quality Progress, p71-73 Jan 88.

Keywords: *Quality control, *Leadership, Legislation, Productivity, Awards, Reprints, *Malcolm Baldrige National Quality Improvement Act of 1987, Innovations, Technology transfer.

The report summarizes the key provisions of the Malcolm Baldrige National Quality Improvement Act of 1987 (P.L. 100-107) which created a U.S. national award for quality improvement and leadership.

Research Program Administration & Technology Transfer

000,006

PB90-172453 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Cooperative Research Opportunities at NIST (National Institute of Standards and Technology).

Special pub. (Final).
Oct 89, 61p NIST/SP-763
Also available from Supt. of Docs. as SN003-003-02992-1. Supersedes PB87-157236.

Keywords: *Research management, Metallurgy, Manufacturing, Computers, Chemical analysis, Applications of mathematics, Atomic physics, Optics, Ceramics, Electronics, Fires, Reliability, *Coordinated research programs, *National Institute of Standards and Technology.

The report contents include: Cooperative research at NIST; Research opportunities; Analytical chemistry; Applied mathematics; Atomic, molecular, and optical physics; Building technology; Ceramics; Chemical technology; Computer systems; Electronics and electrical engineering; Fire research; Manufacturing engineering; Materials reliability; Metallurgy; Neutron scattering and diffraction; Nondestructive evaluation; Polymers; Radiation research; and Standard reference data.

000,007

PB90-204694 PC A13/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.

Transcript of Hearing on Improving U.S. Participation in International Standards Activities. Third Day: April 5, 1990.

5 Apr 90, 297p NISTIR-4306
See also PB90-204702.

Keywords: *United States, *Standards, *Standardization, Government policies, *National Institute of Standards and Technology, Accreditation, Certification, Global aspects, Hearings.

The National Institute of Standards and Technology held a hearing on April 3, 1990 through April 5, 1990 to gather information, insights, and comments related to U.S. participation in international standards-related activities and possible government actions. The transcript relates the activities of the third day.

000,008

PB90-204702 PC A11/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.

Transcript of Hearing on Improving U.S. Participation in International Standards Activities. First Day: April 3, 1990.

3 Apr 90, 234p NISTIR-4304
See also PB90-204694.

Keywords: *United States, *Standards, *Standardization, Government policies, *National Institute of Standards and Technology, Certification, Accreditation, Global aspects, Hearings.

The National Institute of Standards and Technology held a hearing from 3 April 1990 through 5 April 1990 to gather information, insights, and comments related to U.S. participation in international standards-related activities and possible government actions. The transcript relates the activities of the meeting's first day.

000,009

PB90-207150 PC A12/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.

Transcript of Hearing on Improving U.S. Participation in International Standards Activities, Second Day: April 4, 1990.

Apr 90, 256p NISTIR-4305
See also PB90-204702 and PB90-204694.

Keywords: *United States, *Standards, *Standardization, Government policies, *National Institute of Standards and Technology, Accreditation, Certification, Global aspects, Hearings.

The National Institute of Standards and Technology held a hearing on April 3, 1990 through April 5, 1990 to gather information, insights, and comments related to U.S. participation in international standards-related ac-

tivities and possible government actions. The transcript relates the activities of the second day.

000,010

PB90-207283 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Physics, Chemistry and Engineering in the 1990's. H. Hellwig. Apr 90, 45p NISTIR-90/4284

Keywords: *Physics, *Chemistry, *Engineering, *Research management, Management planning, Surveys, Trends, Technology, *National Institute of Standards and Technology.

During the past several years, the National Research Council (NRC) commissioned and published four surveys which are directly relevant to physical, chemical and engineering research. The report summarizes the considerable complexity of these surveys and facilitates the planning of research at the National Institute of Standards and Technology. The four surveys, their structure, concept and content are introduced and observations common to all four surveys are reported. Common observations include those on interdisciplinary linkages, 'new disciplines', the continuum of science and engineering, and the importance of instrumentation. The areas of application and the research opportunities in physics, chemistry and engineering, as seen by the respective surveys, are summarized. The report concludes with a listing of priority areas for research as recommended by the four NRC surveys.

000,011

PB90-215534 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Services.

Government's Role in Standards-Related Activities: Analysis of Comments.

W. G. Leight. Jul 90, 37p NISTIR-4367
See also PB90-207150.

Keywords: *United States, *Standards, *Standardization, National government, International standards, Certification, Hearings, *National Institute of Standards and Technology.

The National Institute of Standards and Technology, supported by a panel of standards experts from other agencies, conducted a hearing on April 3-5, 1990, to gather information, insights, and comments relating to improving U.S. participation in international standards-related activities and to possible Government actions. Oral presentations were made by 65 organizations and individuals; written submissions were received from 257 others. Thorough review of the hearing transcripts and the complete supplementary written record reveals a number of areas where the private sector and the Federal Government should take constructive actions, especially with respect to coordinating mechanisms for conformity assessment processes.

000,012

PB90-235250 (Order as PB90-235243, PC A06)
National Inst. of Standards and Technology, Gaithersburg, MD.

New Program and Directions at the National Institute of Standards and Technology.

Bi-monthly rept.
D. R. Johnson. 1990, 5p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n1 p1-5 Jan-Feb 90.

Keywords: *Research projects, Manufacturing, Standards, Trade, Organization charts, Technology transfer, *US NBS, *US NIST.

The Trade Act of 1988 created the National Institute of Standards and Technology (NIST) from the National Bureau of Standards (NBS). In addition to explicitly defining and reconfirming the traditional measurement services, the law assigned new responsibilities to NIST to assist U.S. industry in capitalizing on new technologies developed in the U.S. scientific and technical community at a faster rate. This article describes the new programs being established at NIST to comply with this mandate and the new organizational unit at NIST that brings together the traditional services and the new programs.

000,013

PB90-257635 PC A08/MF A01

Research Program Administration & Technology Transfer

National Inst. of Standards and Technology, Gaithersburg, MD.

Technology-Based Economic Development: A Study of State and Federal Technical Extension Services.

Special pub. (Final).

R. E. Chapman, M. K. Clarke, and E. Dobson. Jun 90, 169p NIST/SP-786

Also available from Supt. of Docs. as SN003-003-03026-1. Prepared in cooperation with National Governors' Association, Washington, DC. Center for Policy Research and Analysis.

Keywords: *Economic development, *Technology innovation, *State government, *Technology transfer, Technical assistance, Promoting, Government policies, National government, Reviews, Surveys, Information services, Directories, *Small businesses, *Industrial development, *State programs.

The document reports on a study of state and federal technology extension services. The study was requested to capture information on the various programs the states are using to promote technological innovation. To date, no study of state economic development - technological innovation activities has focused on identifying those programs which reach out to provide technological assistance to businesses at the local level, or on the degree to which such programs make use of federal programs and activities in carrying out their missions. The study serves to document these activities as well as identify potential sources of synergism between the states and federal technology transfer programs. The purpose of the report is to summarize the study's major findings and to provide recommendations on the future federal role in technology extension. A two-pronged approach was used in carrying out the study. The first part of the study focused on an in-depth review of the literature on technology transfer and technology extension services. The second part of the study involved a nationwide survey of state and federal extension services.

000,014
PB90-271818

PC A18/MF A03

National Inst. of Standards and Technology, Gaithersburg, MD. Information Resources and Services Div.

Publications of the National Institute of Standards and Technology, 1989 Catalog.

Rept. for Jan-Dec 89.

R. J. Pardee, and E. T. Gladden. Jul 90, 411p NIST/SP-305-SUPPL-21

Also available from Supt. of Docs. as SN003-003-03037-6. See also PB89-218382.

Keywords: *Catalogs(Publications), *Bibliographies, Science, Technology, Research management, *National Institute of Standards and Technology.

Contents:

About the National Institute of Standards and Technology;

Catalog structure and use;

Availability and ordering information;

NIST publications announcements;

Indexes;

Appendixes;

Order forms;

NIST technical publications program;

NTIS subject categories.

000,015
PB91-134288

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Office of Energy-Related Inventions.

Fostering General Awareness of the Importance of Inventiveness.

Final rept.

G. P. Lewett. 1987, 15p

Pub. in Proceedings of International Seminar Inventiveness for Development Purposes, Plovdiv, Bulgaria, November 12-15, 1985, p83-97 1987.

Keywords: *Technology innovation, Research management, Technology transfer, Reprints, *ERIP(Energy Related Inventions Program), Small businesses, Entrepreneurship.

The paper describes the Energy Related Inventions Program, and insights derived from operation of the program. The focus is on the need to increase general awareness of the importance of inventiveness as a means of stimulating and encouraging technological innovation.

000,016
PB91-134296

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Office of Energy-Related Inventions.

Innovation: Analyzing the Process.

Final rept.

G. P. Lewett. 1985, 16p

Sponsored by Utah Innovation Center, Salt Lake City. Pub. in Proceedings of International Technical Innovation and Entrepreneurship Symposium (1st), Salt Lake City, UT., September 11-13, 1985, 16p.

Keywords: *Technology innovation, Research management, Technology transfer, Reprints, *Small businesses, *Entrepreneurship, ERIP(Energy Related Inventions Program), Commercialization.

The paper is based on findings and projections from operation of the Energy Related Inventions Program (ERIP) which is conducted by the Department of Energy (DOE) and the National Bureau of Standards (NBS). In ERIP, the Government role is to facilitate operation of the private sector-small business innovation process. While many major inventions have come from individuals and very small businesses, the general lack of credibility of the individual inventor and the very small business is a deterrent to potential supporters. ERIP is designed to counter this barrier. In addition, however, the program also serves as a 'test-bed.' That is, data are developed and insights gained as to significant factors involved in the overall national innovation process; activities are then initiated to stimulate and improve process operation. The presentation calls attention to this facet of ERIP, and to two specific areas in which activity could have a favorable impact on innovation.

AERONAUTICS & AERODYNAMICS

Aerodynamics

000,017
PB91-118570

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Wind Tunnel Tests and Equivalent 1-Minute Loads for the Design of Cladding Glass.

Final rept.

E. Simiu, and E. M. Hendrickson. 1988, 10p

Pub. in Jnl. of Wind Engineering and Industrial Aerodynamics 29, n1-3 p49-58 1988.

Keywords: *Glass, *Design, *Wind pressure, Stress analysis, Loads(Forces), Strength, Mechanical properties, Estimating, Fracturing, Reprints, *Wind tunnel tests, *Wind loads.

Three methods for converting fluctuating wind loads to equivalent 1-minute constant loads have been proposed in the literature: (1) a method based on fracture mechanics models and nonlinear stress analysis, developed at the National Bureau of Standards; (2) a simplified method applicable to annealed glass that assumes a linear load-stress relationship; and (3) a simplified method that assumes a linear load-stress relationship and, in addition, that the glass strength is affected only by the peak wind pressure rather than by the whole time history of the load. The paper compares the three methods for estimating equivalent 1-minute wind loads and examines the effect on the estimates of assuming different distribution parameters of glass strength and different fracture mechanics parameters. The results suggest that the second of the above methods is adequate in most cases but that the third method yields equivalent 1-minute loads that are too low by about 15% for annealed glass and about 50% for heat strengthened glass.

Aircraft

000,018
PB90-155821

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

Recent Improvements in Time-Domain EMC (Electromagnetic Compatibility) Measurement System.

J. W. Adams, A. R. Ondrejka, K. H. Cavcey, J. E.

Cruz, H. W. Medley, and J. H. Grosvenor. Nov 89,

27p NISTIR-89/3927

Sponsored by Army Aviation Systems Command, St. Louis, MO.

Keywords: *Electromagnetic compatibility, *Electromagnetic fields, *Aircraft, Power spectra, Electromagnetic radiation, Horn antennas, Graphs(Charts), Tests, Resonant frequency, Electric fields.

Improved techniques for determining critical resonant frequencies and the current response of internal wiring due to external fields for rotary-wing aircraft are given. The measurement method uses a train of low-level, radiated pulses. These do not disturb other spectrum users, nor do other spectrum users significantly disturb the measurements. The fields are low, a distinct advantage from both cost and personnel hazard standpoints. The problems that should be addressed before the full potential of the technique can be realized are discussed.

000,019
PB90-217712

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.

World Modeling for Sensory Interactive Trajectory Generation.

Final rept.

L. Kelmar, and R. Lumia. 1990, 8p

Pub. in Proceedings of International Symposium on Robotics and Manufacturing (3rd), Vancouver, Canada, July 18-20, 1990, 8p.

Keywords: *Models, Systems engineering, Manipulators, Algorithms, Reprints, *Trajectory control, *Robotics, Control systems, Computer vision, Sensory feedback.

A major consideration in the design of sensory interactive trajectory generation software for a Flight Telerobotic Servicer (FTS) is the availability and maintenance of a current model of the manipulator's world. The paper discusses the role of world modeling in support of trajectory generation and execution. The paper discusses the world modeling modules of a hierarchical control system which facilitate sensory interactive trajectories by decoupling and supporting the sensory and manipulator planning processes. It defines the types of information which should be included in the interfaces to the modules, as well as the modules' structure and function. Finally, it discusses the implementation and results of a particular sensory interactive algorithm performed in our laboratory.

AGRICULTURE & FOOD

Food Technology

000,020
PB90-169814

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Examination of Gamma-Irradiated Fruits and Vegetables by Electron Spin Resonance Spectroscopy.

Final rept.

M. F. Desrosiers, and W. L. McLaughlin. 1989, 4p

Pub. in Radiation Physics and Chemistry 34, n6 p895-898 Dec 89.

Keywords: *Fruits, *Vegetables, *Gamma irradiation, *Electron paramagnetic resonance, Irradiated foods, Electromagnetic radiation detection, Dosimetry, Reprints.

The electron spin resonance (ESR) spectra of the seeds, pits, shells, and skins of a variety of irradiated fruits and vegetables were measured. All spectra, control and irradiated, contained a single resonance with a g-factor of 2.00. Additional resonances due to Mn(2+) were observed for the drupelets of blackberries and red raspberries. An unusual radiation-induced radical

Food Technology

was observed for irradiated mango seed; however, the signal decayed completely within a few days. It was concluded that only in a few specialized cases could the ESR resonances observed be suitable for postirradiation monitoring or dosimetry.

000,021
PB90-254368 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Materials.
NBS Standard Reference Materials for Validating Determinations of Micronutrients and Toxic Substances in Foods.
 Final rept.
 R. Alvarez. 1989, 3p
 Pub. in Nutrient Availability: Chemical and Biological Aspects, p66-68 1989.

Keywords: *Food analysis, *Food contamination, *Nutrients, Cholesterol, Vitamins, Trace elements, Quality control, Chemical analysis, Reprints, *Standard reference materials, *Toxic substances.

Instrumental methods for determining nutrients and potentially hazardous substances in foods and other biological materials have replaced older, time-consuming procedures. Because the instruments are usually calibrated with laboratory synthetic standards, the accuracy of the results depends on the reliability of the standards. If the constituents of interest and matrix components are of questionable purity, the analytical determinations, especially of micronutrients and hazardous constituents will be suspect. An independent method for validating analytical results is to use certified reference materials, such as those issued by the National Bureau of Standards as Standard Reference Materials. Examples of such SRMs include the recently characterized materials, wheat flour, (SRM 1567a) and rice flour (SRM 1568a), which are certified for nutrients and potentially toxic trace elements, and a fortified coconut oil (SRM 1563), which is certified for cholesterol and selected fat soluble vitamins.

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Gylden Systems: Rotation of Pericenters.
 Final rept.
 A. Deprit, B. R. Miller, and C. A. Williams. 1989, 32p
 Pub. in Astrophysics and Space Science 159, p239-270 1989.

Keywords: *Celestial mechanics, Perturbation theory, Planetary orbits, Solar wind, Gravitation, Reprints, Canonical transformations.

A canonical transformation in phase space and a rescaling of time are proposed to reduce a Keplerian system with a time dependent Gaussian parameter to a perturbed Keplerian system with a constant Gaussian parameter. When the time variation is slow, the perturbation through second order in the reduced problem is conservative, and, as a result, the orbital space of the averaged system is a sphere on which the phase flow causes a differential rotation representing a circulation of the line of apsides. The flow presents two isolated singularities corresponding to circular orbits travelled respectively in the direct and in the retrograde sense, and a degenerate manifold of fixed points corresponding to the collision orbits. As an application, an estimate is offered for the apsidal rotation that a second order time derivative in the mass of the sun would induce on planetary orbits.

000,024
PB91-117986 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Microwave and Optical Lunar Transponders.
 Final rept.
 P. L. Bender, J. E. Faller, J. L. Hall, J. J. Degnan, J. O. Dickey, X. X. Newhall, J. G. Williams, R. W. King, L. O. Macknik, D. O'Gara, R. L. Ricklefs, P. J. Shelus, A. L. Whipp, J. R. Wiant, and C. Veillet. 1990, 7p
 Pub. in Proceedings of NASA Workshop Astrophysics from the Moon, Annapolis, MD., February 5-7, 1990, p647-653 1990.

Keywords: *Radio transponders, Microwave equipment, General relativity, Geodynamics, Tests, Reprints, Optical transponders, Earth rotation, Lunar bases, Lunar librations, Lunar orbits, Lunar tides, K band.

The location at a lunar base of an additional laser ranging retroreflector package and a tracking beacon would result in increased ranging accuracy through augmentation of the data rate and from more uniform coverage through the lunar cycle. However, an even more attractive approach would be to place a combination of small microwave and optical transponders on the moon. This could improve the lunar ranging accuracy by nearly two orders of magnitude and also simplify the measurements. The K-band microwave transponders would be operated at the lunar base and at two remote sites to permit much improved lunar libration and tidal displacement measurements. A two-wavelength laser transponder also would be operated at the lunar base so that accurate tropospheric propagation corrections can be made. This would make possible major improvements in measurements of the lunar orbit and of the Earth's rotation, as well as in tests of general relativity.

Astrophysics

000,025
DE86008715 PC A02/MF A01
 Los Alamos National Lab., NM.
Nova Outburst Modeling and Its Application to the Recurrent Nova Phenomenon.
 W. M. Sparks, S. Starrfield, and J. Truran. Dec 85, 13p LA-UR-86-806, CONF-851272-1
 Contract W-7405-ENG-36
 Conference on RS Ophiuchi and the recurrent nova phenomenon, Manchester, England, 1 Dec 1985.

Keywords: *Novae, Calculation Methods, Hydrodynamics, Star Accretion, Star Evolution, Star Models, ERDA/640102.

The thermonuclear runaway (TNR) theory for the cause of the common novae is reviewed. Numerical simulations of this theory were performed using an implicit hydrodynamic Lagrangian computer code. Rele-

vant physical phenomena are explained with the simpler envelope-in-place calculations. Next the models that include accretion are discussed. The calculations agree very well with observations of common novae. The observational differences between common novae and recurrent novae are examined. We propose input parameters to the TNR model which can give the outburst characteristics of RS Ophiuchi and discuss the implications. This review is concluded with a brief discussion of two current topics in novae research: shear mixing on the white dwarf and Neon novae. 36 refs., 4 figs. (ERA citation 11:028651)

000,026
DE87001962 PC A02/MF A01
 Los Alamos National Lab., NM.
Theoretical and Observational Review of Results on Nova Explosions Occurring on ONeMg White Dwarfs.
 S. Starrfield. 7 Jul 86, 13p LA-UR-86-3512, CONF-860793-2
 Contract W-7405-ENG-36
 IAP recontre on nuclear astrophysics, Paris, France, 7 Jul 1986.
 Portions of this document are illegible in microfiche products.

Keywords: Carbon 12, Carbon 13, Hydrodynamics, Magnesium, Neon, Nitrogen 14, Nitrogen 15, Oxygen 16, Oxygen 17, Reviews, White Dwarf Stars, ERDA/640102, *Noval.

The nova outburst is the second most violent explosion that occurs in a galaxy. This review presents the recent observational and theoretical studies that have demonstrated that there exist two classes of nova outburst. One type of nova occurs on a CO white dwarf and the other type of nova occurs on an ONeMg white dwarf. The second class of outbursts are much more violent and occur much more frequently than the first class of outbursts. Hydrodynamic simulations of both kinds of outbursts are in excellent agreement with the observations. 51 refs. (ERA citation 12:012569)

000,027
DE87001982 PC A02/MF A01
 Los Alamos National Lab., NM.
Using Nonradial Pulsations to Determine the Envelope Composition of Very Evolved Stars.
 S. Starrfield. 7 Jul 86, 8p LA-UR-86-3684, CONF-860793-4
 Contract W-7405-ENG-36
 IAP recontre on nuclear astrophysics, Paris, France, 7 Jul 1986.

Keywords: *Dwarf Stars, Carbon, Helium, Hydrogen, Oxygen, *Pulsating Variable Stars, Star Evolution, Surfaces, ERDA/640102.

Recent observational and theoretical studies of the ZZ Ceti variables (DA degenerate dwarfs), the DBV variables (DB degenerate dwarfs), and the GW Vir variables (DO degenerate dwarfs) have shown them to be pulsating in nonradial g sup + -modes. The pulsation mechanism has been identified for each class of variable star and, in all cases, involves predictions of the stars envelope composition. The ZZ Ceti variables must have pure hydrogen surface layers, the DBV stars must have pure helium surface layers, and the GW Vir stars must have carbon and oxygen rich surface layers. 44 refs. (ERA citation 12:019269)

000,028
N88-13185/9
 (Order as N88-13092/7, PC A07/MF A01)
 Joint Inst. for Lab. Astrophysics, Boulder, CO.
Measurements of Stellar Magnetic Fields: Empirical Constraints on Dynamo and Rotational Evolution Theories. Abstract Only.
 J. L. Linsky, and S. H. Saar. Jul 87, 1p
 In Colorado Univ., Cambridge Workshop on Cool Stars, Stellar Systems and the Sun (5th), 1p.

Keywords: *Dwarf stars, Field strength, Stellar activity, Stellar evolution, *Stellar magnetic fields, Stellar spectra, Chronology, Dynamo theory, Gas pressure, Line spectra, Photosphere, Zeeman effect.

Recent results are presented of an ongoing survey of the magnetic field properties of over 30 dwarf stars of spectral types F to M. The data was analyzed using a modification of the Robinson technique that includes line saturation, the full Zeeman patterns, and compensation for line blends. The derived magnetic parameters, the mean active region field strength (B) and

ASTRONOMY & ASTROPHYSICS

Astronomy & Celestial Mechanics

000,022
N89-13317/7
 (Order as N89-13310/2, PC A14/MF A01)
 National Inst. of Standards and Technology, Gaithersburg, MD.
Application of PN and Avalanche Silicon Photodiodes to Low-Level Optical Radiation Measurements.
 G. Eppeldauer, and A. R. Schaefer. Sep 88, 41p
 In NASA, Ames Research Center, Second Workshop on Improvements to Photometry p 111-151.

Keywords: Detectors, Light (Visible radiation), Optical measurement, *Photodiodes, Radiation measuring instruments, *Research facilities, Amplifiers, Design analysis, Silicon, Solid state, Silicon diodes, Avalanche diodes.

New approaches to the discovery of other planetary systems require very sensitive and stable detection techniques in order to succeed. Two methods in particular, the astrometric and the photometric methods, require this. To begin understanding the problems and limitations of solid state detectors regarding this application, preliminary experiments were performed at the National Bureau of Standards and a low light level detector characterization facility was built. This facility is briefly described, and the results of tests conducted in it are outlined. A breadboard photometer that was used to obtain stellar brightness ratio precision data is described. The design principles of PN and avalanche silicon photodiodes based on low light level measuring circuits are discussed.

000,023
PB90-136391 Not available NTIS

area filling factor (f) occupied by these fields, refer to magnetic regions outside of spot umbrae. Attention is called to important trends emerging in the data that provide empirical constraints on acceptable dynamo theories: (1) B increases toward T sub eff and larger g such that B approximately = B sub eq = (δp IP sub gas) sup 0.5. Thus in the photosphere B is determined by the balance of magnetic pressure and the gas pressure, largely independent of the nature of the dynamo; (2) B and f are uncorrelated and fB is not a constant; (3) f does not depend on T sub eff; and (4) B is independent of stellar age, but f varies as t sup -0.6 for stars older than the Pleiades. This result is consistent with theoretical predictions of the angular momentum history of dwarf stars. It is concluded that decrease in activity with stellar age is due to the decrease in f as a star evolves.

000,029
N89-13320/1

(Order as N89-13310/2, PC A14/MF A01)
National Inst. of Standards and Technology, Gaithersburg, MD.

Introduction to Blocked Impurity Band Detectors (Abstract Only).

J. Geist, Sep 88, 1p
In NASA, Ames Research Center, Second Workshop on Improvements to Photometry p 193.

Keywords: *Detectors, Impurities, Photomultiplier tubes, Spectral bands, Accuracy, Astronomy, Light (Visible radiation), Planets, Seismology, Stars.

Blocked impurity band detectors fabricated using standard silicon technologies offer the possibility of combining high sensitivity and high accuracy in a single detector operating in a low background environment. The solid state photomultiplier described by Petroff et al., which is a new type of blocked impurity band detector, offers even higher sensitivity as well as operation in the visible spectral region. The principle of operation and possible application of blocked impurity band detectors for stellar seismology and the search for extra-solar planets are described.

000,030
N89-16614/4

(Order as N89-16635/1, PC A19/MF A01)
National Aeronautics and Space Administration, Greenbelt, MD, Goddard Space Flight Center.

IUE's Legacy for the Future: The Final Archive and Goals for Its Implementation.

J. L. Linsky, and J. Nichols-bohlin. cJun 88, 5p
In Esa, Proceedings of the Celebratory Symposium on a Decade of Uv Astronomy with the Iue Satellite, Volume 2 p 391-395.

Keywords: *Data bases, *IUE, Spaceborne astronomy, Ultraviolet astronomy, Ultraviolet spectra, Data processing, Signal to noise ratios, Spectrum analysis, User requirements.

Requirements for the IUE archive, and how the signal/noise (S/N) ratio in photometrically corrected images can be enhanced considerably by cross-correlating the fixed pattern in a data image with that in a suitable flat-field image are described. From these cross-correlations it is feasible to derive an accurate geometrical correction to apply to the data image before applying the intensity transfer functions. The standard IUE processing software does not generate a sufficiently accurate geometric correction so that typical spatial errors of 1 to 2 pixels conspire with the large fixed pattern in raw images to produce significant misregistration noise. Tests on flat-field images demonstrate that an explicit geometric correction procedure can avoid most of the misregistration noise and can thereby improve the S/N ratio of IUE data by factors of 1.5 to 2.4.

000,031
PB90-136276

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Spectral Diagnostics from X-ray to Radio Wavelengths.

Final rept.
J. L. Linsky. 1989, 20p
Grant NGL-06-003-057, Contract NASA-NAG5-82
Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Proceedings of IAP Astrophysics Meeting on Modeling the Stellar Environment: How and Why, Paris, France, June 28-30, 1989, p97-116.

Keywords: *Astronomical spectroscopy, Line spectra, Ultraviolet spectra, X-ray spectra, Stellar atmospheres,

Radio astronomy, Stellar chromospheres, Stellar coronal.

'Astronomers are a little like poets: they MAKE the universe by interpreting messages, extrapolating spectra, and inventing 'models' of the cosmos or of stars - fictional constructions whose observable part constitutes only a small fraction of the whole, and which only the inductive logic of the theoretician allows us to consider as representing unique physical reality.' -Jean-Claude Pecker (1970).

000,032

PB90-169566

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Coronal Temperatures of Selected Active Cool Stars as Derived from Low Resolution 'Einstein' Observations.

Final rept.
O. Vilhu, and J. L. Linsky. 1990, 4p
Contract NSG5-986

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Advances in Space Research 10, n2 p139-142 1990.

Keywords: X ray spectra, Temperature, Reprints, *Cool stars, *Stellar coronas, HEAO 2.

Mean coronal temperatures of some active G-K stars were derived from Rev1-processed EINSTEIN-observatory's IPC-spectra. The combined X-ray and transition region emission line data are in rough agreement with static coronal loop models. Although the sample is too small to derive any statistically significant conclusions, it suggests that the mean coronal temperature depends linearly on the inverse Rossby-number, with saturation at short rotation periods. For an individual active star (VW Cep), the IPC-temperature was found to depend on the (variable) X-ray flux.

000,033

PB90-169574

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Ultraviolet Variability of HD 45166 (qWR+B8 V): Evidence for Stellar Wind Radiative Instabilities.

Final rept.
A. J. Willis, I. D. Howarth, D. J. Stickland, and S. R. Heap. 1989, 13p
Pub. in Astrophysical Jnl. 347, p413-425, 1 Dec 89.

Keywords: Ultraviolet spectra, Reprints, *HD 45166 star, *Stellar winds, *Wolf-Rayet stars, High resolution, Instability, IUE.

High-resolution IUE spectroscopy of the low-mass qWR star HD 45166, obtained at several epochs during 1980-1988, reveals a complex pattern of variability in its stellar wind emission lines, P Cygni profiles, and highly ionized photospheric absorption spectrum. The authors' most intensive observations, obtained during a 36 hr continuous run in 1988 February, show the presence of discrete absorption components (DACs) in the C IV wavelength 1550 resonance doublet. These DACs can blend to give the appearance of a well-developed P Cygni absorption profile seen at some other times, roughly doubling the column density of the ground state C(3+) ions in the wind.

000,034

PB90-169723

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Stability of Kuzmin/Toomre Discs.

Final rept.
J. Frank, and I. Shlosman. 1989, 4p
Contract NAGW-766

Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 346, p118-121, 1 Nov 89.

Keywords: Stability, Reprints, *Stellar disks, Stellar envelopes.

The authors consider a simple two-component system consisting of a Kuzmin/Toomre disk embedded in a spherically symmetrical 'halo' with Plummer's density distribution. They examine analytically the bounds on the mass fraction of the disk component which result from applying the semiempirical criterion against bar instabilities due to Ostriker and Peebles, and compare their results with recent numerical simulations. They find that the locus $t = 0.14$, calculated using analytic approximations for a variety of rotation laws, agrees

reasonably well with the neutral stability line derived from numerical results.

000,035

PB90-169731

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Survey of the Radio Continuum Emission of RS Canum Venaticorum and Related Active Binary Systems.

Final rept.
S. A. Drake, T. Simon, and J. L. Linsky. 1989, 26p
Grant NGL-06-003-057

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Astrophysical Jnl. Supplement Series 71, p905-930 Dec 89.

Keywords: *Binary stars, *Radio sources(Astronomy), Surveys, Reprints.

The authors have observed 77 RS CVn and related active binary systems with the VLA (Very Large Array) at a continuum frequency of 4.86 GHz, and have detected 33 as radio sources above a typical (3 Sigma) threshold of 0.2 mJy. Combining their new data with other VLA 6 cm observations of these and similar systems, they bring the total number thus observed to 122, of which 66 were detected on one or more occasions. The authors have searched for correlations of the radio properties of these systems with various systemic and stellar parameters, e.g., orbital and rotational periods, rotational velocities, and with C IV and X-ray emissions, using a maximum-likelihood technique in order to include the radio upper limits in the correct statistical way.

000,036

PB90-169749

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Radio Continuum Emission from the Ionized Stellar Winds of Warm Supergiants.

Final rept.
S. A. Drake, and J. L. Linsky. 1989, 11p
Grant NGL-06-003-057

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Astronomical Jnl. 98, n5 p1831-1841 Nov 89.

Keywords: *Radio sources(Astronomy), Reprints, *Supergiant stars, *Stellar winds, Stellar mass ejection, Rigel star.

The authors have used the Very Large Array at an observing wavelength of 6 cm to survey 25 supergiants of spectral types between B2 and F8. They have definitely detected only one of these stars (beta Ori < - Rigel) as a radio continuum source. Rigel may also be an X-ray source.

000,037

PB90-169764

Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

IUE Observations of the M Dwarfs CM Draconis and Rossiter 137B: Magnetic Activity at Saturated Levels.

Final rept.
O. Vilhu, C. W. Ambruster, J. E. Neff, J. L. Linsky, A. Brandenburg, I. V. Ilyin, and N. I. Shakovskaya. 1989, 8p

Pub. in Astronomy and Astrophysics 222, p179-186 1989.

Keywords: *Dwarf stars, *Binary stars, Reprints, *CM Draconis star, *Rossiter 137B star, Pre-main sequence stars, M stars, Stellar flares, Stellar activity, Stellar magnetic fields, IUE.

The authors present IUE observations of two active M dwarfs, CM Draconis and Rossiter 137B, that they expect to be almost totally convective. CM Dra was also monitored optically during the IUE observations, and two flares were detected. CM Dra is a binary star (M4+M4, P=1.27d) and Rst 137B(M3-5) forms a physical pair with the rapidly rotating pre-main sequence K star AB Dor (HD 36705). The activity of CM Dra is due to the forced rotation in a close binary, while the authors suppose Rst 137B to rotate fast enough (due to its young age) to generate its magnetic activity.

000,038

PB90-170507

Not available NTIS

Astrophysics

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div. **Search for Methylene in the Orion Nebula.** Final rept. J. M. Hollis, P. R. Jewell, and F. J. Lovas. 1989, 5p Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in *Astrophysical Jnl.* 346, p794-798, 15 Nov 89.

Keywords: *Interstellar matter, Chemical radicals, Rotational spectra, Microwave spectra, Radio astronomy, Reprints, *Orion Nebula, *Methylene radicals, Interstellar radiation.

The authors have conducted a deep search for the J = 4-3 and 5-4 fine-structure components of the N(KK) = 4(04)-3(13) rotational transition of methylene (CH₂) toward the hot core of the Orion-KL nebula. They detected an approximate sigma emission feature which is frequency-coincident with a hyperfine blend of the J = 4-3 component and observed weak features (approximate 2-3 sigma) frequency-coincident with the resolved F = 6-5 and 5-4 hyperfine components of the J = 5-4 component. The relative intensities of these spectral features and their observational repeatability suggest that assignment to interstellar CH₂ is likely correct, although the result must be confirmed. The authors also report new interstellar transitions of known interstellar molecules detected in the CH₂ search bandpasses: CH₃OH, CH₃CCH, SO₂, HCOOCH₃, C₂H₅CN, (CH₃)₂O, and an unidentified line at 68320 MHz toward Orion-KL as well as SiC₂, and CH₃CN toward IRC + 10216.

000,039
PB90-206913 Not available NTIS
 National Bureau of Standards (NML), Boulder, CO. Quantum Physics Div. **4 Meter FTS Observations of Photospheric Magnetic Fields on M Dwarfs.** Final rept. S. H. Saar, J. L. Linsky, and M. S. Giampapa. 1988, 7p Grant NGL-06-003-057 Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in *Observational Astrophysics with High Precision Data*, p103-109 1988.

Keywords: *Dwarf stars, Reprints, *Stellar magnetic fields, Late stars, M stars, Magnetic stars, Stellar activity.

Much of the observed activity on M dwarfs (e.g., spots, flares, chromospheric and coronal emission) has been attributed to the interaction of magnetic fields with the stellar atmosphere. Since data on the magnetic field parameters of M dwarfs can potentially reveal much about the physical mechanisms behind these phenomena and, additionally, about stellar dynamos and the evolution of stellar angular momentum, the authors have begun a program to measure the mean magnetic field strength (B) in stellar active regions, and the surface filling factor (f) of these regions for a sample of M dwarfs. In the paper they discuss some preliminary results of the survey.

000,040
PB90-207036 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Equation of State for Stellar Envelopes. 4. Thermodynamic Quantities and Selected Ionization Fractions for Six Elemental Mixes.** Final rept. D. Mihalas, D. G. Hummer, B. W. Mihalas, and W. Dappen. 1990, 9p Contract NAGW-766 Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in the *Astrophysical Jnl.* 350, p300-308, 10 Feb 90.

Keywords: *Thermodynamics, Stellar structure, Equations of state, Plasmas(Physics), Ionization, Reprints, *Stellar envelopes, Stellar pulsations, Solar abundances.

The authors have employed the free-energy minimization technique to evaluate thermodynamic quantities and ionization fractions on a fine temperature and density grid for six astrophysical mixtures of 15 elements. The mixtures range from that appropriate to super-metal-rich stars, through abundance, to that for extreme Population II objects. The full tables are available on magnetic tape. In the paper the results for

solar abundances are summarized in a form that is illustrative and which facilitates comparison with the results from other equation of state calculations.

000,041
PB90-241498 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Orbital Variability in the Wind of the Massive X-ray Binary HD 153919/4U 1700-37.** Final rept. G. Hammerschlag-Hensberge, I. D. Howarth, and T. R. Kallman. 1990, 11p Pub. in the *Astrophysical Jnl.* 352, p698-708, 1 Apr 90.

Keywords: Binary stars, Ultraviolet spectra, Reprints, *X ray binaries, Stellar winds, IUE.

Forty high-dispersion IUE spectra of HD 153919, the Of-type primary in the 4U 1700-37 X-ray binary system, have been examined for evidence of orbital profile variability associated with the Hatcher-McCray effect. Although the effect is negligible in the resonance lines of C IV, Si IV, and N V, some subordinate lines show clear orbital changes. The variability in the absorption profile of N IV wavelength 1718, in particular, is shown to be in agreement with model calculations. The interstellar spectrum is studied, and highly ionized species are shown to be capable of being maintained by the primary's radiation field alone.

000,042
PB90-261264 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Solar and Stellar Observations from the South Pole.** Final rept. J. L. Linsky. 1989, 14p Contract NASA-NGL-06-003-057 Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in *AIP Conference Proceedings 198 Astrophysics in Antarctica*, Philadelphia, PA., June 9, 1989, p205-217.

Keywords: *Astronomical observatories, *South Pole, Reprints, Helioseismology, Asteroseismology, Starspots.

An astronomical observatory located at the geographic South Pole could provide important new insights into the physical bases of stellar variability by monitoring stars for long periods of time with minimal interruptions by the day-night cycle. The author summarizes three broad topics that could be studied with monitoring techniques -- magnetic phenomena on stars, helioseismology, and asteroseismology.

000,043
PB90-271081 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Optical Interferometer in Space.** Final rept. P. L. Bender, J. E. Faller, J. L. Hall, D. Hils, R. T. Stebbins, and M. A. Vincent. 1989, 9p Contract NAGW-822 See also N90-19940. Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in *Proceedings of NASA Workshop on Relativistic Gravitation Experiments in Space*, Annapolis, MD., June 28-30, 1988, p80-88 1989.

Keywords: *Optical interferometers, Spaceborne detectors, Precision, Design, Reprints, *Gravitational waves, *Laser interferometers, Spacecraft instruments, Gravitational collapse.

The present design concepts for a Laser Gravitational-Wave Observatory in Space are described. Laser heterodyne distance measurements are made between test masses located in three spacecraft separated by roughly one million km. The major technology issues are: the reduction of spurious acceleration noise for the test masses; and the measurement of changes in the difference of the antenna arm lengths with high reliability. The science objectives are: to measure discrete sinusoidal gravitational wave signals from individual sources with periods of 1 second to 1 day, to measure the stochastic background due to unresolved binaries, and to search for gravitational wave pulses with periods longer than 1 second from possible exotic sources such as gravitational collapse of very massive objects.

000,044
PB90-271362 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Grid of Low Metallicity Line-Blanketed LTE Model Stellar Atmospheres.** Final rept. I. D. Howarth, and A. E. Lynas-Gray. 1989, 6p Pub. in *Monthly Notices of the Royal Astronomical Society* 240, p513-517 1989.

Keywords: *Stellar atmospheres, Mathematical models, Reprints.

Emergent fluxes are given for a grid of low metal abundance line-blanketed ATLAS6 model atmospheres, together with corresponding UVB data and Zanstra integrals. The grid contains 101 models covering the temperature range 10,000 to 50,000 K at steps of 2,000 K and log(g) from 4.5 (cgs) to the Eddington limit at steps of 0.5, with special attention paid to securing a converged model at the lowest possible log(g) for each temperature.

000,045
PB90-271370 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Theoretical Modelling of Algal Disks.** Final rept. I. Hubeny. 1989, 11p Pub. in *Proceedings of IAU Colloquium No. 107 on Algae*, Victoria, Canada, August 1988, p117-126 1989.

Keywords: Mathematical models, Reprints, *Accretion disks, *Algal disks.

A brief review of various theoretical approaches to model accretion disks is presented. Emphasis is given to models that determine self-consistently the structure of a disk, together with the radiation field. It is argued that a proper treatment of the vertical structure is essential for calculating theoretical spectra to be compared with observations. In particular, it is shown that the hot layers above an accretion disk (sometimes called disk 'chromospheres' or 'coronae'), whose presence is indicated by recent UV observations of strong emission lines of highly ionized species, may be explained using simple energy balance arguments.

000,046
PB90-271404 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Near-Stellar Environment of Cool, Evolved Stars.** Final rept. P. G. Judge, R. E. Stencel, and J. L. Linsky. 1990, 3p Contract NAG5-82 Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in *Proceedings of Symposium on Submillimeter and Millimeter Astronomy*, Kona, HI., October 3-6, 1988, p179-180 1990.

Keywords: Infrared radiation, Millimeter waves, Reprints, *Cool stars, Stellar chromospheres, Stellar winds, Stellar mass ejection.

The authors discuss relationships between spectral indicators of chromospheric heating, winds and dust for 'low' and 'intermediate' mass stars evolving up the RGB and AGB, and suggest new observations from infrared to mm wavelengths which are needed. A full discussion of these relations, which are important for theoretical studies of heating and mass-loss processes, is in preparation.

000,047
PB90-271495 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Goals for the Application of High-Resolution X-ray Spectroscopy to the Diagnosis of Stellar Coronal Plasmas.** Final rept. J. L. Linsky. 1990, 17p Contract NASA-H-805318 Sponsored by National Aeronautics and Space Administration, Washington, DC. Pub. in *Proceedings of IAU Colloquium 115, High Resolution X-ray Spectroscopy of Cosmic Plasmas*, Cambridge, MA., August 22-25, 1988, p94-109 1990.

Keywords: *X ray spectroscopy, *Plasma diagnostics, Reprints, *Stellar coronas, High resolution, Electron density.

Examples are given of how high-resolution x-ray spectra may be used to determine the temperature and emission measure distributions, electron densities, steady and transient flow velocities, and location of active regions in stellar coronae. For each type of measurement, the author estimates the minimum spectral resolution required to resolve the most useful spectral features. In general, high sensitivity is required to obtain sufficient signal-to-noise to exploit the high spectral resolution. Although difficult, each measurement should be achievable with the instrumentation proposed for AXAF.

000,048
PB90-271503 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Einstein and Stellar Sources.

Final rept.
J. L. Linsky. 1990, 22p
Contract NAGW-766
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of 'From Einstein to AXAF' Symposium, Cambridge, MA., December 13-15, 1988, p39-59 May 90.

Keywords: Extraterrestrial radio waves, X rays, Reprints, *Stellar coronas, Stellar radiation, Magnetic stars, X-ray sources, HEAO 2.

The major accomplishments of the Einstein Observatory concerning the coronae of nondegenerate stars of each spectral type are reviewed. Einstein was particularly productive in discovering coronal emission from nearly all types of stars, including pre-main sequence, main sequence, and certain classes of post-main sequence stars. The similarities and differences between the coronae of each type of star and the more familiar solar corona are highlighted. An unforeseen picture is now developing in which nearly all types of x-ray emitting stars have both hot thermal plasma and nonthermal electrons that are heated and accelerated by magnetic processes. This picture can explain in principle the stellar x-ray and radio emission, although the details of how magnetic fields lead to this emission differ substantially across the H-R diagram. AXAF is required to answer the many fundamental questions which Einstein observations have raised.

000,049
PB91-112359 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Transition from Red Giant to Planetary Nebula.

Final rept.
S. Kwok. 1990, 12p
Pub. in Proceedings of the Cambridge Workshop on Cool Stars, Stellar Systems and the Sun (6th), Seattle, WA., September 1989, p438-449 1990.

Keywords: *Planetary nebulae, *Stellar evolution, Reprints, *Red giant stars, Stellar envelopes.

Over the past decade, astronomers have come to realize that mass loss on the asymptotic giant branch (AGB) plays a significant role in the formation of planetary nebulae (PN). Characteristics of the circumstellar envelopes of AGB stars such as dust continuum emission and molecular line emissions have now been detected in PN. In the review, it is shown that the evolution from AGB to PN can be traced in a continuous infrared sequence. This sequence predicts properties of proto-PN which allow them to be identified.

000,050
PB91-118307 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Gravitational Radiation from the Galaxy.

Final rept.
D. Hils, P. L. Bender, and R. F. Webbink. 1990, 20p
Contract NAGW-822
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Astrophysical Jnl. 360, n1 p75-94, 1 Sep 90.

Keywords: *Binary stars, Extraterrestrial radiation, Reprints, *Gravitational waves, White dwarf stars, Black holes, Cataclysmic variables, Neutron stars.

The authors calculate the spectral flux of gravitational radiation incident on earth due to major binary compo-

nents in the Galaxy. Binary systems considered are the following: W UMa binaries, unevolved binaries, cataclysmic binaries, neutron star binaries, black hole-neutron star binaries, and close white dwarf binary systems. Tables of various useful quantities such as average gravitational wave luminosity, spectral space density, and energy spectral flux density, and gravitational wave strain amplitude are given.

000,051

PB91-118315 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Spectroscopic Orbic and Evolution of HD 128220, a System Containing an O Subdwarf.

Final rept.
I. D. Howarth, and U. Heber. 1990, 8p
Pub. in Publication of the Astronomical Society of the Pacific 102, n654 p912-919 Aug 90.

Keywords: *Binary stars, Stellar evolution, Reprints, *HD 128220 stars, Stellar mass ejection, Stellar orbits, Subdwarf stars, O stars, Radial velocity.

The authors present radial-velocity measurements for both components of the HD 128220 system, the only double-lined binary with a published orbit which has as one of its members a subdwarf O star. The authors also derive the mass of the G-giant primary, the distance to the system, and the radii and luminosities of the components (all with $\sin i$ dependences). The subdwarf characteristics are in good agreement with evolutionary calculations for a post-AGB star. The authors discuss the evolutionary history of the system in light of their results.

000,052

PB91-118380 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Quantitative Spectroscopy of Hot Stars.

Final rept.
R. P. Kudritzki, and D. G. Hummer. 1990, 43p
Grant NSF-AST88-02937, Contract NAGW-766
Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Annual Review of Astronomy and Astrophysics 28, p303-345 1990.

Keywords: Stellar atmospheres, Stellar evolution, Stellar spectra, Reprints, *Hot stars, Stellar winds.

The determination of the basic parameters of hot stars by fitting precise spectra with those calculated from detailed atmospheric and wind models is reviewed. The latest and most accurate values are tabulated for a large number of stars. The implications for the evolutionary status of these objects, especially in the later stages, are discussed.

000,053

PB91-118398 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Unusual Infrared Line Profiles in the Post-Asymptotic Giant Branch Star HD 56126.

Final rept.
S. Kwok, B. J. Hrivnak, and T. R. Geballe. 1990, 4p
Pub. in Astrophysical Jnl. 360, n1 pL23-L26, 1 Sep 90.

Keywords: *Stellar spectra, Infrared spectra, Planetary nebulae, Stellar evolution, Reprints, *HD 56126 star, Stellar mass ejection, Stellar envelopes.

Brackett series lines with very broad inverted P Cygni and shell-like profiles have been detected toward the post-AGB star HD 56126. These profiles suggest that an active phase of mass loss has begun recently in this star. The star has had at least one previous episode of intense mass loss, attested to by its strong far-infrared emission. HD 56126 is also known for having a broad emission feature at 21 micrometers. The unidentified emission bands at 3.3 and 3.4 micrometers are also present in the spectrum of HD 56126, but the near-infrared spectrum provides little help in establishing the carrier of the 21 micrometer band.

ATMOSPHERIC SCIENCES

Meteorological Instruments & Instrument Platforms

000,054

PB90-163882

(Order as PB90-163874, PC A04)
National Inst. of Standards and Technology, Gaithersburg, MD.

Reduction of Uncertainties for Absolute Piston Gage Pressure Measurements in the Atmospheric Pressure Range.

B. W. Welch, R. E. Edsinger, V. E. Bean, and C. D. Ehrlich. 5 Sep 89, 4p
Included in Jnl. of Research of the National Institute of Standards and Technology, v94 n6 p343-346 1989.

Keywords: *Manometers, *Atmospheric pressure, *Nitrogen, Measurement, Calibrating, Metrology, Gas thermometry.

NIST pressure calibration services with nitrogen are now based on two transfer standard piston gages for which the effective areas have been determined by calibration with the manometer developed at NIST for gas thermometry. Root-sum-squared three sigma uncertainties for the areas for the two gages are 3.05 ppm and 4.18 ppm.

Physical Meteorology

000,055

PB90-254723

Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Thermophysics Div.

Thermodynamic Property Formulation for Air. 2. Pressure and Density Estimation Functions for the Dew and Bubble Lines.

Final rept.
R. T. Jacobsen, W. P. Clarke, S. W. Beyerlein, M. Rousseau, L. J. Van Poolen, and J. C. Rainwater. 1990, 11p
Pub. in International Jnl. of Thermophysics 11, n1 p179-188 1990.

Keywords: *Air, *Thermodynamic properties, Dew point, Bubbles, Nitrogen, Oxygen, Argon, Reprints, Phase equilibrium.

As a companion to a new correlation for the thermodynamic properties of air in single-phase states, new values for the properties on the dew and bubble lines have been calculated. Phase equilibrium properties for air at low and moderate pressures were predicted from accurate equations of state for argon, nitrogen, and oxygen using extended corresponding-states (ECS) methods. For pressures near the critical pressure, property values were calculated using a modified Leung-Griffiths model for mixtures of argon, nitrogen, and oxygen. Available experimental data and newly predicted values have been used in developing new correlating functions for estimating density and pressure on the dew and bubble lines of air. Estimates of the accuracies of these correlations based upon comparisons of calculated properties to data from other sources are also included.

BEHAVIOR & SOCIETY

Education, Law, & Humanities

000,056

PB90-261173

Not available NTIS
National Bureau of Standards (NBS), Gaithersburg,
MD. Factory Automation Systems Div.**Computers Viewing Artists at Work.**

Final rept.

J. Kirsch, R. Kirsch, and S. Ressler. 1988, 12p
Pub. in Proceedings of NATO (North Atlantic Treaty
Organization) Advanced Research Workshop Syntac-
tic and Structural Pattern Recognition, Sitges, Spain,
October 23-25, 1986, p291-301 1988.Keywords: *Arts, *Computer graphics, *Artificial intelli-
gence, Graphic arts, Pattern recognition, Reprints,
*Computer applications.

The title suggests an Artificial Intelligence approach to the use of computers in the fine arts. A powerful tutorial mechanism to use for computers to learn about art is the picture grammar, which allows large classes of compositional structures to be described to a computer by the scholar who has a deep understanding of the art works. A grammar has been developed and implemented to describe and analyze the compositional structure of the contemporary artist Richard Diebenkorn. With such grammatical instruction, the computer can analyze existing paintings, generate new ones of the same style, and provide a beginning to a computational theory of style.

000,057

PB91-101071

Not available NTIS
National Bureau of Standards (NBS), Gaithersburg,
MD. Inorganic Analytical Research Div.**Laboratory Studies of Some European Artifacts Excavated on San Salvador Island.**

Final rept.

R. H. Brill, S. S. C. Tong, I. L. Barnes, E. C. Joel, and M. J. Murtagh. 1986, 47p
Pub. in Proceedings of San Salvador Conference (1st), San Salvador Island, Bahamas, October 30-November 3, 1986, p247-292.

Keywords: *Archaeology, Isotopic labeling, Europe, Lead isotopes, Spain, Chemical analysis, Beads, Reprints, *San Salvador Island, *Artifacts, Laboratory tests, Money.

Recent excavations at The Long Bay Site uncovered artifacts of European manufacture intermingled with native Indian artifacts. These include seven very small glass beads (and fragments of three others), a coin, a small metal buckle, a "D-ring", 32 sherds of melado ware, and two small sherds of white-glazed ware. Laboratory studies have been conducted to help determine the origins and dates of these artifacts. The glass beads are wire-wound and have an extremely unusual high-lead chemical composition. The coin is a billon blanca of Henry IV minted between 1471 and 1474. Both buckles were found to be lightly-leaded bronzes. The melado ware has a lead glaze, as do the white wares, although the latter also contain tin. All of the artifacts contain intentionally-added lead. Their isotope ratios spread over a range, but all are consistent with Spanish origins. The data indicate that the San Salvador artifacts were made in three locations within Spain.

000,058

PB91-112342

Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Weights and Measures.**National Training Program of the National Conference on Weights and Measures - Looking Back, Looking Ahead.**

Final rept.

J. A. Koenig. 1990, 5p

Pub. in Weighing and Measurement 76, n5 p35-39
Sep/Oct 90.

Keywords: Reprints, *National Training Program, *Weights and measures.

The article describes the history, operation, and benefits of the National Training Program (NTP) of the Na-

tional Conference on Weights and Measures. It also takes a look at past, current, and future projects of the NTP and describes the contributions of the weighing and measuring community to the program.

BIOMEDICAL
TECHNOLOGY &
HUMAN FACTORS
ENGINEERINGBiomedical Instrumentation &
Bioengineering

000,059

PB90-169632

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.**Elastic Constants of Three Ni-Cr Dental Alloys at Room Temperature and Elevated Temperatures.**

Final rept.

H. R. Kase, and J. A. Tesk. 1989, 5p

Pub. in Dental Materials 5, p289-293 Sep 89.

Keywords: *Nickel, *Chromium, Elastic properties, Temperature, Reprints, *Dental alloys.

Dental porcelain are fused to metals at elevated temperatures. Therefore, the development of stress that affects the stability of porcelain-fused-to-metal systems may be influenced by the temperature dependence of the elastic constants of both materials. The sonic resonance technique was used to determine the elastic moduli for three nickel-based dental alloys. In addition to room temperature data, the temperature dependencies of the Young's modulus and the shear modulus were determined up to 600 C (873 K). The measured values for the resonant frequencies decreased with increasing temperatures, which resulted in correspondingly low moduli. The decrement of the elastic constants over the temperature range considered is less than 10%. The change of Poisson's ratio as a function of temperature for the alloys considered is presented in the paper.

000,060

PB90-171018

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.**Clinical Biocompatibility of an Experimental Dentine-Enamel Adhesive for Composites.**

Final rept.

R. L. Bowen, N. W. Rupp, F. C. Eichmiller, and H. R. Stanley. 1989, 6p

Sponsored by American Dental Association Health Foundation, Chicago, IL.

Pub. in International Dental Jnl. 39, p247-252 1989.

Keywords: *Adhesives, *Dentistry, Inflammation, Reprints, *Biocompatible materials, Ferric compounds, Tooth extraction.

Previous studies have shown that sequential application of an acidified solution of ferric oxalate, N-phenylglycine, and PMDM (the reaction product of pyromellitic dianhydride and hydroxyethyl methacrylate) yields strong adhesive bonding of composite resins to both dentin and enamel. The purpose of the study was to evaluate clinical characteristics and biocompatibility of this system in human teeth scheduled for orthodontic treatment extraction. Controls were light-cured Scotchbond or ZOE in contralateral teeth. Evaluation criteria, which included clinical feasibility, patient acceptability, retention, margin aesthetics and human pulp response, were met. Within the 4-241 day observation periods, there was no postoperative sensitivity, pain, loss of retention, staining, or discoloration. All pulp responses (double blind pulp analysis including all teeth) were acceptable. With mean RDT (remaining dentin thickness) of 0.67 mm (sd 0.35 mm), all indicators of pulp inflammation (displacement, superficial response, deep response, etc.) averaged between none and slight, < 1 on a 0-4 scale.

000,061

PB90-188533

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Polymers Div.**Calcium Phosphate Root Canal Sealer-Filler.**

Final rept.

A. Sugawara, H. Chohayeb, L. C. Chow, and S. Takagi. 1987, 1p

Sponsored by American Dental Association Health Foundation, Chicago, IL.

Pub. in Jnl. of Dental Research 66, p296 1987.

Keywords: *Calcium phosphates, *Dentistry, *Acid bonded reaction cements, *Dental material, Fillers, Sealers, Reprints, *Root canal obturation.

A calcium phosphate cement (CPC) was examined for ability to provide effective obturation of root canals when used as a sealer-filler combination. Extracted human teeth were chemomechanically prepared and divided into four groups. Root canals were filled with either (1) CPC paste containing dicalcium phosphate anhydrous, (2) CPC containing dicalcium phosphate dihydrate, (3) gutta-percha points sealed with Grossman's cement (GC), or (4) GC alone. After filling, all specimens were kept in 100% humidity for 1 day, immersed in a calcium phosphate (CaPO₄) solution or distilled water at 37 C for 1 week, and then immersed in 1% Poly-R dye solution at 37 C for 1 week after which they were rinsed and sectioned in a buccal-lingual direction for microscopic examination. Extensive dye penetration from the apex into the material-canal wall interface was observed in (3) and (4). Specimens in (1) and (2) showed considerably less dye penetration, especially those aged in the CaPO₄ solution.

000,062

PB90-190745

Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Ionizing Radiation Div.**Mechanically-Induced Generation of Radicals in Tooth Enamel.**

Final rept.

M. F. Desrosiers, M. G. Simic, F. C. Eichmiller, A. D. Johnston, and R. L. Bowen. 1989, 3p

Pub. in Applied Radiation and Isotopes 40, n10-12
p1195-1197 1989.

Keywords: *Dental enamel, *Free radicals, Dosimetry, Ionizing radiation, Archaeology, Electron paramagnetic resonance, Reprints.

Mechanical instrumentation of enamel leads to the formation of long-lived free radicals that can be conveniently measured by electron paramagnetic resonance (EPR) spectroscopy. Powdered enamel tissue exhibited EPR signals remarkably similar to the radicals formed by ionizing radiation. The observations described lead to the conclusion that physical stress will induce a free-radical formation in dental tissues. The observations have significance for other areas of study such as dosimetry and archeological dating.

000,063

PB90-192394

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.**Adsorption of Phenoxyacetic Acid and Trans-Cinnamic Acid on Hydroxyapatite.**

Final rept.

D. N. Misra. 1989, 9p

Sponsored by American Dental Association Health Foundation, Chicago, IL.

Pub. in Surfactants in Solution, v9 p425-433 1989.

Keywords: *Adsorption, *Dental materials, Isotherms, Dentin, Enamel, Polymerization, Reprints, *Hydroxyapatite, *Phenoxyacetic acid, *Trans cinnamic acid.

Adsorption characteristics of phenoxyacetic acid and trans-cinnamic acid were studied for two purposes: to explore whether polymerization is initiated, like that of N-phenylglycine, in a system containing a monomeric resin with an adsorbate-treated synthetic hydroxyapatite, and to investigate their role in a bonding procedure of restorative resin to dentin and enamel. The adsorption isotherm of phenoxyacetic acid is reversible (and Langmuirian) from absolute ethanol but is irreversible from benzene or methylene chloride. The isotherm of trans-cinnamic acid from methylene chloride is also irreversible. For both acids, the irreversible adsorption is exhaustive below a threshold concentration and is constant above it. The irreversibly adsorbed compounds may be completely washed off by excess

water or ethanol. At maximum adsorption the phenyl ring of the reversibly adsorbed molecules is presumably parallel to the apatite surface while that of the irreversibly adsorbed molecules is perpendicular with respect to the substrate. The adsorbate molecules in both configurations may be anchored to the surface primarily via hydrogen bonding with the carboxyl groups.

000,064
PB90-193236 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Corrosion and Degradation of a Polyurethane/Co-Ni-Cr-Mo (MP35N) Pacemaker Lead.
 Final rept.
 P. Sung, and A. C. Fraker. 1987, 11p
 Pub. in Jnl. of Biomedical Materials Research-Applied Biomaterials 21, nA3 p287-297 1987.

Keywords: *Biodeterioration, *Alloys, *Corrosion, *Polyurethane, X-ray diffraction, Scanning electron microscopy, Reprints, *Artificial pacemaker.

An investigation to study changes in the metal surfaces and the polyurethane insulation of heart pacemaker leads under controlled in-vitro conditions was conducted. A polyurethane (Pellethane 2363-80A) coated Co-Ni-Cr-Mo (MP35N) wire lead was exposed in Hanks' physiological saline solution for fourteen months and then analyzed using scanning electron microscopy, x-ray energy dispersive analysis and small angle x-ray scattering. Results showed that some leakage of solution into the lead had occurred and changes were present on both the metal and the polyurethane surfaces.

000,065
PB90-205865 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Transient and Residual Stress in a Porcelain-Metal Strip.
 Final rept.
 K. Asaoka, and J. A. Tesk. 1990, 7p
 Pub. in Jnl. of Dental Research 69, n2 p463-469 Feb 90.

Keywords: *Dental materials, Composite materials, Porcelain, Ceramics, Metals, Crack propagation, Residual stress, Cooling curves, Reprints, Temperature dependence, Solid-solid interfaces.

Porcelain-fused-to-metal (PFM) restorations may develop cracks during processing or in-mouth service if the relative physico-mechanical properties of the porcelain and metal are highly mismatched. A computer simulation of stress developed in a PFM beam was conducted. The simulation considers cooling from temperatures higher than the porcelain saggpoint. The results suggest that transient tensile stress at the porcelain alloy interface may result in cracks in the porcelain during cooling. Occlusal forces may set up stresses to cause cracking at the surface of the porcelain if the compressive residual stress is not high enough. PFM restorations with an alloy of high thermal expansion coefficient require rapid cooling; on the contrary, PFM restorations with the alloys of lower coefficients require slow cooling. A high cooling rate can make up for thermal expansion mismatches between the alloy and the porcelain up to 2×10 (sup -6)/C. Finally, the results indicated that curvature was not a sensitive indication of stress for a multimaterial beam when visco-elastic relaxation and high cooling rates are involved.

000,066
PB90-207044 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Adsorption of Zinc 3,3-Dimethylacrylate and 3,3-Dimethylacrylic Acid on Hydroxyapatite from Solution: Reversibility and Variability of Isotherms.
 Final rept.
 D. N. Misra. 1990, 11p
 Sponsored by American Dental Association Health Foundation, Chicago, IL.
 Pub. in Jnl. of Colloid and Interface Science 135, n2 p363-373, 15 Mar 90.

Keywords: *Dental materials, *Adsorption, *Isotherms, Solutions, Adsorbents, Entropy, Tensile strength, Reprints, *Acrylic acid/(zinc-salt)-dimethyl, *Acrylic acid/dimethyl, *Apatite/hydroxy, Resin matrix composites.

Adsorption of zinc 3,3-dimethylacrylate, a compound specifically prepared to act as a coupling agent between bone or tooth mineral and a prosthetic resin, was studied from ethanol onto synthetic hydroxyapatite at room temperature. The adsorption isotherms are irreversible and Langmuirian and vary with the volume of solution when the amount of adsorbent is kept constant. The adsorption remains constant if the same amounts of solute and adsorbent are used in different volumes of solution. Similar results were obtained for 3,3-dimethylacrylic acid adsorbed from dichloromethane solution. It may be deduced from their adsorptive behavior that it is an effective interaction of the solute and not the solvent with the adsorbed molecules that controls the adsorption equilibria. The adsorbed amounts of the salt or the acid at maximum adsorption, as derived from the Langmuir plots for different isotherms, remain constant for each adsorbate, but the heat terms are directly proportional to the volumes of the solution. The latter fact is explained by a simple analysis of the Langmuirian isotherm and the partition function of free translational motion of a molecule in a shared space. The tensile strength of a polymer composite containing hydroxyapatite as a filler is not affected whether the apatite is coated with the solutes or not.

000,067
PB90-241464 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Multidimensional Internal Setting Expansion of a Phosphate-Bonded Casting Investment Measured with Strain Gauges.
 Final rept.
 R. A. Engler, W. G. de Rijk, J. A. Tesk, and D. Morris. 1990, 6p
 Pub. in the Jnl. of Prosthetic Dentistry 63, n3 p353-358 Mar 90.

Keywords: *Dental materials, *Investment casting, *Phosphate coatings, Strain gages, Expansion, Setting time, Measurement, Reprints.

Strain gauges were used to determine the setting expansion of phosphate-bonded casting investments. The gauges were placed at the approximate site of the wax pattern. The isotropy of the expansion was evaluated with multidirectional strain gauges that measured the difference in expansion in two orthogonal directions. A large difference was found between the setting expansion measured externally (1% to 1.5%) and the method described here (0.01%). For casting rings lined with a nonasbestos layer, no statistically significant differences were found in the setting expansion parallel to the long axis of the ring and the expansion in the direction perpendicular to the long axis.

000,068
PB90-242181 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Cyclopolymerizable Monomers for Use in Dental Resin Composites.
 Final rept.
 J. W. Stansbury. 1990, 5p
 Pub. in Jnl. of Dental Research 69, n3 p844-848 Mar 90.

Keywords: *Dental materials, *Polymers, *Acrylates, Aldehyde polymers, Shrinkage, Cyclization, Polyether resins, Mechanical tests, Reprints, Monomers.

The simple reaction of conventional monofunctional acrylate monomers with paraformaldehyde has yielded a new class of difunctional monomers. The unique proximity of the double bonds within the compounds allows a facile cyclopolymerization to incorporate a cyclic ether structure into the polymer backbone. The external position of the acrylate esters means that the pendant groups can be varied for alteration of the physical properties of the monomers and the corresponding polymers. A series of the new monomers has been prepared and polymerized under dilute solution and bulk conditions to yield non-crosslinked and cross-linked polymers, respectively. The polymers exhibited high degrees of conversion and significantly reduced polymerization shrinkage, compared with polymers obtained from conventional diacrylate or dimethacrylate monomers. The combination of improved conversion to polymer with less contraction makes the monomers ideal candidates for use in dental resin composites.

000,069
PB90-257643 PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Standard Reference Materials: Description and Use of a Precision Thermometer for the Clinical Laboratory, SRM 934.
 Special pub. (Final).
 B. W. Mangum, and J. A. Wise. Jun 90, 23p NIST/SP-260/113
 Also available from Supt. of Docs. as SN003-003-03021-0. Supersedes COM-74-50533.

Keywords: Temperature measurement, Precision, *Clinical laboratories, *Thermometers, *Standard reference materials, Enzymology, Calibration.

Because of the high sensitivity to temperature of many facets of the clinical laboratory, e.g., in enzyme reactions and in pH and blood gas analysis, there is a need for accurate temperature measurement and its control. In order to help satisfy these needs and to aid in getting a usable and accurate temperature scale into the clinical laboratory, the National Institute of Standards and Technology developed SRM 934. This is a precision thermometer that is calibrated at 0 C, 25 C, 30 C, and 37 C. The description, calibration, and the procedures for proper usage of this thermometer are discussed. This SP 260 supersedes SP 260-48 describing both SRMs 933 and 934. SRM 933 will no longer be issued by the SRM Program. The publication is the same as SP 260-48 with the exception that all references to SRM 933 have been removed.

000,070
PB90-260910 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Synthesis and Properties of a Polyfluorinated Prepolymer Multifunctional Urethane Methacrylate.
 Final rept.
 J. M. Antonucci, J. W. Stansbury, and S. Venz. 1990, 12p
 Pub. in Progress in Biomedical Polymers, p121-131 1990.

Keywords: *Methacrylates, *Polymers, *Dental materials, *Resins, Synthesis(Chemistry), Acid resistance tests, Composite materials, Fluorine organic compounds, Surface energy, Urethanes, Hydrochloric acid, Reprints, *Prepolymers, Hydrophobic materials.

The concept of using low surface energy resin binders, having solubility parameters far different from that of oral fluids, as a means of enhancing the intra-oral resistance of resin based dental materials led to the synthesis of a unique polyfluorinated prepolymer multifunctional methacrylate, (PFMA), which yields extremely hydrophobic composites of moderate strength. The study describes the synthesis and properties of an analogous poly-fluorinated prepolymer multifunctional urethane methacrylate, (PFUMA), which is also a low surface energy resin but with greater cohesive energy density than (PFMA). (PFUMA) was isolated in excellent yield from the reaction of 2-isocyanatoethylmethacrylate (IEM) and the same polyfluorinated prepolymer polyol, (PFP), used in the synthesis of (PFMA). Preliminary results indicate that composites based on (PFUMA) are stronger and almost as hydrophobic as those derived from (PFMA).

000,071
PB90-260993 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Applications of the Weibull Method to Statistical Analysis of Strength Parameters of Dental Materials.
 Final rept.
 W. G. de Rijk, J. A. Tesk, R. W. Penn, and J. Marsh. 1990, 8p
 Sponsored by National Inst. of Dental Research, Bethesda, MD.
 Pub. in Progress in Biomedical Polymers, p141-147 1990.

Keywords: *Dental materials, *Composite materials, *Resins, Weibull density functions, Statistical analysis, Fracture strength, Polymers, Reprints, Fracture mechanics.

Weibull's method of analysis was used for fracture data obtained from the testing of dental composite restorative materials.

000,072
PB90-261363 Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
In vitro Evaluation of the Sealing Ability of a Calcium Phosphate Cement When Used as a Root Canal Sealer-Filler.
 Final rept.

A. Sugawara, L. C. Chow, S. Takagi, and H. Chohayeb. 1990, 5p
 Sponsored by American Dental Association Health Foundation, Chicago, IL.
 Pub. in Jnl. of Endodontics 16, n4 p162-165 Apr 90.

Keywords: *Dental materials, *Acid bonded reaction cements, In vitro analysis, Teeth, Calcium phosphates, Sealing compounds, Fillers, Microscopy, Dyeing, Water, Surface chemistry, Reprints, *Endodontics.

A calcium phosphate cement (CPC) was examined for its ability to seal the root canal when used as a sealer-filler. Extracted human teeth were divided into three groups. Root canals were filled with either CPC paste containing dicalcium phosphate anhydrous (group 1), CPC containing dicalcium phosphate dihydrate (group 2), or gutta-percha points sealed with Grossman's cement (group 3). After filling, all specimens were kept in 100% humidity for 1 day, immersed in a CaPO₄ solution or distilled water at 37C for 1 wk, and then immersed in 1% Poly-R dye solution at 37C for 1 wk, after which they were rinsed and sectioned longitudinally for microscopic examination. Specimens in groups 1 and 2, especially those aged in the CaPO₄ solution showed considerably less dye penetration than those in group 3. The good sealing ability of the CPC against dye penetration in vitro suggests that it may provide an adequate seal of the canal without a separate sealer.

000,073
PB90-261389 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Brushing Up on the History of Intermetallics in Dentistry.
 Final rept.

R. M. Waterstrat. 1990, 8p
 Sponsored by American Dental Association Health Foundation, Chicago, IL.
 Pub. in JOM, Jnl. of the Minerals, Metals, and Materials Society 42, n3 p8-14 Mar 90.

Keywords: *Dental materials, *Intermetallics, *Mercury amalgams, Silver alloys, Tin alloys, Mercury alloys, Dental caries, Fillers, History, Reprints.

Employing a silver-tin-mercury intermetallic to repair cavities may seem a little unusual, but intermetallics are quite common in dentistry, ranging from gold crowns to braces. Although the human mouth can be unfriendly territory for a brittle intermetallic alloy, dental amalgam has been around since 659 A.D., and its technology has been developed to the point where a filling can be expected to last 30 years or more.

000,074
PB91-111971 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Methacrylate Oligomers with Pendant Isocyanate Groups as Tissue Adhesives.
 Final rept.

G. M. Brauer, and C. Lee. 1990, 11p
 See also PB89-137533. Sponsored by National Inst. of Dental Research, Bethesda, MD.
 Pub. in Progress in Biomedical Polymers, p41-51 1990.

Keywords: *Dental materials, *Polymers, *Acid bonded reaction cements, Methacrylates, Isocyanates, Unsaturated organic compounds, Synthesis(Chemistry), Bones, Molecular weight, Thermal cycling tests, Dentin, Reprints, Prepolymers.

Oligomers containing pendant isocyanate groups and residual double bonds were synthesized from m-isopropenylidimethylbenzyl isocyanate (TMI) and/or 2-isocyanatoethyl methacrylate (IEM) and methacrylate or vinyl monomers. The compounds were characterized by physico-chemical means. Most of the oligomers are liquids at room temperature, stable in air, have a MW range from 1400 to 2600 and an isocyanate content from 5% to 18%. The compounds, especially those with TMI or IEM and TMI and methacrylate constituents dissolved in suitable solvents and yielded stronger, more permanent bonds to glutaraldehyde treated bone than other tissue adhesives. Thermocycling in water for one week between 5 C and 55 C did not decrease adhesion indicating that exposure to

water or thermal shock produced no deterioration of the bond. No correlation between bonding efficiency and -NCO content or increase in molecular weight could be established. Tensile adhesion of human dentin joined to composite restorative resins by means of the oligomers was similar to that of the best dental bonding agents.

000,075
PB91-112698 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Evaluation of Spiro Orthocarbonate Monomers Capable of Polymerization with Expansion as Ingredients in Dental Composite Materials.
 Final rept.

J. W. Stansbury, and W. J. Bailey. 1990, 7p
 Sponsored by National Inst. of Dental Research, Bethesda, MD.
 Pub. in Progress in Biomedical Polymers, p133-139 1990.

Keywords: *Dental materials, *Polymers, *Acid bonded reaction cements, Dentin, Polymerization, Free radicals, Synthesis(Chemistry), Shrinkage, Expansion, Carbonates, Unsaturated organic compounds, Reprints, Prepolymers.

An efficient synthesis of unsymmetrically substituted spiro orthocarbonate monomers has been devised and their ring-opening polymerization with a 2-3% expansion in volume was investigated. Various techniques for incorporating the spiro monomers into conventional dental composite resins were related to polymerization shrinkage and physical properties observed for these cured experimental systems. Depending on the formulation method, the addition of spiro orthocarbonates to conventional dental monomers yielded materials with significantly reduced polymerization contraction and dramatically improved adhesion. A strong correlation between the degree of polymerization shrinkage and the adhesive strength of the dental composite was apparent.

Bionics & Artificial Intelligence

000,076
PB90-206095 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Lighting for Color Vision.
 Final rept.
 J. A. Worthey. 1988, 7p
 Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Optics, Illumination, and Image Sensing for Machine Vision II, v850 p38-44 1988.

Keywords: *Color vision, *Illuminating, Robots, Visual perception, Models, Reprints, *Computer vision, Metamerism.

Results concerning lighting for human color vision may apply to robot color vision as well. In humans, the spectral sensitivities of the R and G receptors show a large overlap, while that of the B receptors overlaps little with the other two. A color vision model that proves useful for lighting work, and which also models many features of human vision, is one in which the 'opponent color' signals are $T = R - G$, and $D = B - R$. That is, a 'red minus green' signal comes from the receptors with greatest spectral overlap, while a 'blue minus yellow' signal comes from the two with the least overlap. Using the model, the author finds that many common light sources attenuate red-green contrasts, relative to daylight, while special lights can enhance red-green contrast slightly. When lighting changes cannot be avoided, the eye has some ability to compensate for them. In most models of 'color constancy,' only the light's color guides the eye's adjustment, so a lighting-induced loss of color contrast is not counteracted. Also, no constancy mechanism can overcome metamerism--the effect of unseen spectral differences between objects. However, one can calculate the extent to which a particular lighting change will reveal metamerism.

Protective Equipment

000,077
PB90-149170 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Law Enforcement Standards Lab.
Selection and Application Guide to Police Body Armor.
 Final rept.
 D. E. Frank, and L. D. Shubin. 1989, 26p
 Sponsored by National Inst. of Justice, Washington, DC.
 Pub. in NIJ (National Institute of Justice) Guide 100-87, 26p Feb 89. Available from National Criminal Justice Reference Service, Washington, DC. 20531.

Keywords: *Combat uniforms, *Protective clothing, *Body armor, Police, Performance evaluation, Survival clothing, Reprints.

The guide provides information to assist police in the selection of body armor to provide full-time protection throughout a full shift of duty. Data are provided to demonstrate the effectiveness of body armor in protecting police. Specific weapon threats are related to ballistic protection and the six armor type classifications included within the voluntary national performance standard for police body armor, NIJ Standard-0101.03. The National Institute of Justice effort to develop an armor suitable for full-time use is described and information is provided to acquaint the reader with the factors that are important to the performance and wearability of body armor. The use and maintenance of police body armor are discussed, as are the service life of armor and administrative considerations.



BUILDING INDUSTRY TECHNOLOGY

Architectural Design & Environmental Engineering

000,078
DE89014520 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Second-Level Post-Occupancy Evaluation (POE) Analysis.
 B. Collins, W. Fisher, and R. W. Marans. 14 Feb 89, 32p CONF-890898-1
 Contract A101-88CE21027
 IES annual conference, Orlando, FL, USA, 6-10 Aug 1989.
 Portions of this document are illegible in microfiche products.

Keywords: *Lighting Systems, *Office Buildings, Daylighting, Design, Evaluation, Illuminance, Photometers, ERDA/320100.

Findings from a detailed analysis of post-occupancy evaluation data, sponsored by LRI, which involved thirteen office buildings typical of current design practice, will be discussed. Analysis of the data indicates that occupant satisfaction can be related to type of lighting system, presence of daylight, and patterns of luminance in the office. 15 refs., 9 figs., 3 tabs.

000,079
PB90-136482 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Color and Lighting.
 Final rept.
 B. L. Collins. 1987, 4p
 Pub. in Lighting Design and Application 17, n4 p4-6, Apr 87.

Keywords: *Color, *Light sources, *Luminous intensity, Illuminance, Color coding, Safety, Visibility, Quality control, Reprints.

The effects of light sources on the appearance of colors is discussed. Background information on color

vision and color rendering is provided as well as illuminant spectral power distribution. Implications of the effects of light on colors, including color coding, are discussed. Finally, research findings from several studies at NBS on color-light source interaction including safety color appearance and meat and poultry inspection are presented.

000,080
PB90-149253 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Daylighting and Thermal Performance of Roof Glazing in Atrium Spaces.
 Final rept.
 G. Gillette, and S. Treado. 1988, 11p
 Sponsored by Department of Energy, Washington, DC., and American Architectural Mfrs. Association, Des Plaines, IL.
 Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 94, pt1 p826-836 1988.

Keywords: *Roofs, *Window glazing, *Daylighting, Interior lighting, Skylights, Thermal analysis, Performance evaluation, Architecture, Fuel consumption, Heat transfer, Reprints, *Energy conservation, Energy efficiency.

The effect of large areas of roof glazing in atrium spaces is assessed using site energy and peak demand loads as performance measures. Special attention is given to the role daylighting plays in the net performance of the glazing system. A detailed thermal transport and daylighting analysis computer program provided data on three aspects of roof glazing performance: the effects of the atrium alone, the atrium and its surrounding daylighting zone of influence, and the atrium and the coupled building as a whole. The results are presented in terms of comparative performance using a base case building configuration without glazing. The net change in performance due to the inclusion of the roof glazing is systematically evaluated. The results demonstrate the benefits of roof glazing on reducing the lighting energy requirements, and in turn, reducing site energy. These benefits, however, are tempered somewhat by the increased peak demand loads.

000,081
PB90-155417 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Ventilation and Air Quality Investigation of the Madison Building, Phase 1 Report.
 A. K. Persily, and W. S. Dols. Dec 89, 38p NISTIR-89/4219
 Sponsored by Department of Energy, Washington, DC.

Keywords: *Ventilation, *Office buildings, *Air circulation, Air flow, Safety engineering, Environmental engineering, Contaminants, Carbon monoxide, Radon, *Library of Congress, *Indoor air quality, HVAC systems, Indoor air pollution.

The National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards) is conducting a long-term study of ventilation and air quality in the Madison Building of the Library of Congress. NIST is conducting continuous measurements of whole building air exchange rates, as well as periodic measurements of local ventilation characteristics and indoor levels of carbon dioxide, carbon monoxide, respirable particulates, radon and radon progeny, and volatile organic compounds. During the first phase of the study, NIST measured whole building air exchange rates, local air exchange characteristics, and indoor concentrations of carbon dioxide and carbon monoxide. The report presents the techniques used to make these measurements and the results that have been obtained as of September 1989. The results indicate that the whole building air exchange rate is relatively constant over time and that the ventilation air is well distributed throughout the building.

000,082
PB90-161829 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Suprathreshold Visibility Meter to Directly Assess the Conspicuity of Office Tasks.
 Final rept.
 G. T. Yonemura, and K. Lister. Jan 90, 33p NISTIR-89/4226
 Sponsored by Department of Energy, Washington, DC. Building Services Div.

Keywords: *Office equipment, *Visibility, *Illuminating, Interior lighting, Visual perception, Thresholds(Perception), Light(Visible radiation), Measuring instruments, Human factors engineering.

An apparatus and methodology for evaluating the relative difficulty of visibility related office tasks are described. The methodology differs from current evaluation techniques in that tasks are assessed in the laboratory as seen in the real world. The contrast of a reference task (5-bar grating) is varied until the conspicuity (how well the detail stands out from the background) is perceived to be equal to that of the sample task presented simultaneously. Data using typical alphanumeric materials encountered in commercial activities are presented. The investigation indicates that the apparatus and methodology give a good indication of the relative difficulty of real world sample tasks. Procedures for calibrating the task evaluators or the inclusion of a criterion correction factor in order to minimize differences in absolute values between evaluators are recommended.

000,083
PB90-162009 PC A06/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Numerical Method for Calculating Indoor Airflows Using a Turbulence Model.
 T. Kurabuchi, J. B. Fang, and R. A. Grot. Jan 90, 123p NISTIR-89/4211
 Prepared in cooperation with Tokyo Univ. (Japan). Faculty of Engineering.

Keywords: *Air flow, *Ventilation, *Numerical analysis, *Turbulence, Mathematical models, Navier-Stokes equation, Convection, Flow distribution, Heat flux, Temperature, Pressure.

The report describes a numerical method for simulating indoor air flows in a building using a k-e turbulence method. The model treats three dimensional non-isothermal turbulent flows using the Boussinesq approximation for buoyancy. It solves the resulting nonlinear system of momentum, energy and turbulence equations by an explicit time marching technique to obtain a solution to either a steady state or transient flow. An upwind/central combination scheme with arbitrary specification for the switching parameter is used to approximate the convective terms. This switching parameter can be specified at each point in the flow regime allowing for different strategies in different flow regions. The switching technique includes both the central and hybrid schemes found in the literature. A pressure relaxation method is used to satisfy the Poisson equation for continuity. The model handles a variety of flow, pressure, temperature and heat flux boundary conditions including prescribed inflows, outflows by either prescribing the flow or pressure, wall boundary conditions together with heat flux and temperature and/or heat transfer coefficients specified on the boundary. Volumetric heat sources can also be included. The model has the ability of handling an arbitrary number of obstacles in the flow region.

000,084
PB90-164484 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Environmental Evaluation of the Portland East Federal Office Building Preoccupancy and Early Occupancy Results.
 R. A. Grot, A. Persily, A. T. Hodgson, and J. M. Daisey. Apr 89, 29p NISTIR-89/4066
 Prepared in cooperation with Lawrence Berkeley Lab., CA. Indoor Environment Program. Sponsored by General Services Administration, Washington, DC.

Keywords: *Office buildings, *Ventilation, *Contaminants, Air flow, Air filters, Airborne wastes, Public health, Radon, Organic compounds, *Indoor air pollution, *Sick building syndrome, Air quality standards, Portland(Oregon).

The report describes the results of the preoccupancy and early first year occupancy tests of the Portland East Federal Building. The National Institute of Standards and Technology installed a diagnostic center in the newly constructed federal office building in Portland, OR. The diagnostic center was used to determine the building's air infiltration and ventilation rates, the building envelope lightness, interzone air movement, and the levels of indoor contaminants. The indoor contaminants measured included carbon dioxide, carbon monoxide, respirable particulates, formaldehyde, radon and volatile organic compounds.

000,085

PB90-169897 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Engineering Analysis of Major Plant Components.
 Final rept.
 C. W. Hurley. 1984, 14p
 Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v90 pt2B p721-734 1984.

Keywords: *Cooling systems, *Heating, Air conditioning equipment, Thermal efficiency, Distribution systems, Boilers, Heat distributing units, Buildings, Reprints.

The paper presents brief engineering analyses of the major components of the plant and the distribution systems made from an energy point of view. The analyses presented are based on the engineering data derived from the raw data collected during the period of observation by the National Bureau of Standards for the Department of Housing and Urban Development and the Department of Energy. The analyses indicate several minor changes which could have improved the plant efficiency during the period of observation.

000,086

PB90-169905 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Engineering Data Collected during the Operation of a Total Energy Plant.
 Final rept.
 C. W. Hurley. 1984, 20p
 Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v90 pt2B p701-720 1984.

Keywords: *Electric power demand, *Buildings, *Heating load, *Cooling load, Thermal efficiency, Distribution systems, Cooling systems, Heating equipment, Reprints.

The paper presents a brief description of the plant and distribution system located at the total energy site in Jersey City, New Jersey. Engineering data derived from raw data recorded during the period of observation by the National Bureau of Standards for the Department of Housing and Urban Development are presented in tabular and graphical forms. The projected impact with the environment is also presented.

000,087

PB90-169913 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Simulation of a Multizone Air Handler.
 Final rept.
 C. R. Hill. 1985, 14p
 Sponsored by Department of Energy, Washington, DC. Office of Buildings and Community Systems, and Civil Engineering Lab. (Navy), Port Hueneme, CA.
 Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v91 pt1B p752-765 1985.

Keywords: Ventilation, Air circulation, Computerized simulation, Reprints, *Space HVAC systems, *Building systems, MODSIM program.

A detailed simulation of a large HVAC system is described. The simulation is intended to demonstrate the capabilities of a new modular simulation program, MODSIM, which has been developed as part of a building system simulation package. The system chosen for the demonstration is a multizone air handler serving two zones. The system is a typical HVAC sub-system and is large enough to demonstrate the capability of MODSIM to carry out detailed simulation of complete building systems under complex operational conditions. Three simulations are presented which demonstrate the system performance during a simplified morning startup situation for different control methods.

000,088

PB90-183336 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Model of a Simple Fan-Resistance Ventilation System and Its Application to Fire Modeling.

J. H. Klotz, and L. Y. Cooper. Sep 89, 37p NISTIR-89/4141
Sponsored by David Taylor Research Center, Bethesda, MD.

Keywords: *Ventilation, *Air circulation, *Fires, Fans, Air conditioning equipment, Mathematical models, Ducts, Intake systems, Smoke, Air flow, Blowers, *Building fires.

The paper describes the model FANRES for predicting transport through a simple fan-resistance ventilation system. The system consists of a fan and a duct with a single inlet and outlet. The fan characteristics in the range of normal fan operation and the duct resistance are assumed to be known and specified. Also assumed to be specified are the pressure and density of the environment, and relative elevation local to the two system end-points. The model predicts the system flow rate for arbitrary end-point conditions and can be used to provide an estimate of flow rate even when end-point environments lead to fan operation in the potentially unstable high-head-pressure region of small-positive-flow and small-back-flow. While the model described here is useful generally in the simulation of flow dynamics in facilities with simple heating ventilating air conditioning (HVAC) systems, its development was motivated by the need to predict the effects of HVAC systems on compartment fire environments. In particular, the FANRES model was developed for use in zone-type, multi-room compartment fire computer models.

000,099

PB90-185117 PC A06/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology, Study on the Performance of Residential Boilers for Space and Domestic Hot Water Heating.

C. Park, and G. E. Kelly. Jun 89, 102p NISTIR-89/4104
Sponsored by Department of Energy, Washington, DC.

Keywords: *Performance tests, *Residential buildings, *Boilers, *Space heating, *Hot water heaters, Mathematical models, Simulation, Burners, Efficiency, Test facilities, Fuel consumption, Building technology.

A residential boiler for space heating and domestic hot water heating was studied by conducting laboratory tests and computer simulations. A clam-shell, wet-base, oil-fired, residential boiler with a tankless coil for heating domestic water was selected for this research project. The purpose of the study was to develop a method for evaluating the performance of an integrated space and water heating appliance. Based upon laboratory tests, a computer model was developed and used with the HVACSIM building system simulation program to simulate the operation of the integrated appliance.

000,090

PB90-198441 PC A09/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Life-Cycle Costing for Energy Conservation in Buildings: Instructor's Guide.

Final rept.
R. T. Ruegg. Aug 89, 179p NISTIR-89/4129
Sponsored by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy.

Keywords: *Public buildings, *Design standards, *Cost analysis, Service life, Architecture, Fuel consumption, *Federal buildings, *Energy conservation, Energy economics, Life-cycle cost, Curriculum.

An Instructor's Guide for an intensive 2-day course on how to use life-cycle costing and related economic methods to make cost-effective decisions in designing and retrofitting Federal buildings for energy conservation. The Guide provides an overview of the course; an agenda; learning objectives; daily detailed lesson plans; exercises and problems with solutions, and paper copies of slides used in the course. The course combines theory with application to teach engineers, architects, and other building professionals how to design and size independent and interdependent building systems for cost effectiveness, allocate a budget among competing projects for maximum net savings, and make decisions under uncertain conditions. Two computer programs for evaluating economic performance are taught in the course.

000,091

PB90-198912 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology, Evaluation of Thermal Bridges Using a Mobile Test Facility.

J. B. Fang, and R. A. Grot. Mar 90, 35p NISTIR-90/4258
Sponsored by Department of Energy, Washington, DC. Office of Buildings Energy R and D.

Keywords: *Buildings, *Thermal measurements, *Heat loss, *Walls, *Thermal resistance, Calorimeters, Fuel consumption, Heat transmission, Model tests, Thermal conductivity, Design standards, Energy efficiency, Energy conservation.

The construction details of a mobile test facility with removable walls and roof used for installation and performance evaluation of the test specimens are described. Descriptions of the overall performance of a newly developed portable calorimeter employed for quantification of the heat flow through exterior walls of a building corner are given. Laboratory tests were conducted using an in-situ thermal resistance measurement technique to evaluate the performance of thermal bridges occurring in a metal-frame, insulated wall construction. The local heat flow rates and thermal resistances under steady-state conditions were measured by means of portable calorimeters, heat flux transducers and thermistors at various locations of the test structure. The measured wall thermal resistance values were compared with the predicted values obtained by the zone and the series/parallel resistance methods. The calorimeter measurement generally gave lower thermal resistance values than the heat flux transducers due to enhanced heat conduction through highly conductive fasteners and framing members.

000,092

PB90-199068 PC A13/MF A02
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Life-Cycle Costing for Energy Conservation in Buildings: Student's Manual.

R. T. Ruegg, and S. R. Petersen. Mar 90, 282p NISTIR-89/4130
Sponsored by Department of Energy, Washington, DC. Federal Energy Management Program Staff.

Keywords: *Public buildings, *Design standards, *Cost analysis, Service life, Architecture, Fuel consumption, *Federal buildings, *Energy conservation, Curriculum, Energy economics, Life-cycle cost.

The Student's Manual for an intensive two-day course on how to use life-cycle costing and related economic methods to make cost-effective decisions in designing and retrofitting Federal buildings for energy conservation. The manual is designed to serve as an in-class workbook and as a source for later reference and review. It contains 10 learning modules, the mastery of which will satisfy the course's goal of enabling and encouraging building professionals to take into account long-run economic consequences of their decisions.

000,093

PB90-207259 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Fire Experiments of Zoned Smoke Control at the Plaza Hotel in Washington DC.

J. H. Klotz. Feb 90, 76p NISTIR-90/4253
Sponsored by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA., Bell Atlantic Telephone Co., Arlington, VA., New Jersey Bell Telephone Co., Newark, NJ Fire Administration, Emmitsburg, MD., and Department of Veterans Affairs, Washington, DC.

Keywords: *Fire tests, *Hotels, *Fire protection, *Smoke, *Ventilation, Residential buildings, Fire safety, Fires, Combustion products, Air circulation, Air flow, Mathematical models, Temperature, Experimental data, Pressure gradients.

A series of full-scale tests were conducted to evaluate the current approach to zoned smoke control systems with and without stairwell pressurization. Smoke movement and the performance of smoke control systems were studied with smoke generated from unsprinklered wood fires, sprinklered wood fires, and smoke bombs. As expected, the zoned smoke control system

prevented smoke migration beyond the fire floor. The minimum pressure difference approach to achieve smoke control for zoned smoke control systems was evaluated. The minimum pressure difference approach is based on a tacit assumption of a constant mass flow rate into the zone where the fire is located. To evaluate the assumption, a model was developed for mass flow in the smoke zone. Agreement between experimental results and calculations based on the model was good.

000,094

PB90-218058 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.

Measurements of Ventilation Rates and Ventilation Effectiveness.

Final rept.
A. K. Persily, and R. A. Grot. 1985, 11p
Pub. in Proceedings of International Symposium on Recent Advances in Control and Operation of Building HVAC Systems, Trondheim, Norway, May 22-23, 1985, p53-63.

Keywords: *Office buildings, *Ventilation, *Flow measurement, Air flow, Measurement, Intake systems, Environmental engineering, Efficiency, Reprints, *Indoor air quality, Energy conservation, HVAC systems.

The ventilation of office buildings has taken on increased importance due to concerns about energy conservation and indoor air quality. Tracer gas techniques have been developed to measure whole building ventilation rates. These measurements have revealed that in many buildings intentional ventilation is similar in magnitude to unintentional air leakage through the building envelope. In some buildings the net ventilation rates are lower than recommendations for minimum outside air intake levels based on ASHRAE Standard 62-1981. Also, due to variations in internal air distribution, specific areas within buildings are ventilated at lower rates than the whole building average. The concept of ventilation effectiveness or efficiency has been developed to quantify air distribution. Ventilation efficiency has been studied in laboratory facilities, but its measurement in actual office buildings requires special procedures.

000,095

PB90-218298 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.

Estimating Air Leakage through Doors for Smoke Control.

Final rept.
D. Gross. 1990, 7p
Pub. in Fire Technology 26, n1 p75-81 Feb 90.

Keywords: *Doors, *Air flow, *Smoke, *Leakage, Seals(Stoppers), Pressure reduction, Ventilation, Estimating, Fire safety, Reprints.

A generalized, nondimensional relationship for flow through defined narrow gaps is used to predict leakage flow past closed door assemblies. Typical gap shapes considered include straight-through; single or double sharp (90 deg) bends; baffle at leading edge; comb-type labyrinth; and filament brush seal. Applications for prediction and design appropriate to smoke control systems are indicated.

000,096

PB90-219809 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Fire Research Publications, 1989.

N. H. Jason. Apr 90, 36p NISTIR-4311
See also PB89-193304. Errata sheet inserted.

Keywords: *Fire safety, *Bibliographies, Burning rate, Smoke, Sprinkler systems, Ventilation, Flame propagation, Plastics, Composite materials, Fire resistant materials, Safety engineering, Heat measurement, Research.

'Fire Research Publications, 1989' is a supplement to previous editions; the last five editions are as follows: 1984 PB85-208502; 1985 PB86-208317; 1986 PB88-109889; 1987 PB89-199641; 1988 PB89-183304.

000,097

PB90-219833 PC A09/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Post Occupancy Evaluation of Federal Buildings - The Portland Federal Building and Others.

A. I. Rubin. Apr 90, 179p NISTIR-4307
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Evaluation, *Design, *Public buildings, *Office buildings, Commercial lighting, Ventilation, Office equipment, Acoustics, Human factors engineering, *Indoor air quality, *Thermal comfort.

The report presents an evaluation of the working conditions at the 'old' and new Portland Federal Building, occupied by the Bonneville Power Administration. Assessments were made by questionnaires filled out by employees, and interviews with operational and facility management personnel. Other federal buildings were examined to obtain supplementary information. Interviews were conducted with facility management personnel at the Department of Labor, the Treasury Department, the General Services Administration and the Office of Personnel Management (OPM). A limited questionnaire survey was conducted at OPM. Some of the buildings examined were new ones, while others were being retrofitted. A summary of 'lessons learned' is included, in addition to evaluations of the buildings examined.

000,098
PB90-221854 PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Rating Procedure for Mixed Air-Source Unitary Heat Pumps Operating in the Heating Mode.
P. A. Domanski. May 90, 15p NISTIR-90/4298
See also PB89-193247. Sponsored by Department of Energy, Washington, DC. Office of Buildings and Community Systems.

Keywords: Standards, *Residential buildings, Ratings, Capacity, *Heat pumps, Air conditioners, Efficiency, Evaporators, Mathematical models, *Heating, Fans, *Air source heat pumps.

A procedure is presented for determining the heating performance ratings of air-source unitary heat pumps consisting of an outdoor section and an indoor section which were not tested together as a system. The procedure allows calculation of capacity at the 47 F rating point and heating seasonal performance factor, HSPF, using as a reference point performance ratings of the outdoor unit tested under current DOE procedures in conjunction with a different indoor section. The procedure requires as input data the matched system rated performance, the ratio of condensing capacities of mixed and matched indoor coils, and the ratio of powers of mixed and matched indoor fans.

000,099
PB90-232810 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Least-Cost Energy Decisions for Buildings: Introduction to Life-Cycle Costing. Video Training Workbook.
R. T. Ruegg. Apr 90, 27p NISTIR-4309
Sponsored by Department of Energy, Washington, DC. Federal Energy Management Program Staff.

Keywords: *Buildings, *Economic analysis, Training films, Decision making, Dictionaries, *Energy consumption, Energy conservation, Life cycle costs.

The workbook accompanies the video training film 'Least-Cost Energy Decisions for Buildings'; it is not a stand-alone tutorial. The workbook contains a glossary of key terms, formulas, exercises, and discount factor tables presented in the video. Running time (without pauses to do the exercises) is about one hour.

000,100
PB90-241381 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Evaluation of the Role of Luminance Distributions in Occupant Response to Lighting.
Final rept.
B. L. Collins. 1990, 10p
Sponsored by Lighting Research Inst., New York, Electric Power Research Inst., Palo Alto, CA., New York State Energy Research and Development Authority, New York, and Department of Energy, Washington, DC.
Pub. in CIBSE National Lighting Conference, p1-10 Apr 90.

Keywords: *Office buildings, *Luminance, *Human factors engineering, *Responses, Luminous intensity, Illuminance, Brightness, Illuminating, Evaluation, Reprints, Lighting systems.

Findings from a detailed analysis of post-occupancy evaluation data, which involved thirteen office buildings typical of current design practice, are discussed. Analysis of the data indicates that occupant satisfaction can be related to patterns of luminance, lighting characteristics, and presence of daylight in the office.

000,101
PB90-244427 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
High Technology Office Evaluation Survey: A Pilot Study.
A. I. Rubin. Jun 90, 69p NISTIR-4354
Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Office buildings, *Workplace layout, *Human factors engineering, Noise reduction, Acoustics, Furniture, Design, Office equipment, Commercial lighting, Interior decorating, Air quality, Lighting systems, Thermal comfort, Workstations.

The report provides insights about how offices and workstations are planned and designed in the private and public sectors. Among the issues explored are the quality of the workplace, the effects of technology on design, space allocations, and systems furnishings. The data were collected by a detailed questionnaire survey, administered with the cooperation of the Corporate Architects Committee of the American Institute of Architects (AIA). The respondents were designers and facility managers of major corporations and governmental agencies with broad planning experience and major design responsibilities. The sample is a limited one, including only twenty-two respondents, therefore the findings are indicative of current design practices and experiences. The survey was designed to cover a broad range of topics and provide the opportunity to comment freely about them. As a result, much of the data is in narrative form.

000,102
PB90-269515 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Experimental Study on the Performance of a Combination Appliance for Domestic Hot Water and Space Heating.
S. T. Liu, G. E. Kelly, and C. P. Terlizzi. Aug 90, 32p NISTIR-4356
Sponsored by Department of Energy, Washington, DC.

Keywords: *Space heaters, *Water heaters, *Gas appliances, Heating equipment, Thermal efficiency, Gas heating, Space heating, Performance evaluation, Hot water heating, Heat load, Experimental data.

A Type II combination appliance consisted of a 50-gallon gas-fired water heater and a fan-coil air handling unit was tested in the laboratory to evaluate different methods for the determination of the combined heating seasonal, non-heating seasonal efficiencies and combined annual efficiency. Laboratory tests were conducted in accordance with the ASHRAE/ANSI Standard 103-1988R for boilers and the DOE 10 CFR 430 for domestic water heaters to obtain the steady state and heating seasonal efficiencies of the water heater functioning as a space heating boiler and the energy factor of the heater functioning as a domestic water heater. These efficiency values were used to compute the combined heating seasonal and non-heating seasonal efficiencies by two different calculation methods. A series of tests with part load space heating cycling combined with domestic hot water draws were also conducted to measure the combined efficiencies directly. Comparison of the measured heating seasonal efficiency with those obtained from the two proposed calculation methods showed very good agreement. Recommendation was made to adopt the NIST developed calculation method for the rating of the combination appliance.

000,103
PB91-107490 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Ventilation Characterization of the Consumer Product Safety Commission Combustion Test Chamber Facility.

Final rept.
W. S. Dols. Sep 90, 23p NISTIR-4415
Sponsored by Consumer Product Safety Commission, Washington, DC. Directorate of Engineering Science.

Keywords: *Space heaters, *Test chambers, *Ventilation, Gas heaters, Methane, Kerosene, Air pollution, Exhaust gas, Air flow, Test facilities, *Indoor air pollution, Tracer techniques, Air quality.

The Consumer Product Safety Commission (CPSC) is evaluating pollutant emissions from kerosene and methane heaters using a test chamber. Under an inter-agency agreement with CPSC, the Indoor Air Quality and Ventilation Group of the National Institute of Standards and Technology (NIST) measured the air exchange rate of the chamber under various ventilation system operating conditions, the extent of air mixing within the chamber, and the interior volume of the chamber. The air exchange rate of the chamber was determined using the tracer gas decay method with sulfur hexafluoride as the tracer gas. Carbon dioxide was also used as a tracer gas in order to verify the decay rates obtained with the SF₆ system; however CO₂ could not be used during combustion tests. The effect of pollutant monitoring systems and combustion devices⁵ on air exchange rates was also examined. Based on multi-point concentration measurements during decays, the extent of mixing within the chamber appeared to be adequate to employ the single-zone tracer gas decay method. The interior air volume of the chamber was determined using the constant injection tracer gas technique and yielded a volume very close to the volume based on the physical dimensions of the chamber. Recommendations for an air exchange rate measurement system for the chamber and modifications to be made in order to more effectively utilize the system are made.

000,104
PB91-118018 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Effect of Wall Mass on the Annual Heating and Cooling Loads of Single-Family Residences for Five Selected Climates.
Final rept.
D. M. Burch, G. N. Walton, K. Cavanaugh, and B. A. Licitra. 1987, 26p
See also PB88-122148.
Pub. in Proceedings of Conference on Thermal Insulation: Materials and Systems, Dallas, TX., December 2-6, 1984, ASTM STP 922, p541-566 1987.

Keywords: *Residential buildings, *Heating load, *Cooling load, *Thermal insulation, Walls, Thermal radiation, Construction materials, Framed structures, Masonry, Thermal analysis, Computerized simulation, Reprints, *Building materials, Energy consumption, Energy conservation, Energy models.

The space heating and cooling loads for a typical house and a high-solar-gain house containing partition walls and interior furnishings are simulated using a computer program called the Thermal Analysis Research Program (TARP). Separate computer runs are carried out for the following wall constructions: insulated wood frame, insulated masonry with mass on the exterior, and insulated masonry with insulation sandwiched between interior and exterior mass. The reductions in annual space heating and cooling loads achieved in typical houses with masonry wall construction compared with identical houses with lightweight wood-frame wall construction are derived as a function of five climates. Insulation credits for energy conservation standards to account for reductions in space conditioning loads for masonry houses are investigated. The presence of interior mass features was observed to cause the typical house to approach a 'static high-mass limit' that coincided with steady-state theory. Under such a condition, wall mass was found to have a small effect on annual space heating and cooling loads.

000,105
PB91-118430 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Simultaneous Measurements of Infiltration and Intake in an Office Building.

Final rept.
A. K. Persily, and L. K. Norford. 1987, 15p
Sponsored by Department of Energy, Washington, DC.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning) Transactions, v93 pt2 15p 1987.

Keywords: *Office buildings, *Measuring instruments, *Air flow, *Ventilation, Leakage, Air intakes, Fans, Heating load, Cooling load, Reprints, *Air infiltration.

Tracer gas decay measuring techniques exist to determine whole building air exchange rates. The paper presents two new measuring techniques to determine simultaneously both the amount of air exchange due to intentional outdoor air intake and the amount due to uncontrolled envelope infiltration. One of these techniques was applied to a new office building as a demonstration of the procedure, and to investigate the air exchange characteristics and mechanical ventilation system performance in this particular building. Using a tracer gas measuring technique in combination with multithermistor airflow-rate measuring systems, intake and infiltration rates were measured under a range of weather conditions and outdoor air intake rates. The results indicate that the outdoor air intake rates for this building are often well below their design values, a significant percentage of the net air exchange rate of the building is due to envelope leakage, and the amount of envelope leakage is dependent primarily on the outdoor air intake rate.

000,106
PB91-120196 PC A12/MF A02
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
3D Piping IGES Application Protocol, Version 1.0.
M. E. Palmer, and K. A. Reed. Sep 90, 253p NISTIR-4420
Sponsored by Naval Sea Systems Command, Washington, DC., and Department of Defense, Washington, DC.

Keywords: *Piping systems, *Design criteria, Pipes(Tubes), Supports, Distribution systems, Marine engineering, Risers, Manifolds, *Computer aided design, Computer applications, Protocol(Computers).

The 3D Piping IGES Application Protocol (AP) specifies the mechanisms for defining and exchanging 3D piping system models in IGES format. The AP defines three-dimensional arrangement data of piping systems which includes definition data types of geometry (shape and location), connectivity, and material characteristics. The scope of this AP includes only piping system data and not drawings or internal details of equipment. The specified piping model is sufficiently detailed to support the fabrication and final assembly of a piping system. IGES is designed to support a broad range of applications and information, and it is recognized that few implementations will support all of the specification. An application protocol defines a logical subschema of the IGES specification, the usage of the subschema, and the necessary benchmarks for testing implementations. The 3D Piping IGES Application Protocol is the first IGES AP to be delivered to industry and is an important example for the development of STEP (Standard for the Exchange of Product Model Data) application protocols.

Building Equipment, Furnishings, & Maintenance

000,107
PB90-141383 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Risk Exposure and Risk Attitude of Homeowners in Fire Protection Investment Decisions.

S. K. Fuller. Dec 89, 83p NISTIR-89/4212
Keywords: *Fire detection systems, *Benefit cost analysis, *Risk, *Residential buildings, Fire protection, Economic analysis, Fire alarm systems, Sprinkler systems, Computer applications, Smoke detectors, Analytic hierarchy process.

The report demonstrates that the Analytic Hierarchy Process (AHP) is a promising decision tool for evaluating fire protection systems for homeowners. The study

explores how to include in the decision-making process information on an individual's risk exposure and risk attitude, information which is generally difficult or impossible to quantify. By differentiating between risk exposure and risk attitude, the application goes beyond the AHP's conventional treatment of risk. The AHP is applied to the choice of purchasing smoke detectors, a sprinkler system, or a combination of the two. Two hypothetical cases are assumed, one in which the homeowner is risk-taking and has lower-than-average risk exposure, and one in which the homeowner is risk-averse and has higher-than-average risk exposure. Subjective probabilities of fire, death, injury, and property loss are merged with more easily quantifiable benefit and cost criteria. A method of pairwise comparisons provides the data to calculate priority vectors for the fire protection alternatives.

000,108
PB90-162090 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Automated Maintenance Management Program Part 2: The Integration of Databases and Image Processing Results for the Quantitative Assessment of the Exterior Condition of Metal Buildings.
L. J. Kaetzl, J. W. Martin, and M. M. Hocker. Jan 90, 39p NISTIR-89/4179
See also PB88-192448.

Keywords: *Maintenance management, *Buildings, Decision making, Steel structures, Organic coatings, Algorithms, *Image processing, *Computer applications, Data base management systems, File structures.

The establishment of an automated system for assessing the exterior condition of structures can provide facility managers with an important tool for making decisions. The integration of different forms of knowledge into a coherent system provides the fundamental basis for an expert system. The system can reduce the time required to analyze and interpret information, and provides a historical record of the rate of failure for building structures. The report discusses the feasibility of establishing an automated maintenance management program for making maintenance decisions using computer image processing to obtain quantitative results database technologies and the design and structure of the database for condition assessment are discussed. Image acquisition, processing, storage, and retrieval of images of a water tower are presented as a case study.

000,109
PB90-241480 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Cigarette Ignition of Soft Furnishings.
Final rept.
R. G. Gann, R. H. Harris, J. F. Krasny, R. S. Levine, and H. E. Miltner. 1989, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (2nd), Tokyo, Japan, June 13-17, 1988, p77-86 1989.

Keywords: *Ignition, *Furniture, *Flammability testing, Tobacco, Flammability, Fire tests, Combustion, Heat transfer, Reprints, *Cigarettes.

Changes in the propensity of cigarettes to ignite upholstered furniture and bedding could reduce fire losses significantly. The paper describes fundamental and empirical studies of the effect on ignition propensity of varying cigarette characteristics. Reduced tobacco density, circumference and paper porosity were especially effective. Energy transfer from the cigarette to the substrate was measured and relationships between cigarette combustion behavior and ignition propensity were explored. Using these data, computer modeling of the cigarette on a substrate manifested key features of the ignition process. A fully-documented technical report is available.

000,110
PB90-256850 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Furniture Flammability: An Investigation of the California Technical Bulletin 133 Test. Part 1. Measuring the Hazards of Furniture Fires.
J. G. Quintiere. Jul 90, 30p NISTIR-4360
See also Part 2, PB90-257692 and Part 3, PB90-257700.

Keywords: *Furniture, *Fire hazards, Measurement, Ignition, Carbon dioxide, Materials, Smoke, Improvement, Flashover.

The hazards due to furniture fires are examined. These include ignition of an adjoining item, flashover, CO toxicity, and reduced visibility as a result of smoke. Theoretical analyses are given to quantify the hazards, and typical parametric values are given for several materials representative of a range of fire performance. Results are presented in terms of conditions at the flame tip, at the onset of flashover, and for a ventilation-limited fire. Critical hazard measurements are identified, and an illustration is given on how to characterize the hazards.

000,111
PB90-257692 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Furniture Flammability: An Investigation of the California Bulletin 133 Test. Part 2. Characterization of the Ignition Source and a Comparable Gas Burner.
T. J. Ohlemiller, and K. Villa. Jun 90, 42p NISTIR-4348
See also Part 1, PB90-256850 and Part 3, PB90-257700.

Keywords: *Ignition, *Furniture, *Flammability testing, Sources, Gas burners, Heat flux, Upholstery, Temperature measurement, Smoke, Comparison, Reproducibility, Chairs.

The California Bulletin 133 upholstery ignition source is based on the use of crumpled newsprint. The present work examined the reproducibility of several aspects of the source when placed on an inert chair mock-up. The tendency of the source to heat the side arms of a chair, the area of the seat back subjected to high heat fluxes, the peak flux there and the flux duration all showed substantial variability. For inherently lesser variability a gas burner is preferred. A gas burner, derived from that developed at the British Fire Research Station, was shaped so as to deposit a similar pattern of heat to that of the CB 133 source. The two sources were tested for comparability both on chair mock-ups and on full-scale chairs made from a wide variety of materials.

000,112
PB90-257700 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Furniture Flammability: An Investigation of the California Technical Bulletin 133 Test. Part 3. Full Scale Chair Burns.
W. J. Parker, K. M. Tu, S. Nurbakhsh, and G. H. Damant. Jul 90, 44p NISTIR-4375
See also PB90-256850 and PB90-257692. Prepared in cooperation with California State Dept. of Consumer Affairs, North Highlands. Bureau of Home Furnishings and Thermal Insulation.

Keywords: *Chairs, *Flammability testing, *Ignition, Fabrics, Foam, Sources, Gas burners, Heat flux, Oxygen consumption, Temperature measurement, Calorimeters, Correlation, Fiberglass.

Ten sets of upholstered chairs were obtained. One chair out of each set was tested in the ASTM room, two chairs out of each set were tested in the furniture calorimeter, and four chairs in the different sets varied only in the type of fabric, type of foam, and whether or not there was a fiberglass interliner present. Some of the chairs were ignited with the standard TB133 newspaper ignition source. The rooms were instrumented to measure the total heat release rate of the chairs by oxygen consumption. It was found that (1) similar results were obtained in the TB133 and ASTM rooms, (2) a total heat release rate of 65 Kw in either of the rooms or in the furniture calorimeter was equivalent to the failure criterion of a 111 deg C (200 deg F) temperature rise 25 mm below the ceiling and directly above the burning chair in the TB 133 test and (3) below 600 kW the heat release rates of the chairs measured in the rooms were the same as those in the furniture calorimeter. The combinations of fabric, fiberglass interliner and foam were also tested in the Cone calorimeter.

000,113
PB90-269523 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD.

Building Equipment, Furnishings, & Maintenance

Evaluation of Exit Signs in Clear and Smoke Conditions.

B. L. Collins, M. S. Dahir, and D. Madrzykowski. Aug 90, 79p NISTIR-4399

Keywords: *Visibility, *Visual perception, *Optical density, Doors, Luminance, Contrast, Color, Smoke, *Exit signs, *Direction signs, Emergency lighting.

The paper provides a short review of the research literature on the visibility of exit signs, directional markings, and emergency lighting. It also presents a study which assessed the visibility of several types of exit signs including conventional and electroluminescent (EL) signs in both clear and smokey conditions. A two-part evaluation was performed. In the first, signs were measured photometrically in clear conditions with two different photometers in a laboratory to determine their luminance under dark conditions and with an ambient room illumination of 54 lx (5 fc). Analysis of these data indicated very wide variations in luminance as a function of sign type. In the second part of the study, the visibility of the signs in both clear conditions and smoke was assessed psychophysically. A total of 21 observers participated in the assessment of visibility. Analysis of the data indicated that overall sign luminance was one of the primary determinants of visibility in smoke conditions, while uniformity was also an important contributor. The data indicated that some EL signs can be effective in clear conditions and in smoke.

Building Standards & Codes

000,114
PB90-139635 PC A05/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.
Guide Specifications and Reference Specification System.

R. G. Mathey, and J. R. Clifton. Jun 89, 79p NISTIR-89/4094
Sponsored by Naval Facilities Engineering Command, Alexandria, VA.

Keywords: *Design standards, *Construction industry, *Engineering standards, *Cost effectiveness, *Quality assurance, Project planning, Materials specifications, Construction management, Systems management, Management methods.

Guide specifications enable faster, more efficient, and cost-effective preparation of construction project specifications. By editing guide specifications instead of writing new requirements for each project, the produced construction project specifications are also generally of higher and more consistent quality, and should lead to less disputes and litigation. Established national specifications are referenced in guide specifications and this technique has proven extremely effective in communicating material, product, system, and construction requirements. Reference specifications are also used for workmanship standards. Decision rules were developed to assist in the selection of the most appropriate reference specifications. Tiering of referenced documents in guide specifications was assessed with regard to the volume of reference material that the contractor and contract administrator must study and act upon to comply with the terms of the contract. Recommendations on ways to improve Navy guide specifications and to resolve issues dealing with selection of reference documents and with their tiering are presented.

000,115
PB90-149154 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.
International Harmonization of Standards: Done with or without Us.
Final rept.
J. G. Gross. 1989, 2p
Pub. in the Building Official and Code Administrator, p46-47 Sep/Oct 89.

Keywords: *Construction industry, *Quality assurance, *International relations, Performance standards, Regulations, Competition, Commerce, International trade, Construction materials, Reprints, Standardization.

The paper summarizes European efforts and commitments to realize a single market by 1992. Activities re-

lated to standardization, certification, regulations and product approval systems for building materials and construction are reviewed. Actions to improve the competitive position of the United States construction industry are outlined for consideration.

000,116
PB90-150079 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg,
MD. Building Materials Div.

Roles of the National Bureau of Standards in Quality Assurance in Buildings and Other Construction. Final rept.

G. Frohnsdorff, and J. R. Clifton. 1984, 14p
Pub. in Proceedings of Quality Assurance Conference, Dallas, TX., July 18-20, 1983, 14p 1984.

Keywords: *Construction industry, *Quality assurance, Performance standards, Mechanical tests, Quality control, Safety engineering, Design standards, Inspection, Construction materials, *Building technology, *National Institute of Standards and Technology.

Since its founding, the National Bureau of Standards (NBS) has provided technical bases for the national physical measurement system and for much of the measurement system considered in broader terms. In building technology, NBS develops methods of measurement in the areas of structures, building materials, building physics, and building equipment, and proposes performance tests and criteria which, through acceptance by committees of voluntary consensus standards organizations such as ASHRAE and ASTM, may become national standards. These standard measurement and test methods are an essential part of quality assurance systems for buildings and other structures. They support quality assurance at all stages of the building cycle. NBS staff members in the Center for Building Technology work closely with other organizations in the building community to share their research results and maintain awareness of the measurement needs.

000,117
PB90-218181 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.
Harmonization of Standards and Regulations: Problems and Opportunities for the United States. Final rept.
J. G. Gross. 1990, 4p
Pub. in Building Standards, p32-35 Mar/Apr 90.

Keywords: *United States, *Construction industry, *Standardization, *European economic community, International trade, Quality control, Certification, Recommendations, Product development, Tests, Reprints, Global aspects.

The article provides information on the rapidly changing global market for construction products and services. Particularly, the unification of the European Community and activities in the development of the EC 92 internal market are discussed. Standards development processes in the United States and internationally are reviewed. Related testing, certification and product approval requirements are also reviewed. Recommendations for the U.S. construction community are provided.

000,118
PB90-254632 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.
International Harmonization of Standards. Final rept.

J. G. Gross. 1990, 25p
See also PB90-149154.
Pub. in Prospects for International Engineering Practice, p11-34 1990.

Keywords: *Building codes, *Design criteria, Construction materials, Europe, Standards, Construction, Quality assurance, Regulations, Reprints, *International cooperation.

The paper focuses on the current and near future expected changes in the international construction market for products and services. The importance of standards as a basis for regulations, contracts, and quality assurance systems is discussed. A review of building and construction standards and their development and use in the United States is covered, including product approval systems which are supported by laboratory accreditation and certification. The European EC 92 programs, the development and use of interna-

tional standards, and the related certification and testing programs are reviewed. The European effort directed to the harmonization of building regulations for all of Europe is also outlined. In the summary, eight action recommendations are provided for consideration by the U.S. construction community.

000,119
PB90-257726 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Fire Research.
EXPOSURE80A: A Computer Program Version of NFPA 80A.

R. L. Smith. Jul 90, 49p NISTIR-4372
Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Fire protection, *Building codes, Fire prevention, Fire safety, Safety engineering, Exposure, *Computer applications.

The report describes a computer program, EXPOSURE80A, written in Symbolics Common Lisp, that leads the user through NFPA 80A: Recommended Practice for Protection of Buildings from Exterior Fire Exposures. EXPOSURE80A is designed for use by fire protection professionals. It tells the user whether two buildings comply with the recommendations of NFPA 80A and if they do not, it suggests changes that will bring the buildings into compliance. EXPOSURE80A is easier to use than the written version of NFPA 80A since an understanding of 80A is not required. The approach used in EXPOSURE80A provides valuable information about the knowledge required of the user and the appropriate interface for the targeted class of users of an expert system, EXPOSURE, which is described in a separate report.

000,120
PB90-271347 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.
International Harmonization of Standards: Done with or without Us. Final rept.
J. G. Gross. 1990, 3p
See also PB90-149154.
Pub. in International Jnl. of Roofing Technology 2, p6-7 1990.

Keywords: *Construction materials, *Standards, Building codes, Europe, Regulations, Competition, Standardization, Product inspection, Reprints.

The paper summarizes European efforts and commitments to realize a single market by 1992. Activities related to standardization, certification, regulations and product approval systems for building materials and construction are reviewed. Actions to improve the competitive position of the United States construction industry are outlined for consideration.

000,121
PB91-101261 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.
Development and Enforcement of U.S. Building Regulations. Final rept.
J. G. Gross, and R. N. Wright. 1989, 14p
Pub. in Directory of Building Codes and Regulations, Chapter 7, v1 p51-64 Jul 89.

Keywords: *Building codes, Regulations, Design standards, Construction materials, Buildings, Architecture, Reprints.

U.S. practices for development and enforcement of building standards and codes are described for the guidance of those who seek to develop or apply improved building products or practices. Trends, such as mitigation of effects of natural hazards, conservation of energy, water and environment, and efforts to reduce barriers to beneficial innovations or trade, lead to demands for changes in building products and practices. Understanding of the U.S. building regulatory system and the roles of participating organizations is essential to introduction of new products or practices and to improvement of the building regulatory system. The paper begins with a description of the building process, its principal actors, and the role of standards in the building regulatory system and in the building process. Interfaces between the building regulatory system and the building process are described. Tech-

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nical and policy trends leading to changes in building regulations and regulatory processes are noted.

000,122
PB91-112839 PC A05/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology. **Development of Thermal Envelope Design Guidelines for Federal Office Buildings.**
 A. K. Persily. Oct 90, 87p NISTIR-4416
 Contract GSA/PBS-87-03
 Sponsored by Public Buildings Service, Washington, DC.

Keywords: *Office buildings, *Design standards, Leakage, Construction materials, Thermal analysis, Design, Roofs, Walls, Windows, Thermal insulation, *Thermal envelopes, *Energy efficiency, *Energy conservation, *Federal buildings.

Office building envelopes are generally successful in meeting a range of structural, aesthetic and thermal requirements. However, poor thermal envelope performance will occur when there are discontinuities in the envelope insulation and air barrier systems, such as thermal bridges and air leakage sites. These discontinuities result from designs that do not adequately account for heat, air and moisture transmission, with many thermal defects being associated with inappropriate or inadequate detailing of the connections of envelope components. Despite the existence of these thermal envelope performance problems, information is available to design and construct envelopes that do perform well. In order to close the gap between available knowledge and current practice, the Public Buildings Service of the General Services Administration has entered into an interagency agreement with the Center for Building Technology of the National Institute of Standards and Technology to develop thermal envelope design guidelines for federal office buildings. The goal of the project is to transfer the knowledge on thermal envelope design and performance from the building research, design and construction communities into a form that will be used by building design professionals. The report describes the NIST/GSA envelope design guidelines development at the end of the first year of effort on the project.

000,123
PB91-134072 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology. **Developing a Response to EC '92.**
 Final rept.
 J. G. Gross, and R. G. Kammer. 1990, 7p
 Pub. in Construction Specifier 43, n9 p92-94, 96, 98, 100-101 Sep 90.

Keywords: *Building codes, *Regulations, *Construction industry, United States, International trade, Standards, Construction materials, Market research, Commerce, Competition, Reprints, *European Community, Certification.

The article provides information on the rapidly changing global market for construction products and services. Particularly, the unification of the European Community and activities in the development of the EC 92 internal market are discussed. Standards development processes in the United States and internationally are reviewed. The importance of standards as the basis for regulation and commerce makes these activities extremely important for the U.S. design profession and building product producers. Related testing, certification and product approval requirements are reviewed. Recommendations for the U.S. construction community are provided.

Construction Management & Techniques

000,124
PB90-241589 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div. **Review of Economic Methods and Risk Analysis Techniques for Evaluating Building Investments (Part 1).**
 Final rept.
 H. E. Marshall. 1989, 8p
 Pub. in Jnl. of CIB 17, n6 p342-349 Nov/Dec 89.

Keywords: *Buildings, *Investments, *Economic analysis, Decision making, Risk, Simulation, Benefit cost analysis, Return on investment, Reprints, Life cycle costs.

Traditional economic methods—life-cycle costing, benefit-to-cost ratio, net benefits analysis, adjusted internal rate of return, and discounted payback—are described for evaluating building decisions about accepting or rejecting a given building investment, the economically efficient design or size of a building, and the economically efficient combination of projects competing for a limited budget. Appropriate applications for each method are described. Technically correct formulas for the methods are presented. These economic methods are often applied using 'best-guess' estimates of project input variables as if they were certain estimates. Techniques are described that to some extent account for uncertainty in input variables and in some cases risk exposure and risk attitude. The techniques are conservative benefit and cost estimating, sensitivity analysis, the risk-adjusted discount rate, mean-variance criterion, coefficient of variation, decision analysis, simulation, mathematical/analytical technique, and portfolio analysis. Advantages and disadvantages of each are described. Guidance is provided for selecting the appropriate technique for any given investment problem.

Construction Materials, Components, & Equipment

000,125
PB90-135773 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div. **Method for Characterizing the Dynamic Performance of Wall Specimens Using a Calibrated Hot Box.**
 Final rept.
 D. M. Burch, R. R. Zarr, and B. A. Licitra. 1988, 16p
 Sponsored by Department of Energy, Washington, DC. Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v94 pt1 p125-140 1988.

Keywords: *Masonry, *Walls, *Heat transfer, *Dynamic response, Calorimeters, Heat measurement, Transfer functions, Diurnal variations, Energy dissipation, Performance evaluation, Reprints.

A masonry wall, having known heat transfer properties, was installed between the metering and climatic chambers of a calibrated hot box (CHB). Time-dependent excitation functions, including a sol-air diurnal cycle, a four-harmonic diurnal cycle, a step function, and a triangular pulse were generated in the climatic chamber. The metering chamber was maintained at a typical indoor condition and was used as a calorimeter. The transient heat transfer rate at the inside surface of the wall specimen at hourly time steps was determined from an energy balance of the metering chamber. The measured specimen heat transfer rate determined for each of these excitation functions was compared with good agreement to predicted values using an analytical model. For each of the excitation functions, empirical transfer function coefficients (TFCs) for the masonry wall were determined by curve fitting the measured specimen heat transfer rate. The empirical TFCs derived from the diurnal cycle tests successfully predicted the specimen heat transfer rate for the other excitation functions. However, these sets of TFCs were not unique and differed from those obtained from an analytical model.

000,126
PB90-151721 PC A04/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research. **Quick Response Sprinklers in Chemical Laboratories: Fire Test Results.**
 W. D. Walton. Nov 89, 56p NISTIR-89/4200
 See also PB88-164223. Sponsored by National Institutes of Health, Bethesda, MD.

Keywords: *Fire tests, *Chemical laboratories, *Sprinklers, Sprinkler systems, Burning rate, Fire protection, Temperature, Experimental data.

A series of fire tests in typical chemical laboratories was conducted in order to address the use of quick

response sprinkler technology. For each test, the performance of an automatic sprinkler system in extinguishing a fire originating in an acetone spill was evaluated. The test parameters included standard sprinklers with exposed steel piping, quick response sprinklers with exposed steel piping, quick response sprinklers with exposed plastic piping, quick response sidewall sprinklers and no sprinklers. Measurements of air temperature and the concentration of oxygen, carbon monoxide and carbon dioxide were taken. A free burn test was conducted to characterize the heat release rate of the initial items ignited.

000,127
PB90-154626 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research. **Examination of the Variability of the ASTM (American Society for Testing and Materials) E 648 Standard with Respect to Carpets.**
 S. Davis, J. R. Lawson, and W. J. Parker. Oct 89, 46p NISTIR-89/4191
 Sponsored by Carpet and Rug Inst., Dalton, GA., American Fiber Mfrs. Association, Washington, DC, and American Textile Manufacturers Inst., Washington, DC.

Keywords: *Standards, *Flammability testing, *Carpets, Ignition, Combustion, Fire tests, Flame propagation, Air flow, Experimental data, Floor coverings, *ASTM E 648.

The research program investigated the variability of the ASTM E 648 Standard with respect to carpets and to make recommendations for revising the standard to improve the repeatability and reproducibility of the measured results. Several ignition sources and procedural variations were studied to assure that flame propagation away from the point of ignition would occur if the critical radiant flux of the carpet was less than the maximum flux from the panel. This resulted in the replacement of the propane torch point source pilot burner by a propane line burner. A coefficient of variation study was carried out to select one carpet for a parametric study of the test variables. As a result of the parametric study and a subsequent 'proficiency round,' recommendations were made to ASTM Committee EO5 on Fire Standards for revision of ASTM E 648. The most significant changes were the use of the line burner for ignition and a tighter control of the air flow through the chamber.

000,128
PB90-169327 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div. **Cigarettes with Low Propensity to Ignite Soft Furnishings.**
 Final rept.
 J. F. Krasny, R. H. Harris, R. S. Levine, and R. G. Gann. 1989, 38p
 Pub. in Jnl. of Fire Science 7, n4 p251-288 Jul/Aug 89.

Keywords: *Flammability testing, *Ignition, *Furniture, Tobacco, Fire tests, Upholstery, Fire prevention, Bedding equipment, Reprints, *Cigarettes.

The paper describes some of the results of a two-and-a-half year, Congressionally-mandated effort to identify cigarettes with properties that would reduce their propensity to ignite soft furnishings (upholstered furniture and mattresses). For this purpose, the ignition propensities of 41 specially designed and 5 patented cigarettes were investigated. Several of these experimental cigarettes were found to have considerably lower ignition propensities than current commercial cigarettes. These cigarettes combined low tobacco content (attained by low packing density and low cigarette circumference), and low paper permeability and citrate content. Some of these low ignition propensity cigarettes had tar, nicotine, and CO yields comparable to large-selling commercial brands. The five patented cigarettes also exhibited considerably lower ignition propensity than commercial cigarettes.

000,129
PB90-169582 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div.

Experiments of Piston Effect on Elevator Smoke Control.

Final rept.
J. H. Klote, and G. T. Tamura. 1987, 12p
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 93, pt2 p2217-2228 1987.

Keywords: *Elevators(Lifts), *Smoke, *Fires, *Fire tests, Smoke abatement, Numerical analysis, Experimental data, Buildings, Safety engineering, Fire protection, Reprints.

The transient pressures produced when an elevator car moves in a shaft are a potential problem for elevator smoke-control systems. This piston effect can pull smoke into a normally pressurized elevator lobby. The paper presents the results of piston effect experiments under smoke-control conditions. The results of a theoretical analysis and those of the experiments are in good agreement. For most elevators the piston-effect problem can be overcome by designs that prevent smoke from being pulled into elevator lobbies, and equations for the amount of pressurization air needed to accomplish this are presented.

000,130

PB90-170739 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Update: ASTM (American Society for Testing and Materials) Standards for Single-Ply Membranes.

Final rept.
W. J. Rossiter. 1986, 3p
Pub. in Roofing/Siding/Insulation (RSI) 63, n10 p62-64 Oct 86.

Keywords: *Roofing, *Membranes, *Polyvinyl chloride, *Chloroprene, *Copolymers, Standards, Structural plastics, Construction materials, Reprints, *American Society for Testing and Materials.

The American Society for Testing and Materials (ASTM) and its Committee D-8 on Roofing, Waterproofing and Bituminous Materials is the lead organization to which the U.S. roofing industry turns for guidance in developing voluntary consensus standards. The report presents an update of the latest developments at ASTM regarding single-ply standards. A standard for PVC membrane materials is expected to be issued by early 1987.

000,131

PB90-170838 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.

Setting Time and Strength to Concrete Using the Impact-Echo Method.

Final rept.
S. P. Pessiki, and N. J. Carino. 1988, 11p
Pub. in ACI Materials Jnl. 85, n5 p389-399, 10 Sep 88.

Keywords: *Concretes, *Compressive strength, *Setting time, *Impact tests, *Echoes, Monitors, Measurement, Nondestructive tests, Reprints, Impact-echo method, P waves.

Tests were performed to evaluate the feasibility of using the impact-echo method to determine setting time and to monitor strength development of concrete. In the impact-echo method, the test object is subjected to point impact and the surface displacement is monitored at a point adjacent to the impact. From the measured displacement waveform and the thickness of the object, the P-wave velocity is determined. A strong correlation was found between the time of initial setting of mortars sieved from the concrete, as determined by penetration resistance (ASTM C 403), and the time when the P-wave velocity began to increase. Two approaches for using the impact-echo method to define the setting time of concrete are presented. Tests were performed to examine the relationship between P-wave velocity, as determined by the impact-echo method, and the compressive strength of concrete. At early ages (up to about 3 days at standard temperature), the relationship was independent of curing temperature and water cement ratio. It is concluded that the impact-echo method is a promising nondestructive technique for monitoring the development of mechanical properties in concrete from initial setting to ages of several days.

000,132

PB90-187493 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Rational Development of Bench-Scale Fire Tests for Full-Scale Fire Prediction.

Final rept.
V. Babrauskas, and U. Wickstrom. 1989, 10p
Pub. in Proceedings of International Symposium on Fire Safety Science (2nd), Tokyo, Japan, June 13-17, 1988, p813-822 1989.

Keywords: *Fire tests, *Flammability testing, *Standards, Calorimeters, Flames, Flammability, Fires, Heat measurement, Furniture, Upholstery.

National standards for flammability have, in most countries, been established for many years. Thus, they are based on an understanding of fire physics which may be several decades old. In more recent times, however, significant strides have been made in developing test methods which are based on an improved understanding of building fires. The best-possible estimate of the flammability of building products or contents would be, by definition, a full-scale fire experiment. These are recently being standardized, and will serve an important reference function. Because of cost and practical difficulties, however, it is generally desirable to do the majority of product evaluations by bench-scale tests. In the paper the rational bases for achieving validated bench-scale tests for flammability are examined, and a number of recent examples are cited where such a process has been followed. It is also shown that these test results have a current relationship to the full-scale phenomena.

000,133

PB90-187865 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Effect of Temperature and Stress on the Time-to-Failure of EPDM T-Peel Joints.

Final rept.
J. W. Martin, E. Embree, and D. P. Bentz. 1987, 8p
Pub. in Durability of Construction Materials, v3 p1310-1317 1987.

Keywords: *Glued joints, *Stresses, Construction materials, Elastomers, Seams(Joints), Accelerated tests, Ethylene copolymers, Roofing, Weibull density functions, Reprints, Ethylene propylene diene polymers, Temperature dependence, Time dependence, Time to failure.

Creep-rupture experiments were conducted on adhesively bonded EPDM T-peel seams to determine the sensitivity of the time-to-failure distributions to temperature and mechanical stress. Experimental results indicate that time-to-failure distributions are very sensitive to mechanical stress, but not temperature. That is, at a given temperature, as mechanical stress increases, the time-to-failure distributions decrease. However, at a given stress, changes in temperature do not cause a significant change in the time-to-failure distributions, except at the lowest experimental stress level where an increase in temperature may result in an increase in the times-to-failure. The increase at the lowest experimental stress, is due to the formation of fibers between separating seam piles. The change in failure mode at the lowest experimental stress level may limit the use of temperature and stress as acceleration factors.

000,134

PB90-217779 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Thermodynamic Aspects of Concrete Durability.

Final rept.
P. W. Brown. 1987, 8p
Pub. in Pore Structure and Construction Materials Properties, v1 p363-370 1987.

Keywords: *Concretes, Construction materials, Thermodynamic equilibrium, Durability, Deterioration, Freezing, Porosity, Sulfates, Corrosion, Leaching, Acid resistance, Carbonation, Alkali aggregate reactions, Reprints.

The major deterioration processes affecting the durability of concrete are discussed with regard to thermodynamic driving forces. The driving forces are considered in terms of the phase equilibria that determine the conditions under which deterioration processes may occur. The deterioration processes that are considered include: freezing of pore solutions, sulfate attack, acid attack and leaching, carbonation, the alkali-silicate reaction and corrosion. The constraints associated with limiting the number of components in the multi-component systems necessary to rigorously consider the deterioration processes are discussed in detail.

000,135

PB90-217969 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Prediction of Service Life of Building and Construction Materials.

Final rept.
L. W. Masters. 1987, 4p
Pub. in Durability of Construction Materials, v3 p1318-1321 1987.

Keywords: *Construction materials, Service life, Life(Durability), Predictions, Reprints.

RILEM 71-PSL/CIB W80 on Prediction of Service Life was established in 1981 to address the need for improved methodologies to aid service life prediction of building and construction materials. The final report of the Committee, entitled 'Prediction of Service Life of Building Materials and Components', presents a summary of the state of the art, an identification of technical barriers to service life prediction, a description of some general methodologies which have been used in various laboratories and nations and a recommended methodology for use in RILEM and CIB activities. The article is a brief summary of the report prepared by the Committee.

000,136

PB90-218165 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div.

Investigation of the Effects of a Stratified Two Layer Environment on Fire Plume Temperatures.

Final rept.
D. Evans, and J. Morehart. 1987, 6p
Pub. in Proceedings of ASME-JSME Thermal Engineering Joint Conference, Honolulu, HI., March 22-27, 1987, p381-386.

Keywords: *Fire tests, *Temperature measurement, *Plumes, *Boundary layer flow, Experimental data, Mathematical models, Temperature measuring instruments, Jet flow, Ceilings(Architectural), Heat transfer, Fire protection, Fire detection systems, Sprinkler systems, Reprints.

A layer of gas at elevated temperature accumulates below the ceiling of a room during a fire. This layer affects fire plume and ceiling jet flows, heat transfer to the ceiling material, and ultimately detector (suppression system) response time. The paper experimentally examines the effects of a stratified warm gas layer on plume flow temperatures originating from a source located in an ambient lower layer. Measurements of spatial distributions of temperature at steady state are presented for a confined 1.2 m diameter cylindrical ceiling configuration. Encouraging agreement is found between experimental temperature measurements and predictions by two existing models for describing temperatures in this two layer environment.

000,137

PB90-219783 PC A07/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Manual for the Cement Hydration Simulation Model.

Technical note (Final).
L. Struble, S. Johnson, M. Hartmann, L. Kaetzel, and H. Jennings. Sep 89, 129p NIST/TN-1269
Also available from Supt. of Docs. as SN003-003-02972-6. Prepared in cooperation with Illinois Univ. at Urbana-Champaign, North Carolina State Univ. at Raleigh, and Northwestern Univ., Chicago, IL.

Keywords: *Portland cements, Computerized simulation, Hydration, Mathematical models, Manuals, Graphic methods, Computer systems programs, Construction materials, Calcium silicates, National Institute of Standards and Technology, Tricalcium silicate.

The manual describes the Cement Hydration Simulation Model, a computer-based model developed in the Building Materials Division of the Center for Building Technology, National Institute of Standards and Technology (NIST). The model simulates microstructural changes during hydration of tricalcium silicate, the principal constituent of portland cement. Output of the model may be in the form of two- or three-dimensional images, showing the location and size of each constituent. The model is written in FORTRAN 77. It is interactive and modular. The model is installed on a super-mini computer at NIST, which can be accessed by

other, suitably configured computers. The manual provides documentation, instructions, and examples of input and output using the model.

000,138
PB90-227976 PC A15/MF A02
 Worcester Polytechnic Inst., MA.
Transient Characteristics of Unconfined Fire-Plume-Driven Ceiling Jets.
 Final rept. Aug 89.
 V. Motevalli, and C. H. Marks. May 90, 328p NIST/GCR-90/574
 Grant 70NANB5H0551
 Prepared in cooperation with Maryland Univ., College Park. Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire tests, *Ceilings(Architecture), *Jets, *Unsteady state, Temperature measurement, Velocity measurements, Jet flow, Theses, Numerical analysis, Fires, Experimental data.

An extensive study of small-scale, unconfined, fire-induced ceiling jets was conducted under ceiling transient and steady state conditions. Detailed velocity and temperature measurements of the ceiling jet were made simultaneously using the cross-correlation velocimetry technique from the start of the fire until the ceiling reached steady state. Velocity and temperature profiles were obtained at several radial locations away from the plume impingement point. These measurements were made for transient and steady ceiling jet conditions in the case of the H=1.0 m. All the transient measurements in the H=0.5 m case were limited to temperature measurements. At steady state, however, both temperature and velocity measurements were obtained.

000,139
PB90-234998 PC A04/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Risk Assessment Method: Case Study 1, Upholstered Furniture in Residences.
 S. W. Stiefel, R. W. Bukowski, J. R. Hall, and F. B. Clarke. Jun 90, 64p NISTIR-90/4243
 See also PB90-235052. Prepared in cooperation with National Fire Protection Association, Quincy, MA., and Benjamin/Clarke Associates, Inc., Kensington, MD.

Keywords: *Fire hazards, *Upholstery, *Residential buildings, Fires, Mathematical models, Operations research, Hazards, Fire safety, Furniture, Flammability, Statistical analysis, Ignition, Risk assessments.

Traditional methods of assessing fire risk are based on probabilistic treatment of fire incident data. Recent advances in the ability to make deterministic predictions of the consequences of specific fire scenarios presents an opportunity to reduce this dependency on incident data and greatly improve the ability to assess the risk associated with new products for which such data do not exist. The paper presents a trial application of a risk assessment method developed for such a purpose. A separate report provides the essential documentation for the methodology to be understood and applied by others. There are three other associated reports detailing trial applications of the methodology to other selected products and occupancies. This report deals with upholstered furniture in residences.

000,140
PB90-235037 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Risk Assessment Method: Case Study 2, Carpet in Offices.
 S. W. Stiefel, R. W. Bukowski, J. R. Hall, and F. B. Clarke. Jun 90, 43p NISTIR-90/4244
 See also PB90-234998. Prepared in cooperation with National Fire Protection Association, Quincy, MA., and Benjamin/Clarke Associates, Inc., Kensington, MD.

Keywords: *Fire hazards, *Carpets, *Office buildings, Fires, Mathematical models, Operations research, Hazards, Fire safety, Fabrics, Statistical analysis, Flammability, Ignition, *Risk assessment.

Traditional methods of assessing fire risk are based on probabilistic treatment of fire incident data. Recent advances in the ability to make deterministic predictions of the consequences of specific fire scenarios presents an opportunity to reduce this dependency on incident data and greatly improve the ability to assess the risk associated with new products for which such

data do not exist. The paper presents a trial application of a risk assessment method developed for such a purpose. A separate report provides the essential documentation for the methodology to be understood and applied by others. There are three other associated reports detailing trial applications of the methodology to other selected products and occupancies. This report deals with carpets in offices.

000,141
PB90-235045 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Risk Assessment Method: Case Study 3, Concealed Combustibles in Hotels.
 S. W. Stiefel, R. W. Bukowski, J. R. Hall, and F. B. Clarke. Jun 90, 48p NISTIR-90/4245
 See also PB90-235037. Prepared in cooperation with National Fire Protection Association, Quincy, MA., and Benjamin/Clarke Associates, Inc., Kensington, MD.

Keywords: *Hotels, *Fire hazards, *Flammability, Fires, Mathematical models, Operations research, Fire safety, Statistical analysis, Ignition, *Risk assessment, Building materials.

Traditional methods of assessing fire risk are based on probabilistic treatment of fire incident data. Recent advances in the ability to make deterministic predictions of the consequences of specific fire scenarios presents an opportunity to reduce this dependency on incident data and greatly improve the ability to assess the risk associated with new products for which such data do not exist. The paper presents a trial application of a risk assessment method developed for such a purpose. A separate report provides the essential documentation for the methodology to be understood and applied by others. There are three other associated reports detailing trial applications of the methodology to other selected products and occupancies. This report deals with combustibles in hotels.

000,142
PB90-235052 PC A05/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Risk Assessment Method: Description of Methodology.
 R. W. Bukowski, S. W. Stiefel, J. R. Hall, and F. B. Clarke. Jun 90, 79p NISTIR-90/4242
 See also PB90-235045. Prepared in cooperation with National Fire Protection Association, Quincy, MA., and Benjamin/Clarke Associates, Inc., Kensington, MD.

Keywords: *Fire hazards, *Buildings, Flammability, Fires, Mathematical models, Operations research, Fire safety, Statistical analysis, Ignition, *Risk assessment.

Traditional methods of assessing fire risk are based on probabilistic treatment of fire incident data. Recent advances in the ability to make deterministic predictions of the consequences of specific fire scenarios presents an opportunity to reduce this dependency on incident data and greatly improve the ability to assess the risk associated with new products for which such data do not exist. The paper presents a risk assessment method developed for such a purpose, and provides the essential documentation for the methodology to be understood and applied by others. There are also four associated reports detailing trial applications of the methodology to specific products in specified occupancies. This report covers the methodology.

000,143
PB90-242199 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Durability of Cement Pastes, Mortars, and Concretes.
 Final rept.
 L. Struble. 1989, 82p
 Pub. in Cements Research Progress, p157-238 1989.

Keywords: *Cements, *Mortars(Material), *Concretes, *Alkali aggregate reactions, Corrosion, Concrete durability, Reviews, Reinforced concrete, Chlorides, Thermal cycling tests, Permeability, Reprints.

A comprehensive review is presented of the literature published during 1986 concerning the durability of cementitious materials. Included are permeability, degradation in aggressive salts, expansion due to alkali-aggregate reactions, degradation due to freezing and thawing, corrosion of reinforcing materials, and other durability studies. The review covers the durability of hardened cement, paste, mortar, and concrete.

000,144
PB90-244443 PC A05/MF A01
 Virginia Polytechnic Inst. and State Univ., Blacksburg.
Experimental Investigation of Glass Breakage in Compartment Fires.
 Master's thesis.
 M. J. Skelly. Jun 90, 92p NIST/GCR-90/578
 Grant 60NANB-8-D0829
 Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Window glass, *Fire tests, *Breaking, Thermal stresses, Test facilities, Experimental data, Fires, Buildings, Temperature.

An experimental investigation has been completed which studied the breaking of window glass by fire. Experimental data was collected from two test groups: the first for windows with their edges insulated from the fire (edge-protected) and the second for windows uniformly heated by the fire (edge-unprotected). Results of the edge-protected window tests indicated that the glass breakage was caused by a critical temperature difference between the central heated portion of the pane and the glass edge, which was approximately 90C. When breakage occurred, the cracks spread throughout the glass, joined together and caused at least partial collapse of the pane. Results from the edge-unprotected window tests were quite different. There were relatively few cracks developed and almost no propagation across the glass. Consequently, there was no window collapse in any of these cases.

000,145
PB90-244450 PC A03/MF A01
 National Fire Protection Association, Quincy, MA.
Fire Risk Assessment Method: Case Study 4, Interior Finish in Restaurants.
 R. W. Bukowski, W. W. Jones, J. R. Hall, and F. B. Clarke. May 90, 37p NISTIR-90/4246
 See also PB90-235045. Prepared in cooperation with Benjamin/Clarke Associates, Inc., Kensington, MD. Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Fire hazards, *Finishes, Probability theory, Ignition, Fire safety, Flammability, Buildings, Statistics, *Risk assessment, *Restaurants.

Traditional methods of assessing fire risk are based on probabilistic treatment of fire incident data. Recent advances in the ability to make deterministic predictions of the consequences of specific fire scenarios presents an opportunity to reduce this dependency on incident data and greatly improve the ability to assess the risk associated with new products for which such data do not exist. The paper presents a trial application of a risk assessment method developed for such a purpose. A separate report provides the essential documentation for the methodology to be understood and applied by others. There are three other associated reports detailing trial applications of the methodology to other selected products and occupancies.

000,146
PB90-244468 PC A03/MF A01
 California Univ., Berkeley. Dept. of Mechanical Engineering.
Thermal Analysis of a Compartment Fire on Window Glass.
 Rept. for 1 Sep 88-31 Aug 89.
 A. Joshi, and P. J. Pagni. Jun 90, 24p NIST/GCR-90/579
 Grant 60NANB-8D0848
 Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Window glass, *Fires, *Thermal analysis, Thermal stresses, Mathematical models, Thermal conductivity, Heating, Heat transfer.

Windows break in fires due to thermal stress from the differential heating of the central portion and the shaded edge. The paper determines the surface temperature history of the glass. Typical property values suggest the range of 50 C-100 C for the breaking temperature. Here the transient, one-dimensional (into the glass normal to the pane), inhomogenous (in-depth radiation absorption) energy equation is solved using an innovative Laplace Transform technique suggested by

Baum. Time varying incident radiative flux and the glass temperatures are included. These equations are solved numerically by using the trapezoidal rule for numerical integration and Newton-Raphson's method for determining the roots of nonlinear equations. Results are presented for typical values of the governing dimensionless parameters.

000,147
PB90-247420 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Report of the CIB W14 Workshop on Fire Modeling (4th); Conseil International du Batiment (CIB) Commission W14 on Fire.
J. G. Quintiere. Jun 90, 83p NISTIR-4338
Proceedings of a workshop held in Gaithersburg, MD on February 12-14, 1990.

Keywords: *Fires, *Models, *Buildings, *Workshops, Flammability, Finishes, Algorithms, Mathematical models, Fire safety, Standards, Fire resistance.

A summary of presentations are presented for the 4th Conseil International du Batiment (CIB) Workshop on Fire Modeling. The scope of the presentations, 47 in number, include reports of recent developments and applications of zone and field models, presentations on specific phenomena needed by computer algorithms, and presentations on the subject of interior finish flammability. The Workshop showed that a variety of models are in international use, that data is lacking to confirm the accuracy of the models for applications beyond their base of development, and that it is becoming evident that the fire growth hazard of interior finish materials can be predicted from small scale test data.

000,148
PB90-254855 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Safety Technology Div.
Fundamentals of Enclosure Fire 'Zone' Models, 1989.
Final rept.
J. G. Quintiere. 1989, 21p
See also PB89-176168.
Pub. in Jnl. of Fire Protection Engineering 1, n3 p99-119 Jul/Aug/Sep 89.

Keywords: *Fires, *Models, *Enclosures, Buildings, Vents, Air flow, Mathematical models, Reprints, *Conservation equations.

The conservation laws are presented in control volume form and applied to the behavior of fire in enclosures. The behavior of enclosure fires is discussed and the assumptions for justifying the use of the control volume of 'zone' modeling approach are presented. The governing equations are derived and special solutions are given. Flow through wall vents, room filling, and growing fires are analyzed. The paper is not a review of the literature. It is a theoretical presentation of compartment fire zone modeling, much of which has not been explicitly presented before or integrated into one presentation. The analysis for species in terms of mixture fraction is a distinct new contribution to zone modeling.

000,149
PB90-254871 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Comparisons of NBS/Harvard VI Simulations and Data from all Runs of a Full-Scale Multi-Room Fire Test Program.
Final rept.
J. A. Rockett, M. Morita, and L. Y. Cooper. 1989, 55p
See also PB90-128620.
Pub. in Fire Safety Jnl. 15, p115-169 1989.

Keywords: *Fires, Models, Computerized simulation, Buildings, Fire tests, Proving, Test facilities, Mathematical models, Reprints, Computer applications.

The NBS/Harvard VI multi-room fire model computer code was used to simulate results of previously reported full-scale, multi-room fire experiments. The tests and simulations involved four different compartment configurations made up of two or three rooms connected by open doorways, four different fire types generated by a methane burner located in the room identified as the burn room, and up to four different doorway openings between the burn room and the adjacent space. A total of nineteen different tests were carried

out and simulated. Comparisons between simulated and measured parameters of the fire-generated environments are reviewed. While the computer code is generally found to provide favorable simulations for the entire range of tests, several areas in modeling detail are identified as requiring clarification, research and further improvement. The improvements should be incorporated in future versions of the NBS/Harvard multi-room fire model.

000,150
PB90-271032 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Smoke Measurement Results from the Cone Calorimeter.
Final rept.
V. Babrauskas. 1985, 15p
Pub. in Proceedings of UJNR Joint Panel Meeting on Fire Research and Safety (8th), Tsukuba, Japan, May 13-21, 1985, p420-434.

Keywords: *Soot, *Smoke, *Calorimeters, *Fire tests, *Combustion products, *Thermal measurements, Measuring instruments, Fires, Reprints, Particulates.

The most prevalent apparatus in use for obtaining data on the smoke production tendencies of materials is the NBS Smoke Chamber. Exploratory testing with simple materials in the NBS Smoke Chamber has indicated significant shortcomings in obtaining apparatus-independent data for use in modeling. Most of those difficulties are associated with the fact that this chamber is a static box. Recently a new heat release rate apparatus--the Cone Calorimeter--has been developed at the National Bureau of Standards (NBS), which allows improved heat release rate measurements to be made. Smoke measuring instrumentation has now been developed for use with the Cone Calorimeter, allowing smoke data to be gathered in a dynamic, flow-through environment. Smoke measurements made in the Cone Calorimeter on upholstered furniture specimens are presented and are compared to full-scale test data on the same materials.

000,151
PB90-271040 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Smoke and Soot Data Determinations in the Cone Calorimeter.
Final rept.
V. Babrauskas, and G. Mulholland. 1987, 22p
Pub. in Mathematical Modeling of Fires, ASTM STP 983, p83-104 1987.

Keywords: *Soot, *Smoke, *Calorimeters, *Fire tests, *Combustion products, *Thermal measurements, Standards, Aerosols, Measuring instruments, Irradiance, Fires, Reprints, Particulates.

Two kinds of measurements are often of interest for characterizing aerosols of particulates resulting from fires--direct optical measurements and measurements of the fraction of specimen mass that becomes particulate mass. The former consists of two components, absorption and scattering, but is more typically made for a long time in connection with other-purpose fire tests, such as ASTM E 84 or ASTM E 906, or as separate tests, such as in ASTM E 662. The latter has often been considered the definitive measurement, and is often referenced for regulatory or specification purposes. Recent work at NBS has pointed to a number of shortcomings of this test, including the limited irradiance range, the absence of continuous specimen mass loss measurements, and the small, fixed amount of oxygen available for combustion. This has resulted in the development of both optical and gravimetric soot measuring techniques for the Cone Calorimeter, which is a flow-through system, with adequate irradiance range, load cell, and modern signal manipulation hardware.

000,152
PB90-271222 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Quantitative Assessment of Smoke Toxicity Hazards in Large Structures.
Final rept.
R. W. Bukowski. 1985, 14p
See also PB90-112400.
Pub. in Proceedings of UJNR Joint Panel Meeting on Fire Research and Safety (8th), Tsukuba, Japan, May 13-21, 1985, p85-98.

Keywords: *Fire hazards, *Toxicity, *Smoke, *Buildings, Mathematical models, Fires, Combustion products, Reprints, Risk assessment.

The ongoing program at the Center for Fire Research to develop a quantitative fire hazard assessment method is described. Three types of models - field, zone, and network - are discussed, along with plans for combining them into a hybrid model which provides sufficient detail for addressing practical problems but does not require large computers. Current capabilities of these models are presented along with plans for near term improvements. Efforts to validate the predictive accuracy of the models and simplify the presentation and analysis of data provided by the models is described. Some thoughts on potential uses of these techniques are presented.

000,153
PB90-271230 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Using High-Resolution Hand-Held Radiometers to Measure In situ Thermal Resistance.
Final rept.
D. M. Burch, and D. F. Krintz. 1984, 10p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Conference, v446 p24-33 1984.

Keywords: *Thermal insulation, *Residential buildings, *Radiometers, *Thermal resistance, Thermal measurements, Measuring instruments, Heat flux, Walls, Standards, Field tests, Reprints.

A field study was carried out to investigate the accuracy of using high-resolution radiometers to determine the in situ thermal resistance of building components having conventional residential construction. Two different types of radiometers were used to determine the thermal resistances of the walls of six test buildings located at the National Bureau of Standards. These radiometer thermal resistance measurements were compared to reference thermal resistance values determined from steady-state series resistance predictions, time-averaged heat-flow-sensor measurements, and guarded-hot-box measurements. The study recommends that the ANSI/ASHRAE Standard 101-1981 be modified requiring the heating plant to be operated in a typical cyclic fashion instead of being turned off prior to and during radiometer measurements.

000,154
PB91-107151 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Model for Predicting the Generation Rate and Distribution of Products of Combustion in Two-Layer Fire Environments.
L. Y. Cooper. Sep 90, 53p NISTIR-4403

Keywords: *Combustion products, *Fires, *Buildings, Air flow, Combustion, Mathematical models, Plumes, Smoke, Numerical analysis.

A general model is developed for predicting the generation rates of oxygen, fuel, and any other products of combustion of interest in rooms containing fires. The model is called the generalized global equivalence ratio model. It extends the steady state global equivalence ratio model established from steady-state data of several previous experimental studies. After presenting the details, a concise algorithm is outlined for implementing the model in two-layer zone-type compartment fire model computer codes. With the algorithm in place, such codes could be used to simulate the distribution of products of combustion in single or multi-room fire environments. In an example application, the model is used to simulate the time-dependent environment, including that of steady-state, in some of the above-mentioned experimental studies. For arbitrary experimental conditions and under the assumption of stoichiometric combustion, solutions for concentrations of products of combustion are obtained and presented. In one concise result, the solutions are used to predict the time-to-extinguishment of a burning methane fuel source embedded in an initially ambient-atmosphere upper layer.

000,155
PB91-107169 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Fire Risk Assessment Method: Guide to the Risk Methodology Software.

Internal rept. (Final).
C. L. Forney, and W. W. Jones. Sep 90, 56p NISTIR-4401
Sponsored by National Fire Protection Association, Quincy, MA.

Keywords: *Fires, *Buildings, *Construction materials, Statistical analysis, Furniture, Probability theory, Burning rate, Fire safety, Safety engineering, Fire hazards, Flammability, *Risk assessment, *Computer applications.

The guide provides the background on the computer programs used in the Risk Assessment Method. The program modules are tabulated and explained, together with the file requirements for each. Two examples are carried through the process to show the actual use of the programs in performing an assessment of the risk due to unwanted fires.

000,156
PB91-107482 PC A06/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Full Scale Simulation of a Fatal Fire and Comparison of Results with Two Multiroom Models.
R. S. Levine, and H. E. Nelson. Aug 90, 106p NISTIR-90/4268

Keywords: *Fires, *Residential buildings, *Computerized simulation, Combustion products, Fire tests, Heat transfer coefficients, Carbon monoxide, Air flow, Safety engineering, Computer applications.

In 1987, a fire in a kitchen in Sharon, PA resulted in the deaths of three persons in upstairs bedrooms, one with a reported blood carboxyhemoglobin content of 91%. Considerable physical evidence remained. The fire was successfully simulated at full scale in a fully instrumented seven room test called SHARON 2. The data collected during SHARON 2 have been used to evaluate the precision of two multiroom computer fire codes: FAST 18 and HARVARD 6.3. A coherent ceiling layer flow occurred during the SHARON 2 simulation and quickly carried high concentrations of carbon monoxide (CO) to remote compartments. Such flow is not directly accounted for in either computer code. However, both codes predict well the carbon monoxide buildup in the sixth room (i.e., the room most remote from the fire). Prediction of the pre-flashover temperature rise was good. Prediction of temperatures after flashover of the room of origin was less successful. Other predictions of conditions throughout the seven test rooms varied from good approximations to significant deviation from test data. Hypotheses are presented as to the reasons for the differences. At least some are believed due to phenomena not considered in the computer codes.

000,157
PB91-111997 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Thermal Bridging in Mechanical Fastened Low-Slope Roofs.
Final rept.
D. M. Burch, P. J. Shoback, and K. Cavanaugh. 1988, 14p
Pub. in Proceedings of Conference on Mathematical Modeling of Roof Systems, Oak Ridge, TN., September 15-16, 1988, p131-144 1988.

Keywords: *Heat transfer, *Fasteners, *Roofs, Thermal insulation, Thermal resistance, Thermal conductivity, Finite difference theory, Heat transmission, Thermodynamic properties, Temperature distribution, Reprints.

The heat transfer through cylindrical metal fasteners with metal caps in low-slope roofs having metal and wood decking is analyzed using finite-difference theory. The metal fasteners consisted of a 4.7-mm (3/16-in)-diameter steel rod with a 76-mm (3.0-in) diameter and 0.56-mm-thick (22-mil) steel cap. For a representative case of 5.4 fasteners/sq m (4.5 fasteners/sq yd), metal fasteners were found to reduce the overall thermal resistance of low-slope roofs with metal decking from 3 to 8% for insulation thicknesses ranging from 25 to 150 mm (1 to 6 in.). The effect of metal fasteners on the overall thermal resistance of low-slope roofs with wood decking was found to be about one-half their effect on roofs with metal decking. The use of plastic instead of metal caps on the metal fasteners reduced the thermal bridging of the individual

metal fastener by 44%. In low slope roofs with more than one layer of insulation, the effect of metal fasteners on the overall thermal resistance was reduced by a factor of three by using metal fasteners to attach only the bottom layer of insulation to the roof deck.

000,158
PB91-112334 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Plaza Hotel Fire Experiments.
Final rept.
J. H. Klotz. 1990, 5p
Pub. in ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning Engineers) Jnl. 32, n10 p25-29 Oct 90.

Keywords: *Fire tests, *Hotels, *Smoke, *Air flow, Combustion products, Experimental data, Fire safety, Commercial buildings, Reprints.

A series of full scale tests were conducted with the objective to evaluate the current approach to zoned smoke control systems. Smoke movement and the performance of a zoned smoke control system were studied with smoke generated from unsprinklered wood fires, sprinklered wood fires, and smoke bombs. The smoke control system was designed using the methods of the ASHRAE smoke control manual and the recommended design pressure differences of NFPA 92A. As expected, the zoned smoke control system prevented smoke migration beyond the fire floor. Concerns about fan temperatures were evaluated, and an approach to deal with fan temperature was developed. The experiments showed that chemical smoke from smoke bombs is very different from hot smoke from flaming fires. With few exceptions, smoke bombs should not be used for acceptance tests.

000,159
PB91-112458 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Algorithm for the Mass-Loss Rate of a Burning Wall.
Final rept.
H. E. Mitter. 1989, 10p
See also PB88-153812.
Pub. in Proceedings of International Symposium on Fire Safety Science (2nd), Tokyo, Japan, June 13-17, 1988, p179-188 1989.

Keywords: *Algorithms, *Burning rate, *Fires, Flames, Temperature, Enclosures, Walls, Mass, Thermophysical properties, Models, Fire safety, Reprints.

A derivation is given for a simple algorithm which yields the quasi-steady burning rate of a vertical panel of non-charring, non-melting material in an enclosure with stratification of temperature and oxygen concentration. The algorithm requires the solution of a transcendental equation. Among the thermophysical data which are needed, are the mean flame temperature and the height-dependent absorption coefficient, $\epsilon(z)$. It is found from experiment that $\epsilon(z)$ is well described by PMMA by a two-parameter expression linear in $1/z$. Comparison with a transient experiment yields good agreement for the mass-loss rate, over much of the range.

000,160
PB91-112631 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Risk of Blistering of Built-Up Roofing Membranes Applied to Polyurethane Foam Insulation.
Final rept.
W. J. Rossiter, and R. G. Mathey. 1987, 18p
Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL., Naval Facilities Engineering Command, Alexandria, VA., and Office of the Chief of Engineers (Army), Washington, DC.
Pub. in Thermal Insulation: Materials and Systems, ASTM STP 922, p431-448 1987.

Keywords: *Polyurethane resins, *Cellular plastics, *Roofing materials, *Insulating boards, *Foam rubber, Thermal insulation, Construction materials, Asphalts, Busting, Membranes, Facings, Felts, Degassing, Moisture content, Webs(Supports), Reprints.

The paper presents the results of a study to investigate the effect of application of hot asphalt directly onto polyurethane insulation boards. In addition, it discusses causes of blistering and methods for using polyurethane foam insulation boards in built-up roofing

systems so as to reduce the risk of blistering. Polyurethane foam insulation specimens, typical of those used in the late 1970s in the United States for built-up roofing construction, were included in the study. Most of the insulations contained a facing material. Hot asphalt was applied to the insulations with facings to determine the extent of off-gassing. Hot asphalt was also applied to insulations without facings, to facings removed from insulation, and to oven-dried insulations and facings to investigate the effect of the moisture content of the insulations and facings on the off-gassing. In other tests, oven-dried and moist (room dry) felts were used in the preparation of built-up membranes over polyurethane boards. Delamination of the roofing specimens indicated many large voids in the asphalt layer between the polyurethane insulation and the first ply of felt. These voids were considered to increase the risk of blistering in built-up membranes applied directly on the polyurethane foam insulation. The data support previous suggestions to apply a thin layer of rigid insulation to the polyurethane foam before the membrane is applied.

000,161
PB91-118075 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Investigation into the Factors Affecting Infrared Temperature Measurements for Building Applications.
Final rept.
Y. M. Chang. 1987, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) International Conference on Thermal Infrared Sensing for Diagnostics and Control (Thermosense IX), Orlando, FL., May 18-20, 1987, p11-18.

Keywords: *Infrared equipment, *Thermal measurements, *Buildings, *Construction materials, Temperature measuring equipment, Calibrating, Temperature distribution, Surface properties, Infrared image tubes, Emissivity, Reprints.

Various factors affecting infrared temperature measurements are discussed. Temperature calibration curves at surrounding temperatures between -20C and 25C are presented for two infrared imaging systems operating in the 2 to 5 micrometers and 8 to 14 micrometers wavelength regions. The calibration curves for the 2 to 5 micrometers system were found to be independent to surrounding temperatures, while the calibration curves for the 8 to 14 micrometers system were found to be strongly dependent to surrounding temperatures. Equations to account for changes in surrounding temperatures are presented. Laboratory measurements of emissivity using both systems at different surrounding temperatures (22C, 4C, and -11C) are given for several typical building materials. The emissivity measurements are used in computing surface temperatures of the materials. Comparisons are made between predicted and measured surface temperatures.

000,162
PB91-118083 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Physics Div.
Infrared Inspection Techniques for Assessing the Exterior Envelopes of Office Buildings.
Final rept.
Y. M. Chang, R. A. Grot, and L. S. Galowin. 1987, 21p
Sponsored by General Services Administration, Washington, DC.
Pub. in Thermal Insulation: Materials and Systems, ASTM STP 922, p175-195 1987.

Keywords: *Thermography, *Thermal resistance, *Construction material, *Office buildings, Roofs, Heat loss, Leakage, Infrared equipment, Thermal measurements, Heat flux, Reprints, Energy conservation.

In order to assess the thermal integrity of new and existing office buildings, the National Bureau of Standards (NBS) developed and performed a series of diagnostic tests on eight federal office buildings. These buildings have different sizes, ranging from 1800 sq m to 48,000 sq m of floor area, and are located in various climate zones. Thermographic inspection is one of the diagnostic procedures used to identify the locations of heat loss areas, to determine the extent of deterioration of building materials, and to establish a basis for recommendation of retrofit options. Other test methods applied to these buildings for envelope measure-

ments include heat flow for the thermal resistances, tracer gas for air infiltration, and pressurization tests for building tightness. Three types of thermographic inspections were conducted on these buildings: ground-based infrared surveys, serial infrared surveys, and inspection with a spot radiometer. These buildings were designed to meet the new federal energy guidelines of less than 630 MJ/sq m per year of on-site energy consumption and less than 1200 MJ/sq m per year of off-site energy consumption. The thermographic inspections reveal the existence of several classes of thermal deficiencies in the buildings, which were due to both inadequate building design and poor construction quality. Comparisons of the results from several thermographic techniques are shown. Analysis of thermographic data with examples of thermal defects observed from all inspections is presented. Quantitative comparisons of the wall thermal resistance values measured by the spot radiometer with those from heat flow meter measurements are also included.

000,163

PB91-118133 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div. **Estimating the Environment and the Response of Sprinkler Links in Compartment Fires with Draft Curtains and Fusible Link-Actuated Ceiling Vents - Theory.** Final rept.

L. Y. Cooper. 1990, 27p
See also PB88-215462. Sponsored by American Architectural Mfrs. Association, Des Plaines, IL. Pub. in Fire Safety Jnl. 16, p137-163 1990.

Keywords: *Fires, *Sprinklers, *Buildings, Vents, Fire protection, Fire safety, Air flow, Ventilation, Mathematical models, Plumes, Reprints.

The physical basis and associated mathematical model for estimating the fire-generated environment and the response of sprinkler links in well-ventilated compartment fires with draft curtains and fusible link-actuated ceiling vents is developed. Complete equations and assumptions are presented. Phenomena taken into account include: the flow dynamics of the upward-driven, buoyant fire plume; growth of the elevated-temperature smoke layer in the curtained compartment; the flow of smoke from the layer to the outside through open ceiling vents; the flow of smoke below curtain partitions to building spaces adjacent to the curtained space of fire origin; continuation of the fire plume in the upper layer; heat transfer to the ceiling surface and the thermal response of the ceiling as a function of radial distance from the point of plume-ceiling impingement; the velocity and temperature distribution of plume-driven near-ceiling flows and the response of near-ceiling-deployed fusible links as functions of distance below the ceiling and distance from plume-ceiling impingement.

000,164

PB91-118638 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div. **Small-Scale Vertical Flammability Testing for Fabrics.** Final rept.

K. M. Villa, and J. F. Krasny. 1990, 13p
Pub. in Fire Safety Jnl. 16, p229-241 1990.

Keywords: *Fabrics, *Flammability testing, *Fire tests, Combustion products, Ignition, Fire resistant materials, Test facilities, Flames, After burning, Reprints, Chars.

Many small-scale vertical flammability tests have been designed to assess 'self-extinguishment' of fabrics after exposure to a small flame, where self-extinguishment refers to the cessation of flaming or glowing of the specimen upon removal of the ignition source. The specimens are held vertically in a U-shaped metal frame and ignited at the bottom. The criteria chosen for these tests are char length, afterflame, afterglow, and melt drip. These tests were first promulgated in the 1930s for use on flame-retardant cellulose and wools. The applicability of the test to char-forming as well as thermoplastic fabrics will be discussed.

000,165

PB91-120139 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Program for Calculating the Maximum Radiation on a Wall.

R. L. Smith. Oct 90, 34p NISTIR-4437
Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Fires, *Military facilities, *Walls, Heat flux, Heat transmission, Heat transfer, Fire protection, Fire fighting, *Radiative heat transfer, Expert systems.

The report describes a program module of the expert system EXPOSURE. This module, written in Common Lisp, is for calculating the maximum electromagnetic radiation incident upon a building's wall due to the burning of a neighboring building. It is assumed that the burning building has an arbitrary number of rectangular openings emitting radiation. The exposed wall can be considered as being composed of a number of rectangular regions. These regions may be openings or regions of different materials. This program can determine the maximum radiation for each of these regions and for the wall less these regions.

000,166

PB91-120170 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Algorithm and Associated Computer Subroutine for Calculating Flow through a Horizontal Ceiling/Floor Vent in a Zone-Type Compartment Fire Model.

L. Y. Cooper. Oct 90, 54p NISTIR-4402
Sponsored by Naval Research Lab., Washington, DC.

Keywords: *Fire protection, *Fires, *Air flow, *Vents, Thermodynamics, Fire safety, Computer programs, Mathematical models, Algorithms, Openings, Flames, *Flame propagation.

An algorithm and associated computer subroutine is presented for calculating the effects on two-layer compartment fire environments of the quasi-steady flow through a horizontal vent connecting two spaces. The two spaces can be either two inside rooms of a multi-room facility or one inside room and the outside ambient environment local to the vent. The description of the flow through the vent is determined by combining considerations of (1) the unidirectional-type of flow driven by a cross-vent pressure difference and, when appropriate, (2) the exchange-type of flow induced when the fluid configuration across the vent is unstable, i.e., when a relatively cool, dense gas in the upper space overlays a less dense gas in the lower space. The algorithm/subroutine is called VENTCF. The computer subroutine is written in FORTRAN 77. The subroutine is completely modular, and it is suitable for general use in two-layer, multi-room, zone-type fire model computer codes. It has been tested over a wide range of input variables and these tests are described.

000,167

PB91-133876 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.

Specifications for Cold Weather Concreting. Final rept.

N. J. Carino. 1988, 8p
Pub. in Concrete International 10, n10 p50-57 Oct 88.

Keywords: *Concretes, *Cold weather construction, *Specifications, Concrete construction, Concrete durability, Freezing, Strength, Mechanical properties, Reprints.

The historical developments leading to the new ACI specification on cold weather concreting are reviewed. Attention is focused on the evolution of the current definition of cold weather and on changes in the protection requirements to prevent damage from freezing at an early age. The evolution of the current criteria for form removal is also reviewed, and the paper concludes with a presentation of key aspects of the standard specification.

Structural Analyses

000,168

PB90-145624 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Influence of Horizontal Reinforcement on Shear Resistance of Concrete Block Masonry Walls.

C. W. C. Yancey, and C. F. Scribner. Oct 89, 68p
NISTIR-89/4202
Also available from Supt. of Docs.

Keywords: *Concrete blocks, *Walls, *Reinforcing materials, Mechanical properties, Axial stress, Cyclic loads, Compressive strength, Masonry, Cracking(Fracturing), Shear strength, Dynamic loads.

The tests determined the effect of varying the amount and distribution of horizontal reinforcement on the in-plane shear resistance of concrete masonry walls. Thirteen wall specimens were constructed with hollow concrete block, and varying amounts of reinforcement in the bed joints and in grouted bond beams. The walls were subjected to reversed cyclic, in-plane lateral loads and essentially a constant axial compressive load. The blocks had an average gross area unit strength of approximately 1800 psi. Preliminary results from these tests show small amounts of horizontal reinforcement are effective in increasing post-cracking strength; in-plane shear strength does not increase proportionately with increasing amounts of horizontal reinforcement; and bed joint reinforcement placed in alternating courses is as effective in increasing in-plane shear strength as when placed in every course.

000,169

PB90-149410 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Load Duration and Probability Based Design of Wood Structural Members. Final rept.

B. R. Ellingwood, E. M. Hendrickson, and J. F. Murphy. 1988, 16p
Pub. in Wood and Fiber Science 20, n2 p250-265 1988.

Keywords: *Limit design method, *Loads(Forces), *Wood, *Structural members, *Structural timber, Static loads, Snow, Design criteria, Creep rupture strength, Time, Reliability, Probability distribution functions, Hydrostatic pressure, Reprints.

A limit-states design philosophy for wood offers important advantages in design applications over current working stress design methods. Limit-states design can be cast in a load and resistance factor format, with probability based resistance factors matched to the common LRFD load requirements in ANSI A58. A load duration factor lambda, to account for creep rupture in wood, is determined for snow loads. Important elements for evaluating lambda include realistic stochastic models for snow load, distributions of member strength, and load duration models. With the tools, limit state probabilities are calculated using numerical simulation. Reliability analyses are performed using existing design criteria to assess the effects of different load model characteristics, and different member strength distributions and load duration models. Reliability analyses are performed with, and without, load duration effects considered; lambda is computed as the ratio of results from the two analyses.

000,170

PB90-169665 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

K(sub R)-Curve with Dugdale Model. Final rept.

R. deWit. 1985, 5p
Pub. in Elastic-Plastic Fracture Mechanics Technology, ASTM (American Society for Testing and Materials) STP (Special Technical Publication) 896, p79-83 1985.

Keywords: *Failure, *Loads(Forces), *Structural analysis, Structural members, Forecasting, Crack propagation, Stress strain diagrams, Plastic analysis, Elastic analysis, Reprints, *Fracture mechanics.

A brief description is given of the analysis method used to predict failure loads on complex structural components containing cracks from fracture results on compact specimens. The method is based on the K(sub R) Curve with the Dugdale model.

000,171

PB90-184599 PC A10/MF A02
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

BUILDING INDUSTRY TECHNOLOGY

Structural Analyses

Performance of Structures during the Loma Prieta Earthquake of October 17, 1989.

Special pub. (Final).

H. S. Lew. Jan 90, 204p NIST/SP-778

Also available from Supt. of Docs. as SN003-003-02988-2. Sponsored by Geological Survey, Reston, VA.

Keywords: *Earthquake resistant structures, *Dynamic structure analysis, *Buildings, *Highway bridges, Collapse, Design standards, Building codes, Dynamic response, Failure, Foundations, Fire protection.

Immediately following the magnitude 7.1 Loma Prieta earthquake of October 17, 1989, a team representing the Interagency Committee on Seismic Safety in Construction surveyed the damage to buildings, utilities and transportation structures. The report is based primarily on the data gathered during the site survey and the results of preliminary analyses of structural failures. Most structures designed in accordance with modern codes and standards performed well without serious structural damage. However, there were many concrete and masonry buildings and highway structures in the San Francisco Bay area which were not designed according to modern seismic design codes and which did not perform well. The majority of damaged structures had not been strengthened to increase earthquake resistance. Except for two deaths from landslides and one from fire, the remainder of the 62 deaths from the earthquake was due to partial or total collapse of older structures. The investigation provided the basis for recommendations to improve design and construction practices for buildings and lifeline structures and to mitigate damage to existing structures in future earthquakes.

000,172

PB90-186826

PC A18/MF A03

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Wind and Seismic Effects. Proceedings of the Joint Meeting of the U.S.-Japan Cooperative Program in Natural Resources Panel on Wind and Seismic Effects (21st).

Special pub. (Final).

N. J. Raufaste. Jan 90, 411p NIST/SP-776

Held in Tsukuba, Japan on May 16-19, 1989. Also available from Supt. of Docs. as SN003-003-02989-1. See also PB89-154835.

Keywords: *Wind pressure, *Earthquakes, *Meetings, *Building codes, *Dynamic structural analysis, Highway bridges, Dams, Earthquake resistant structures, Dynamic loads, Design standards, Structural design, *Earthquake engineering, International cooperation, Coordinated research programs.

The 21st Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held at the Public Works Research Institute, Tsukuba, Japan, from May 16-19, 1989. The publication, the proceedings of the Joint Meeting, includes the program, list of members panel resolutions, task committee reports, and 33 technical papers. The papers were presented under six themes: Wind engineering; Earthquake engineering; Storm surge and tsunami; U.S.-Japan cooperative research program; Code development process and code enforcement responsibility; and Armenia earthquake.

000,173

PB90-187584

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.

Probability-Based Criteria for Serviceability Limit States.

Final rept.

B. Ellingwood. 1985, 10p

Pub. in Proceedings of International Conference on Structural Safety and Reliability (4th), Kobe, Japan, May 27-29, 1985, p137-146.

Keywords: *Building codes, Design standards, Structural design, Static structural analysis, Elastic properties, Structural engineering, Mechanical properties, Deformation, Static loads, Vibration, Reprints.

Recent advances in structural code development have taken place within the framework of probability-based limit states design. However, little attention has been directed toward the serviceability limit states, despite their importance in modern design practice. Practical serviceability checking procedures can be developed using principles of probability, statistics and structural reliability. These procedures can be grouped into two broad categories for deformation or damage-related

limit states occurring under essentially static loads, and motion-related limit states due to occupant activities or environmental causes.

000,174

PB90-198425

PC A05/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Experimental Study of Post-Installed Anchors Under Combined Shear and Tension Loading.

M. K. Johnson, and H. S. Lew. Mar 90, 82p NISTIR-90/4274

Keywords: *Concrete construction, *Anchors(Structures), *Dynamic structural analysis, *Mechanical tests, Dynamic loads, Compressive strength, Shear tests, Tensile strength, Failure, Fractures(Materials), Expansion bolts.

The behavior of post-installed anchors subjected to static combined shear and tension loads was studied experimentally. Twenty-four 1 in. diameter wedge-type expansion anchors were tested in uncracked concrete. Anchors were not preloaded and were located sufficiently far from the edge of the concrete specimens. There were two types of shear failures: steel fracture near the bottom of the anchor at the tapered section for anchors with shallow embedment depths and steel fracture along the shank for more deeply-embedded anchors. Two types of tension failures occurred: steel tensile failure at the threads and cone-shaped tensile failure of the concrete. For specimens failing in shear, anchor capacity depended mainly on embedment depth. A limiting capacity was reached at an embedment depth of approximately 6 in. when steel failure controlled. Anchor deformation was influenced by both load angle and embedment depth.

000,175

PB90-198938

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Evaluation of a Surface Treatment to Improve the Erosion Resistance of Coquina Stone at Castillo de San Marcos.

L. I. Knab, J. R. Clifton, and N. Waters. Mar 90, 41p NISTIR-90/4277

Sponsored by National Park Service, Atlanta, GA.

Keywords: *Erosion, *Masonry, *Building stone, *Surface finishing, Protective coatings, Weathering, Abrasion, Exposure, Deterioration, Waterproofing, Surface properties.

A surface treatment, which was intended to improve the erosion resistance of coquina stone at the Castillo de San Marcos, was evaluated. The commercially-available stone surface treatment was claimed to contain both consolidating and water-repellent agents. Limited, short-term tests intended to simulate two types of erosion and to identify any severe degradation problems were conducted. Erosion of sawn surfaces caused by mechanical abrasion from strokes with a steel brush, and a thin stream of water flow were investigated in the laboratory in different stone orientations. The results showed that, for some test conditions, the erosion resistance of the stone was significantly improved by the treatment. For the other test conditions, however, the erosion resistance of the treated and untreated specimens was not significantly different.

000,176

PB90-215849

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Periodic and Chaotic Motions of a Modified Stoker Column: Experimental and Numerical Results.

G. R. Cook, and E. Simiu. Feb 90, 47p NIST/BSS-168

Also available from Supt. of Docs. as SN003-003-03000-7.

Keywords: *Buckling, *Columns(Supports), *Dynamic structural analysis, *Test facilities, Experimental data, Structural engineering, Failure, Vibration, Equations of motion, Mathematical models, Dynamic tests, Elastic analysis, Nonlinear systems, Displacement, Stiffness.

Records are presented of typical measured motion of a modified forced Stoker column, including periodic motion around a stable fixed point, periodic snap-through motion, and chaotic motion. Characterizations of the recorded chaotic motion include: the auto-correlation function; the spectral density plot; capacity dimensions; and the Lyapunov exponent. Two sets of numerical simulations were performed, in which the

same spring stiffnesses (measured under static conditions) and the same dissipative forces (based on the viscous damping model) were used. The first set, in which the device was modeled as a multidegree of freedom system to account for the distributed mass and stiffness of the springs, yielded chaotic motions qualitatively similar to those recorded in the laboratory. No chaotic motions could be obtained from the second set, which did not reflect the fact that the spring properties are distributed and in which the device was therefore modeled as a one degree of freedom system.

000,177

PB90-227992

PC A04/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

NIST (National Institute of Standards and Technology) Structural Research Publications, 1984-1989.

R. D. Dikkers. May 90, 55p NISTIR-90/4297

Also available from Supt. of Docs.

Keywords: *Bibliographies, *Structural engineering, *Research, Indexes(Documents), Steels, Construction, Offshore structures, Structural analysis, Wind pressure, Nondestructive tests.

The report contains a list of research reports and papers authored or co-authored by members of the Structures Division, Center for Building Technology, National Institute of Standards and Technology during the period, 1984-1989. Subject categories included are: Concrete Safety, Earthquake Engineering, Geotechnical Engineering, Masonry, Miscellaneous, Non-destructive Testing, Offshore Structures, Probability Theory, Steel, Structural Dynamics, Structural Investigations, and Wind Engineering.

000,178

PB90-254434

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.

Seismic Performance of 1/3 Scale Post-Tensioned Precast Beam-Column Connections.

Final rept.

G. S. Cheok, and H. S. Lew. 1990, 10p

Pub. in Proceedings of U.S. National Conference on Earthquake Engineering (4th), Palm Springs, CA., May 20-24, 1990, v2 p757-766.

Keywords: *Beams(Supports), *Precast concrete, *Columns(Supports), *Post tensioning, *Cyclic loads, Joints(Junctions), Model tests, Energy dissipation, Grout, Failure, Ductility, Reprints.

A study of the behavior of precast beam-column connections subjected to cyclic inelastic loading was initiated at the National Institute of Standards and Technology. The objective of the study is to develop a moment resistant precast connection that is economical and easily constructed. The experimental program consists of testing both monolithic and precast beam-column connections. The monolithic specimens were designed to 1985 UBC seismic zone 4 criteria. The results from the monolithic specimens provide a reference for comparison with the results from the post-tensioned beam-column tests. The moment resistance of the connection is provided by post-tensioning bars. The effects of fiber reinforced grout between the beam and column are studied. Energy dissipation, ductility, and failure mode will be used to determine the overall behavior of the connections.

000,179

PB90-256751

PC A03/MF A01

National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.

Report to Congress on the Structural Assessment of the New U.S. Embassy Office Building in Moscow.

15 Apr 87, 36p NBSIR-87/3636

See also PB90-256769.

Keywords: *Structural analysis, Office buildings, Structural members, Concretes, Structural engineering, Cracks, Inspection, Walls, Beams(Supports), Settlement(Structural), *Embassies, *Federal buildings, Moscow(USSR), New US Embassy Office Building.

Public Law 99-591, The Continuing Appropriations Act for Fiscal Year 1987, directed the National Bureau of Standards (NBS) to conduct an independent analysis of the new United States Embassy Office Building being constructed in Moscow. The analysis was to in-

clude '...an assessment of the current structure and recommendations and cost estimates for correcting any structural flaws and construction defects...' The report summarizes the investigation, which included field, laboratory and analytical studies, and its findings. The investigation did not address security and other nonstructural deficiencies. The investigation has identified important structural defects in the building and defined remedial measures to correct them. While important, these structural defects, in comparison to the total structural system for the building, are modest in scale and fully correctable.

000,180
PB90-256769 PC A15/MF A02
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Building Technology.
Structural Assessment of the New U.S. Embassy Office Building in Moscow.
 N. J. Carino, J. G. Gross, W. C. Stone, M. Sansalone, and F. Y. Yokel. Apr 87, 347p NBSIR-87/3637
 See also PB90-256751.

Keywords: *Structural analysis, Office buildings, Structural members, Concrete, Structural engineering, Cracks, Inspection, Walls, Beams(Supports), Settlement(Structural), *Embassies, *Federal buildings, *Moscow(USSR), New US embassy Office Building.

Public Law 99-591, The Continuing Appropriations Act for Fiscal Year 1987, directed the National Bureau of Standards (NBS) to conduct an independent analysis of the new United States Embassy Office Building being constructed in Moscow. The analysis was to include: '...an assessment of the current structure and recommendations and cost estimates for correcting any structural flaws and construction defects...' This report describes the investigation, which included field, laboratory and analytical studies, and its findings. The investigation did not address security and other nonstructural deficiencies. The investigation has identified important structural defects in the building and defined remedial measures to correct them. While important, these structural defects, in comparison to the total structural system for the building, are modest in scale and fully correctable.

000,181
PB91-107094 PC A22/MF A03
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Wind and Seismic Effects. Proceedings of the Joint Meeting of the U.S.-Japan Cooperative Program in Natural Resources Panel on Wind and Seismic Effects (22nd). Held in Gaithersburg, MD, on May 15-18, 1989.
 Final rept.

N. J. Raufaste. Sep 90, 524p NIST/SP-796
 Also available from Supt. of Docs. See also PB90-186826.

Keywords: *Wind pressure, *Earthquakes, *Meetings, *Earthquake resistant structures, Dynamic structural analysis, Dynamic loads, Highway bridges, Dams, Building codes, Structural design, *International cooperation, *Wind loads.

The 22nd Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects was held at the National Institute of Standards and Technology from May 15-18, 1990. This publication, the proceedings of the Joint Meeting, includes the program, list of members, panel resolutions, task committee reports, and 39 technical papers. The papers were presented under six themes: Wind Engineering, Storm Surge and Tsunamis, Joint Cooperative Research Program, Earthquake Engineering, Loma Prieta Earthquake, and Summaries of Task Committee Workshop Reports.

000,182
PB91-107623 PC A06/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD.
Performance of 1/3-Scale Model Precast Concrete Beam-Column Connections Subjected to Cyclic Inelastic Loads.
 G. S. Cheok, and H. S. Lew. Oct 90, 105p NISTIR-4433

Keywords: *Beams(Supports), *Precast concrete, *Joints(Junctions), *Cyclic loads, Concrete structures, Structural analysis, Earthquake resistant structures, Model tests, Displacement, Columns(Supports), Experimental data.

An experimental study of the behavior of precast concrete beam-column connections subjected to cyclic inelastic loading was initiated at the National Institute of Standards and Technology. The study was initiated to provide data for the development of a rational design procedure for such connections in high seismic regions. The objective of the study is to develop a moment resistant precast concrete connection that is economical and easily constructed. Results of the experimental tests of both monolithic and precast beam-column connections are described. The monolithic concrete specimens were designed to 1985 UBC Seismic Zone 2 and 4 criteria. The design of the precast concrete specimens was similar to that for the monolithic specimen designed to UBC seismic zone 4. The results from the monolithic specimens provide a benchmark for comparison with the results from the precast tests.

000,183
PB91-118067 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Structure: U.S. Office Building in Moscow.
 Final rept.

N. J. Carino, W. C. Stone, M. Sansalone, F. Y. Yokel, E. M. Hendrickson, E. Simiu, J. G. Gross, and R. N. Wright. 1989, 19p
 Pub. in Jnl. of Performance of Constructed Facilities 3, n1 p16-34, Feb 89.

Keywords: *Office buildings, *Structural analysis, Investigations, Construction, Concrete construction, Steel construction, Design criteria, Loads(Forces), Concretes, Steels, USSR, Reprints.

The National Bureau of Standards conducted a structural assessment of the new U.S. Office Building being constructed in Moscow. The paper reviews the portion of the assessment dealing with the vertical and lateral load resistance of the structural system. The results of field, laboratory, and analytical studies are summarized. The structural assessment, which was based on current U.S. design practice, concluded that the structure was generally adequate for the design loads. However, serious construction deficiencies were noted in the joints of the precast columns and precast shear walls. Companion papers provide background information about the structure and review the findings related to the structure's resistance against progressive collapse and the condition of the brick masonry.

General

000,184
PB90-149527 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
Evaluation of Quarter-Scale Compartment Fire Modeling for Constant and Stepped Heat Inputs.
 Final rept.

H. Dingyi. 1987, 12p
 Pub. in Fire and Materials 11, n4 p179-190 Dec 87.

Keywords: *Fire tests, Fire safety, Flashback, Combustion, Interior decorating, *Building fires.

Quarter-scale tests of ten full-scale room fire tests were conducted by using an existing scaling technique developed at the National Bureau of Standards. The tests confirmed earlier studies which showed that quarter-scale room testing ranked interior finish materials in the same order as did full-scale tests based on their times to achieve room flashover. In general, quarter-scale tests were less severe and took longer time to reach peak room fire buildup because of a lower convection and radiative heat transfer in the quarter-scale room. The tests also generate more CO per unit mass of material and experienced lower combustion efficiencies.

000,185
PB90-152802 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Negatively Buoyant Wall Flows Generated in Enclosure Fires.
 Final rept.

Y. Jaluria, and L. Y. Cooper. 1989, 24p
 Pub. in Progress in Energy and Combustion Science 15, p159-182 1989.

Keywords: *Fires, *Boundary layer flow, *Walls, Heat transfer, Jet flow, Mass transfer, Mathematical models, Experimental data, Fire tests, Combustion, Reprints, *Natural convection, *Building fires.

The paper considers wall flows that arise in enclosure fires. Such flows are generated due to the temperature difference between the wall and the adjacent environment as well as due to the downward turning of the fire-plume-driven ceiling jet at the corners of the compartment. At various stages of fire growth and at several locations, the flow is subjected to an opposing buoyancy force. These flows are termed negatively buoyant and the paper investigates in detail the penetration and heat transfer characteristics of flows relevant to enclosure fires. The transport of mass, momentum and energy in wall flows is determined quantitatively, using available analytical results on boundary layer flows. The significance of wall flow effects in a typical compartment fire is studied. It is shown that these effects are important, since they cause additional transport which is comparable to that due to the fire plume or the flow at the opening, and must be included in a mathematical model for an accurate prediction of the changing environment in the enclosure. Negatively buoyant wall and free jets are studied experimentally to obtain the penetration depth, the entrainment into the flow and the wall heat transfer. The penetration of buoyancy-induced wall flows and of negatively buoyant wall jets in a two-layer stably stratified environment is also studied in detail experimentally.

000,186
PB90-170531 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Measurement of Flame Lengths under Ceilings.
 Final rept.

D. Gross. 1989, 14p
 Pub. in Fire Safety Jnl. 15, p31-44 1989.

Keywords: *Fire tests, *Flames, *Measurement, Ceilings(Architecture), Buildings, Test facilities, Fires, Safety engineering, Flame propagation, Reprints, *Building fires.

Measurements of luminous flame extensions beneath ceilings under steady burning conditions are presented. Tests were conducted using both axisymmetric and corner-wall-ceiling configurations for a range of energy supply rates up to 400 kW and burner-to-ceiling heights up to 2-3 m. Flame length observations, which were made both visually and photographically, are expressed in dimensional and in nondimensional terms. Comparisons are made with previous measurements reported in the literature.

000,187
PB90-187543 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.
Fire Hazard Protection Hazard I and Its Role in Fire Codes and Standards.
 Final rept.

R. W. Bukowski. 1990, 4p
 Pub. in ASTM (American Society for Testing and Materials) Standardization News 18, n1 p40-43 Jan 90.

Keywords: *Fire hazards, Buildings, Safety engineering, Building codes, Design standards, Fire safety, Computerized simulation, Fire prevention, Reprints, Building fires, HAZARD I model.

Developments in fire hazard modeling at the Center for Fire Research are discussed. An overview of HAZARD I, the recently-released fire hazard analysis method and supporting software package, is presented. Some thoughts on the potential impact of these methods on the codes and standards system are presented.

000,188
PB90-193251 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Experimental Fire Tower Studies of Elevator Pressurization Systems for Smoke Control.
 Final rept.

G. T. Tamura, and J. H. Klote. 1987, 22p
 Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v93 pt2 p2235-2256 1987.

Keywords: *Fire safety, *Smoke abatement, *Elevators(Lifts), Fire tests, Safety engineering, Pres-

General

sure control, Air flow, Ventilation, Design standards, Buildings, Reprints, *Building fires.

Tests were conducted in the experimental fire tower at the National Research Council of Canada to study smoke movement through elevator shafts caused by a large fire and to determine the effectiveness of mechanical pressurization in keeping the elevator shaft and lobbies tenable for evacuation of the handicapped and for use by firefighters. The tests indicated that pressure control is required to cope with loss of pressurization due to open doors. Equations were developed to assist in designing pressure control systems involving either a variable supply air rate with feedback control or relief dampers in the walls of the elevator shaft or lobbies. Tests conducted in the tower indicated that for both methods of pressure control, comparison of measured and calculated values of supply air rates and pressure differences are in good agreement.

000,189
PB90-215823 PC A06/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research. **FIREDOC Vocabulary List, 3rd Edition.** Special pub. (Final).
 N. H. Jason. Feb 90, 105p NIST/SP-779
 Also available from Supt. of Docs. as SN003-003-02997-1. Supersedes PB87-181988.

Keywords: *Fire safety, *Subject index terms, Terminology, Thesauri, Fire hazards, *FIREDOC database, *Fire Research Information Services.

The List, now in its third edition, contains over 4,000 keywords representing the subject matter of the documents included in the FIREDOC bibliographic database. The List was originally developed in 1975 as a tool to be used for searching a small fire safety database developed for NASA/ASRDI (National Aeronautics and Space Administration/Aerospace Safety Research and Data Institute). Since then, the List has been updated and expanded to reflect current national and international fire research interests and to reflect shifts in the acceptance and/or usage of technical concepts. Fire Research Information Services, established in 1971, maintains a collection of over 35,000 national and international documents on fire research representing the programmatic interests of the Center for Fire Research. FIREDOC is the on-line bibliographic database of this collection.

000,190
PB90-217936 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div. **Prototype Methodology for Fire Hazard Analysis.** Final rept.
 R. D. Peacock, and R. W. Bukowski. 1990, 26p
 Pub. in Fire Technology 26, n1 p15-40 Feb 90.

Keywords: *Fire hazards, *Risk, Fire damage, Fire losses, Toxicity, Buildings, Prototypes, Methodology, Reprints, *Computer applications.

The first version of a method for predicting the hazards to occupants involved in a building fire is described. The method and available computer software, called HAZARD I, can predict the time varying environment within a building resulting from a specified fire; the locations and actions of occupants; and the impact of the exposure of each of the occupants to the fire products in terms of whether the occupants successfully escape, are incapacitated, or are killed.

000,191
PB90-218256 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Science and Engineering Div. **EXITT: A Simulation Model of Occupant Decisions and Actions in Residential Fires.** Final rept.
 B. M. Levin. 1987, 14p
 Pub. in Proceedings of Joint Panel Meeting of the UJNR Panel on Fire Research and Safety (9th), Norwood, MA., May 4-8, 1987, p280-293.

Keywords: *Fire safety, *Fire hazards, Computerized simulation, Decision making, Human behavior, Residential buildings, Reprints, *Building fires, *Evacuation, Escape time.

EXITT is a discrete event simulation of occupant decisions and actions in a simulated fire. Before the simulation starts, the characteristics of a residence, a fire in

that residence, and the occupants of the residence are entered into the computer. Based on a large set of decision rules, the occupants 'make' decisions which are a function of the smoke conditions in the building, the characteristics and status of the occupants (including their capabilities), and the available travel routes. The occupants investigate the fire, alert and assist others, and evacuate the building. The simulation ends when all of the occupants are either out of the building or are trapped by the smoke.

000,192
PB90-228040 PC A06/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology. **Building Technology Project Summaries, 1990.**
 N. J. Raufaste. Apr 90, 109p NISTIR-90/4288
 See also PB89-193213.

Keywords: *Buildings, *Research projects, *Construction, Project management, Research management, Contract administration, Dynamic structural analysis, Concretes, Paints, Quality assurance, Refrigerants, *Construction materials.

The Center for Building Technology (CBT) of the National Institute of Standards and Technology (NIST) is the national building research laboratory. CBT works cooperatively with other organizations, private and public, to improve building practices. It conducts laboratory, field, and analytical research to predict, measure, and test the performance of building materials, components, systems, and practices. CBT's technologies are widely used in the building industry and adopted by governmental and private organizations that have standards and codes responsibilities. The report summarizes the research underway in the Center during 1990.

000,193
PB90-250184 PC E99/MF E99
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research. **Consolidated Compartment Fire Model (CCFM) Computer Code Application CCFM, Vents. Parts I, II, III, and IV.**
 L. Y. Cooper, G. P. Forney, and W. F. Moss. Jul 90, 365p-in 4v
 Set includes PB90-250192 through PB90-250226. Sponsored by Naval Sea Systems Command, Washington, DC.

Keywords: *Buildings, *Fires, *Mathematical models, Vents, Regions, Algorithms, Heat transfer, Subroutines, Systems analysis, Computer simulation, Computer programs, Computer graphics, Plotting, *Computer applications, *Computer software, Software engineering, User manuals(Computer programs), National Institute of Standards and Technology.

A project was carried out at The National Institute of Standards and Technology (NIST) to study the feasibility of developing a new-generation, multi-room, compartment fire model computer code, called the Consolidated Compartment Fire Model (CCFM) computer code. The idea was that such a code would consolidate past progress in zone-type compartment fire modeling, and allow readily for integration of future advances with the greatest possible flexibility. The project led to the development of a prototype multi-room CCFM product called CCFM.VENTS. This is a four-part report which documents CCFM.VENTS. The four parts of this report are: Part I: Physical Basis; Part II: Software Reference Guide; Part III: Catalog of Algorithms and Subroutines; and Part IV: User Reference Guide.

000,194
PB90-250192 PC A05/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research. **Consolidated Compartment Fire Model (CCFM) Computer Code Application CCFM, Vents - Part I: Physical Basis.**
 L. Y. Cooper, and G. P. Forney. Jul 90, 95p NISTIR-4342
 See also Part 2, PB90-250200. Sponsored by Naval Sea Systems Command, Washington, DC.
 Also available in set of 4 reports PC E99/MF E99, PB90-250184.

Keywords: *Buildings, *Fires, *Mathematical models, Vents, Regions, Algorithms, Heat transfer, *Computer applications, National Institute of Standards and Technology.

A project was carried out at The National Institute of Standards and Technology (NIST) to study the feasibility of developing a new-generation, multi-room, compartment fire model computer code, called the Consolidated Compartment Fire Model (CCFM) computer code. The idea was that such a code would consolidate past progress in zone-type compartment fire modeling, and allow readily for integration of future advances with the greatest possible flexibility. The project led to the development of a prototype multi-room CCFM product called CCFM.VENTS. The report is Part I of a four-part report which documents the above effort. Introductory remarks discuss the generic features of the CCFM and the specific features of CCFM.VENTS. The main objective of the Part I document is to present a comprehensive description of the governing equations of CCFM.VENTS and their technical basis.

000,195
PB90-250200 PC A05/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. **Consolidated Compartment Fire Model (CCFM) Computer Code Application CCFM, Vents - Part 2: Software Reference Guide.**
 G. P. Forney, and L. Y. Cooper. Jul 90, 93p NISTIR-4343
 See Part 1, PB90-250192 and Part 3, PB90-250218. Sponsored by Naval Sea Systems Command, Washington, DC.
 Also available in set of 4 reports PC E99/MF E99, PB90-250184.

Keywords: *Buildings, *Fires, *Mathematical models, Vents, Regions, Subroutines, Systems analysis, *Computer applications, *Computer software, Software engineering, National Institute of Standards and Technology.

A project was carried out at The National Institute of Standards and Technology (NIST) to study the feasibility of developing a new-generation, multi-room, compartment fire model computer code, called the Consolidated Compartment Fire Model (CCFM) computer code. The idea was that such a code would consolidate past progress in zone-type compartment fire modeling, and allow readily for integration of future advances with the greatest possible flexibility. The project led to the development of a prototype multi-room CCFM product called CCFM.VENTS. The report is Part II of a four-part report which documents the above effort. The main objective of the Part II document is to document the design and underlying structure of the CCFM.VENTS computer software. It serves as a guide for those persons interested in extending, modifying, and if necessary, correcting CCFM.VENTS at a later date.

000,196
PB90-250218 PC A06/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. **Consolidated Compartment Fire Model (CCFM) Computer Code Application CCFM, Vents - Part 3: Catalog of Algorithms and Subroutines.**
 L. Y. Cooper, and G. P. Forney. Jul 90, 125p NISTIR-4344
 See also Part 2, PB90-250200 and Part 4, PB90-250226. Sponsored by Naval Sea Systems Command, Washington, DC.
 Also available in set of 4 reports PC E99/MF E99, PB90-250184.

Keywords: *Buildings, *Fires, *Mathematical models, Algorithms, Subroutines, Vents, Regions, Computerized simulation, Computer programs, *Computer applications, National Institute of Standards and Technology.

A project was carried out at The National Institute of Standards and Technology (NIST) to study the feasibility of developing a new-generation, multi-room, compartment fire model computer code, called the Consolidated Compartment Fire Model (CCFM) computer code. The idea was that such a code would consolidate past progress in zone-type compartment fire modeling, and allow readily for integration of future advances with the greatest possible flexibility. The project led to the development of a prototype multi-room CCFM product called CCFM.VENTS. The report is Part III of a four-part report which documents CCFM.VENTS. It is a catalog of all the modular algorithms and associated computer subroutines used to simulate the physical phenomena in CCFM.VENTS.

Each physical algorithm entry includes a description of the phenomenon simulated, a concise presentation of the calculation procedure used, identification of all input and output parameters, and a listing of the sub-routine. The catalog entries have been developed and are presented as modular, stand-alone products. The stand-alone design feature allows the catalog entries to be used both in CCFM and in any other modular, zone-type, compartment fire model computer code.

000,197

PB90-250226 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD.
Consolidated Compartment Fire Model (CCFM) Computer Code Application CCFM. Vents - Part 4: User Reference Guide.
G. P. Forney, L. Y. Cooper, and W. F. Moss. Jul 90, 52p NISTIR-4345
See also Part 3, PB90-250218. Sponsored by Naval Sea Systems Command, Washington, DC.
Also available in set of 4 reports PC E99/MF E99, PB90-250184.

Keywords: *Buildings, *Fires, *Mathematical models, Computer graphics, Plotting, Vents, Regions, *Computer applications, User manuals(Computer programs), National Institute of Standards and Technology.

A project was carried out at The National Institute of Standards and Technology (NIST) to study the feasibility of developing a new-generation, multi-room, compartment fire model computer code, called the Consolidated Compartment Fire Model (CCFM) computer code. The idea was that such a code would consolidate past progress in zone-type compartment fire modeling, and allow readily for integration of future advances with the greatest possible flexibility. The project led to the development of a prototype multi-room CCFM product called CCFM.VENTS. The report is Part IV of a four-part report which documents the above effort. The main objective of the Part IV document is to document the use of CCFM.VENTS. Its capabilities and limitations are described. A simple two room tutorial is presented to get the user quickly acquainted with the input requirements of CCFM.VENTS. Each CCFM.VENTS command is described. Finally, a program for plotting CCFM.VENTS data is presented. The program runs on an IBM-PC or compatibles with a VGA graphics monitor.

000,198

PB90-271511 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Measuring Economic Performance.
Final rept.

H. E. Marshall. 1990, 19p
Pub. in Performance of Buildings and Serviceability of Facilities, ASTM STP 1029, p93-110 1990.

Keywords: *Economic analysis, *Buildings, *Maintenance management, Risk, Cost engineering, Cost analysis, Interest rate of return, Value engineering, Benefit cost analysis, Mathematical models, Real property, Reprints.

Traditional economic methods--life-cycle costing, benefit-to-cost ratio, net benefits, adjusted internal rate of return, and discounted payback--are described for evaluating building decisions about accepting or rejecting a given building investment, the economically efficient design or size of a building, and the economically efficient combination of projects competing for a limited budget. Appropriate applications for each economic method are described. Technically correct formulas for the methods are presented. These economic methods are often applied using 'best-guess' estimates of project input variables as if they were certain values. Such applications generate single-value, deterministic answers which provide decision makers insufficient information to know their economic risk exposure. Techniques are described that to some extent account for uncertainty in input variables and in some cases risk exposure and risk attitude.

000,199

PB91-101063 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Combustion Product Toxic Potency Measurements: Comparison of a Small Scale Test and 'Real-World' Fires.

Final rept.
E. Braun, R. G. Gann, B. C. Levin, and M. Paabo.
1990, 18p
Pub. in Jnl. of Fire Sciences 8, n1 p63-79 Jan/Feb 90.

Keywords: *Fires, *Combustion products, *Toxicity, *Cotton fabrics, *Polyurethane resins, Chemical properties, Smoke, Fire tests, Environmental impacts, Reprints.

A long range goal of fire science is to be able to predict 'real-world' fire performance from a small set of laboratory scale fire measurements. One material property of primary concern is the toxicity of decomposition products. Several small scale toxicity protocols that measure toxic potency of the smoke from burning materials have been developed. While several attempts have been made to correlate individual protocols with large scale results, no systematic set of criteria for determining the extent of similarity has been defined and tested. In the paper, three criteria have been proposed and tested using one set of materials (cotton fabric and polyurethane foam) in two different large-scale enclosures and three different fire scenarios. Tests were conducted to determine the extent of similarity between the NBS Toxicity Test Protocol and large-scale 'real-world' fire performance.

BUSINESS & ECONOMICS

Consumer Affairs

000,200

PB91-107144 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Checking the Net Contents of Packaged Goods. Third Edition, Supplement.
Final rept.

C. S. Brickenkamp. Sep 90, 52p NIST/HB-133-ED-3-SUPPL
Also available from Supt. of Docs. as SN003-003-03049-0. See also report for 1989, PB89-132575.

Keywords: *Packaging, *Commodities, *Labels, *Handbooks, Requirements, Sampling, Revisions, Tests, Procedures.

Only minor additions and revisions to NIST (formerly NBS) Handbook 133, Third Edition, 'Checking the Net Contents of Packaged Goods' were adopted by the Conference in 1989 and 1990. A few editorial corrections have also been made. The document consists of change pages to be added to Handbook 133, Third Edition.

Domestic Commerce, Marketing, & Economics

000,201

PB90-219858 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1990.

B. C. Lippiatt, and R. T. Ruegg. May 90, 64p NISTIR-85/3273-4
See also PB87-180253, PB86-223104, PB88-138227 and PB89-153860. Sponsored by Department of Energy, Washington, DC. Assistant Secretary for Conservation and Renewable Energy.

Keywords: *Cost indexes, *Prices, Present worth, Economic analysis, Cost analysis, Discounted cash flow, *Life cycle costs, *Energy expenses, Energy conservation.

This is the 1990 annual edition of energy prices and discount factors for performing life-cycle cost analyses of energy conservation and renewable energy projects. It supports the Federal life-cycle costing methodology as described in NBS Handbook 135 (HB 135) and private sector life-cycle cost analysis as described in NBS Special Publication 709 (SP 709). Tables A, B, and C are revisions of appendices A, B, and C, respectively, of HB 135. Tables A (7%), Ba, and C apply to Federal energy conservation and renewable energy projects. Tables A (10%), Bb, and C apply to Federal projects that require energy price forecasts but are not primarily energy conserving. Tables S, in the last section of the report, are revisions to appendix B, Part I of SP 709 and are provided for the convenience of private sector analysts wishing to make use of Federal energy price forecasts.

000,202

PB90-501198 CP D01
National Inst. of Standards and Technology, Gaithersburg, MD.

Federal Building Life-Cycle Cost (FBLCC) Program (for Microcomputers).

Software.
S. R. Peterson, and W. Bethea. Aug 89, 1 diskette NBS/SW/DK-90/005
Supersedes PB89-151203.

The software is contained on 5 1/4-inch diskettes, double density (360K), compatible with the IBM PC microcomputer. The diskettes are in the ASCII format. Price includes documentation, PB86-223104.

Keywords: *Software, *Buildings, National government, Economic analysis, Benefit cost analysis, Diskettes, *Life cycle costs, *Energy conservation, Energy management, L=BASIC, H=IBM PC.

The Federal Building Life-Cycle Cost (FBLCC) Program provides computational tools and energy price data for performing life-cycle (LCC) analyses of Federal buildings and related subsystems. The method and procedures used in these LCC analyses are based on rules set forth by the U.S. Department of Energy Management Program and U.S. Office of Management and Budget. The FBLCC program (Vers. 2.3) contains the 1989 U.S. Department of Energy's energy price forecasts, as released in January 1990. The FBLCC program includes a number of changes in the Department of Energy's forecasts for the life-cycle cost analysis of Federal buildings. Software Description: The software is written in the BASIC programming language for implementation on an IBM/PC or compatible microcomputer under the MS-DOS operating system. Memory requirement is 64K.

International Commerce, Marketing, & Economics

000,203

PB90-205485 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
Trade Implications of Processes and Production Methods (PPMs).
P. W. Cooke. Mar 90, 24p NISTIR-90-4265

Keywords: *International trade, *Standards, *Production methods, Specifications, Regulations, Economic impact, *General Agreement on Tariffs and Trade, Trade barriers.

The report discusses processes and production methods (or PPMs) and their relationship to trade, the GATT Agreement on Technical Barriers to Trade, and traditional product standards used in international commerce. The report provides background information on PPMs, a suggested definition, and the possible extension of their application from the agricultural sector to industrial products.

000,204

PB90-219817 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.

GATT (General Agreement on Tariffs and Trade) Standards Code Activities of the National Institute of Standards and Technology 1989.
Annual rept.

J. R. Overman. Apr 90, 51p NISTIR-4314
See also PB89-191977.

Keywords: *International trade, *Standards, Tables(Data), Regulations, Specifications, Statistical data, *General Agreement on Tariffs and Trade, Certification, Trade barriers, Technical assistance.

The report describes the GATT Standards Code activities conducted by the Standards Code and Information Program, National Institute of Standards and Technology (NIST), for calendar year 1989. It also presents statistics covering the 10 years (1980 through 1989) of the Standards Code's implementation in the United States. NIST responsibilities include operating the U.S. GATT inquiry point for information on standards and certification activities and the technical office for non-agricultural products; notifying the GATT Secretariat of proposed U.S. Federal Government standards-based rules that might significantly affect trade; assisting U.S. industry with standards-related trade problems; and responding to inquiries about proposed foreign and U.S. regulations.

General

000,205

PB90-147968

PC A05/MF A01

National Inst. of Standards and Technology (NIST), Gaithersburg, MD.

Discount Factor Tables for Life-Cycle Cost Analysis.

S. R. Petersen. Dec 89, 87p NISTIR-89/4203

Keywords: *Cost analysis, Economic analysis, Present worth, Discounted cash flow, Tables(Data), *Life cycle costs, *Discount factors.

The report presents eight types of precalculated discount factors that are useful for life-cycle cost studies. Three sets of discount factor tables are provided. The first set includes six common single-payment and uniform-series discount factors. The second set of tables presents uniform present value factors for a series of payments increasing from period to period at a given rate, rather than remaining constant over the entire study period. The third set of table presents single present value factors for determining the present value of a single payment occurring at a future point in time, to be used when the payment is specified in base-time prices but is expected to increase in value over time at a specified periodic rate. The tables cover discount rates from 1 to 25%, and time periods from 1 to 40 years. Examples of the correct usage of each of these discount factors are provided.

CHEMISTRY

Analytical Chemistry

000,206

PB90-135823

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Inorganic Analytical Research Div.

Analytical Use and Applications of the Nuclear Track Technique.

Final rept.

B. S. Carpenter. 1987, 2p

Pub. in Transactions of the American Nuclear Society 55, p159-160 1987.

Keywords: *Chemical analysis, Concentration(Composition), Autoradiography, Geochronology, Geology, Geothermometry, Dosimetry, Bioassay, Bismuth, Boron, Lithium, Nitrogen, Sulfur, Uranium, Reprints, *Nuclear track technique, *Trace amounts, Semiconductors, Doped materials, Uses.

The nuclear track technique (NTT) has been routinely used to determine trace concentrations of uranium, boron, and lithium in a variety of matrices, as well as macro-concentrations (e.g., = or > 500 microg/g) of nitrogen in steels and biological material and sulfur in selective matrices. In addition to the trace element determinations, the NTT has found significant applications in geology as a viable method for geochronology, geothermometry and geological anomalies. Aside from the analytical and geological uses, the NTT has been applied to micromapping the location, distribution and behavior of dopants, such as boron, lithium, oxygen, sulfur, and uranium, in various materials. This is particularly the case in the semiconductor and biomedical areas, as no convenient long lived radioactive nuclides of these elements exists. Other applications of the technique has been in personnel and reactor dosimetry as well as alpha autoradiography which includes the determination of bismuth from the delayed alpha decay of ²¹⁰Po. The technique has also been useful in producing porous microparticles for use as chromatographic materials and as molecular sieves.

000,207

PB90-136516

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Organic Analytical Research Div.

Two-Dimensional POMMIE J (CH)-Resolved ¹³C NMR Spectrum Editing Application to Peptide and Carbohydrate Derivatives.

Final rept.

B. Coxon. 1988, 8p

Pub. in Magn. Reson. Chem. 26, n6 p449-456 1988.

Keywords: *Nuclear magnetic resonance, *Carbohydrates, *Peptides, Software(Computers), Reprints, Chemical shift.

A Pulse sequence has been implemented for two-dimensional POMMIE J(CH)-resolved ¹³C NMR spectroscopy and has been used to explore three methods for the automated acquisition of data for two-dimensional spectrum editing. In the first two methods, sets of three, two-dimensional data matrices are acquired in either sequential or interleaved modes, by use of three values $\phi = \pi/6, \pi/2, \text{ and } 5\pi/6$ for the phase shift of the multiple quantum read pulse. Computation of linear combinations of these three data matrices by use of a Pascal program that had been written earlier for two-dimensional DEPT spectrum editing yielded two-dimensional POMMIE J(CH)-resolved CH, CH₂, and CH₃ subspectra. In the third method, these subspectra are constructed directly during acquisition, by rotation of the phase shifts of the multiple quantum read pulse and the receiver. Selected small peptides and carbohydrate derivatives have been used as model compounds for the study, and their ¹H and ¹³C NMR assignments have been confirmed by two-dimensional COSY and heteronuclear CH chemical shift correlation techniques.

000,208

PB90-136524

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Organic Analytical Research Div.

Preparation and Certification of Standard Reference Material 1507: 11-Nor-Delta(sup9)-Tetrahydrocannabinol-9-Carboxylic Acid in Freeze-Dried Urine.

Final rept.

N. E. Craft, G. D. Byrd, and L. R. Hilpert. 1989, 5p

Pub. in Analytical Chemistry 61, n6 p540-544, 15 Mar 89.

Keywords: *Carboxylic acids, *Urine, Electrochemistry, Metabolism, Reprints, *Standard reference materials, *Cannabis, *Biological preservation, Mass fragmentography, High performance liquid chromatography.

The National Institute of Standards and Technology (NIST) has prepared and certified SRM 1507, a freeze-dried urine fortified with 11-nor-delta 9-tetrahydrocannabinol-9-carboxylic acid (THC-9-COOH), the major urinary metabolite of marijuana. The certified concentration of 20 + or - 1 ng/mL for the analyte was obtained from the concordant results of analyses of the material by gas chromatography/mass spectrometry (GC/MS) and high-performance liquid chromatography with electro-chemical detection (HPLC-EC). Solid-phase extraction was used to prepare the sample for GC/MS analyses, and liquid-liquid extraction was used for the HPLC-EC analyses. The multistep HPLC method was developed at NIST to circumvent interferences from urinary constituents. The results of a round robin test on this material among five Department of

Defense laboratories involved in drug testing are reported.

000,209

PB90-149212

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Organic Analytical Research Div.

Identification of Mutagenic Methylbenz(a)anthracene and Methylchrysenes Isomers in Natural Samples by Liquid Chromatography and Shpol'skii Spectroscopy.

Final rept.

P. Garrigues, M. P. Marniesse, S. A. Wise, J. Belloca, and M. Ewald. 1987, 6p

Pub. in Analytical Chemistry 59, n13 p1695-1700, 1 Jul 87.

Keywords: *Mutagens, *Anthracene compounds, *Nuclear isomers, Spectroscopy, Polycrystalline, Alkanes, Liquid chromatography, Reprints, *Methylchrysenes, *Methylbenz(a)anthracene, Carcinogenicity tests.

Chromatographic extracts of natural samples (rock and air particulate matter) have been examined by High Resolution Shpol'skii Spectroscopy (HRS) at 15 K in n-alkane polycrystalline frozen solutions for the identification of the twelve methylbenz(a)anthracenes(MBA) and the six methylchrysenes (MC). This is the first report on the unambiguous identification of each MBA in real samples which will provide a better understanding of carcinogenic potency and further quantification of these compounds in tetraaromatic fractions.

000,210

PB90-149352

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Gas and Particulate Science Div.

Observations Derived from the Application of Principal Component Analysis to Laser Microprobe Mass Spectrometry.

Final rept.

R. A. Fletcher, and L. A. Currie. 1987, 3p

Pub. in Microbeam Analysis, p369-371 1987.

Keywords: *Mass spectroscopy, *Chemical analysis, Organic compounds, Multivariate analysis, Reprints, *Ion microprobe analysis, *Laser spectroscopy.

Laser Microprobe Mass Spectrometry (LMMS) provides a unique means to obtain mass spectral information from nonvolatile organic compounds. Information of this sort has the potential to infer structure and identification of compounds, and origins of microparticles. Because of the relatively low mass resolution of the spectrometer, fragment ion and hence chemical identification is often difficult. Studies are exploring a range of powerful multivariate and pattern recognition approaches such as principal components analysis (PCA) to aid in LMMS experiment design and spectrum interpretation.

000,211

PB90-149477

Not available NTIS

National Bureau of Standards (NBS), Gaithersburg, MD. Gas and Particulate Science Div.

Artifacts Observed in Oxygen Profiles of SIMOX Samples by Secondary Ion Mass Spectrometry.

Final rept.

P. Chi, D. S. Simons, and P. Roitman. 1988, 2p

Pub. in Microbeam Analysis, p121-122 1988.

Keywords: *Oxygen, *Mass spectroscopy, *Silicon, *Implantation, Stoichiometry, Silicon dioxide, Charging, Signal processing, Reprints, Ion microprobe analysis, Separation by implantation with oxygen(SIMOX), Depth profiles.

Separation by implantation with oxygen (SIMOX) is a process in which a high dose of oxygen is implanted into a silicon substrate in order to create a stoichiometric SiO₂ layer below the silicon surface. High quality single crystal silicon can be regrown above the buried oxide by a high temperature anneal. When a depth profile measurement of SIMOX material was performed by secondary ion mass spectrometry (SIMS), it was noticed that the oxygen secondary ion signal was not constant in the buried oxide layer. Instead, it tended to increase from the front to back interface, even though Rutherford backscattering spectrometry, Auger electron spectroscopy, and transmission electron microscopy measurements on similar materials have indicated that the buried oxide is homogeneous and stoichiometric SiO₂. Upon investigating the SIMS profiles more carefully, it was found that the changing

oxygen signal was an artifact of the SIMS measurement process, caused by incomplete charge neutralization in the insulating layer.

000,212
PB90-150152 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Concentration-Concentration Histograms: Scatter Diagrams Applied to Quantitative Compositional Maps.

Final rept.
D. S. Bright, D. E. Newbury, and R. B. Marinenko.
1988, 7p
Pub. in *Microbeam Analysis*, p18-24 1988.

Keywords: *Electron probes, *Concentration(Composition), *Histograms, *Quantitative analysis, *Scatter diagrams, Plotting, Mapping, Reprints.

Compositional mapping with the electron microprobe results in arrays of compositional values which are displayed as images with selected gray or color scales to encode the range of compositional values. To establish the spatial correlation of two or more constituents, the composition-composition histogram ('CCH') has been developed to present quantitative compositional mapping data with a straightforward view of the numerical relationships of the constituents. The CCH is the two-dimensional analogy of the usual histogram and is a type of scatter plot. Each pixel in one image is associated with the corresponding pixel in the other image to give a pair of numbers or coordinates. The CCH is the pixel count accumulated in a 256x256 array according to the coordinates. The CCH promises to be useful for detecting inhomogeneities in materials, evaluating sampling and measurement statistics, and selecting phases or features of interest for further analysis.

000,213
PB90-150178 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Ion Implantation Artifacts Detected by Secondary Ion Mass Spectrometry.

Final rept.
D. S. Simons, and P. Chi. 1988, 3p
Pub. in *Microbeam Analysis*, p117-119 1988.

Keywords: *Semiconductor doping, Beryllium, Boron, Silicon, Microanalysis, Reprints, *Secondary ion mass spectroscopy, *Ion implantation, Doped materials, Depth profiles.

Secondary ion mass spectrometry (SIMS) is commonly used to measure the depth distributions of dopants in semiconductors, where the dopant is introduced by high energy ion implantation. Often SIMS is used to study the redistribution of the dopant brought about by sequent thermal processing. In other cases, the extent of ion channeling in a crystalline substrate is of interest, when the incident ion has been intentionally aligned along a high symmetry axis. For these types of studies it is usually assumed that the ion implanter is delivering a pure beam of the specified ion at a well-defined energy and current. The examples presented in the paper will show that this assumption is not always valid, and that SIMS can be a very useful diagnostic tool for detecting unexpected artifacts of ion implantation.

000,214
PB90-150186 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Electron/X-ray Optical Bench for the Measurement of Fundamental Parameters for Electron Probe Microanalysis.

Final rept.
J. Small, D. Newbury, R. Myklebust, C. Fiori, A. Bell, and K. Heinrich. 1988, 4p
Pub. in *Microbeam Analysis*, p263-266 1988.

Keywords: *X ray analysis, *Microanalysis, Quantitative analysis, X ray spectrometers, Goniometers, Electron guns, Reprints, *Electron probe microanalysis, Optical benches.

Since the development of the electron microprobe by Castaing in 1951, quantitative x-ray microanalysis has evolved into one of the most powerful methods of spatially resolved analysis. For most routine analyses, the x-ray generation, absorption, and detection processes are well understood and correction procedures can be

used to perform routine quantitative analyses at an accuracy of 2% relative. There remain, however, several areas of microanalyses for which the electron beam-specimen interaction and the x-ray generation and absorption are not well known. During the past year at NBS the authors have been working on the design and construction of an electron/x-ray optical measurement bench. The system consists of an electron gun, a specimen goniometer which is capable of three-axis orientation, and an x-ray spectrometer mount which can be used to measure x-ray intensities at detector take off angles of 0 to 180 degrees. The authors will use this instrument for the measurement of fundamental parameters relating to improved correction procedures for quantitative analysis.

000,215
PB90-150194 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

SEM (Scanning Electron Microscope) Imaging and Analysis of Submicrometer Particles in Air and Water Samples.

Final rept.
E. B. Steel. 1988, 3p
Pub. in *Microbeam Analysis*, p466-468 1988.

Keywords: *Particle size, Backscattering, Micrometers, Air analysis, Water analysis, Substrates, Filters, Asbestos, Fiberglass, Reprints, *Scanning electron microscopy.

The scanning electron microscope (SEM) has seen considerable use in characterizing the particulate populations associated with air and water samples. However, the SEM has limitations with particle visibility and analytical sensitivity as the particle size decreases below a micrometer and into the nanometer range. In this small particle size range, the secondary electron, backscatter electron, and x-ray yield from a particle can be very small compared to a bulk filter sample substrate. The paper describes results from research into various ways of improving imaging and x-ray analysis from these small particles. Many parameters were studied that would effect the imaging of submicrometer particles. Image contrast was measured as a function of types of substrate filters, sample substrate thickness, conductive coatings, accelerating voltage, and CRT raster rate. The particle application used as test specimens were chrysotile and amosite asbestos and a fiberglass. A method of sample preparation was found that enhances the visibility of small particles and allows for improved x-ray sensitivity.

000,216
PB90-152448 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Performance of a 'Conventional' Monte Carlo Program at Low-Beam Energy.

Final rept.
D. E. Newbury, and R. L. Myklebust. 1988, 4p
Pub. in *Microbeam Analysis*, p139-142 1988.

Keywords: Monte Carlo method, Computerized simulation, Electron scattering, Backscattering, Microanalysis, Depth, X rays, Reprints, *Electron trajectories, Scanning electron microscopy.

Monte Carlo electron trajectory simulation is a powerful technique for modeling the interaction of electrons with matter for problems in microscopy, microanalysis, microfabrication. A 'conventional' Monte Carlo simulation, which uses the screened Rutherford cross section for elastic scattering and the Bethe continuous energy loss equation for inelastic scattering, has been tested for simulation at low beam energies. Comparison with experimental data reveals a systematic overestimation of electron backscattering high atomic number materials. Results are presented for calculation of the depth distribution of x-ray production and the lateral spatial distribution of backscattered electrons.

000,217
PB90-152547 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Organic Analytical Research Div.

Chromatographic Separations of Serum Proteins on Immobilized Metal Ion Stationary Phases.

Final rept.
S. A. Margolis, A. Fatiadi, L. Alexander, and J. Edwards. 1989, 14p
Pub. in *Analytical Biochemistry* 183, p108-121 1989.

Keywords: *Blood proteins, *Chromatographic analysis, *Chelating agents, *Ion mobility, Anions, Amines,

Halides, pH, Salinity, Reprints, *Protein binding, Isoelectric focusing.

The separation of proteins on stationary phases consisting of a bound organic chelator and a chelated divalent transition metal has been studied as a function of metal ion species; mobile phase composition and pH; and anion and cation concentration. Optimum separation was observed at alkaline pH on chelated nickel stationary phases. The results suggest that ligand exchange is the major mechanism of separation under basic conditions and that hydrophobic effects are the result of the competition of nonnitrogen ions with ammonium ions or amines for ligand binding sites modifying or participating in protein binding. Protein binding studies under weak acidic conditions are also presented although the mechanism responsible for protein binding is unclear.

000,218
PB90-152570 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Fingerprinting of Chemical Species in Microparticles: Correlative Laser and Electron Microprobe Studies.

Final rept.
I. H. Musselman, J. T. Rickman, and R. W. Linton.
1987, 4p
Pub. in *Microbeam Analysis*, p361-364 1987.

Keywords: X ray spectrometers, Molecular structure, Nickel, Particles, Reprints, *Laser microprobe mass spectroscopy, *Scanning electron microscopy.

In a previous study, laser microprobe mass spectrometry (LAMMS) was shown to differentiate among particles of various nickel standards. The identification of compounds such as these nickel species and their distribution between, or within, individual environmental particles by LAMMS alone, however, is complicated by both inherent particle heterogeneity and limitations of the LAMMS technique. Using the complementary techniques of scanning electron microscopy coupled to an energy dispersive x-ray spectrometer and LAMMS, however, the authors have shown that molecular structures may be assigned to nickel-containing particles produced by a fluidized bed roaster in a nickel refinery.

000,219
PB90-152588 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Effects of Sample Geometry on Interelement Quantitation in Laser Microprobe Mass Spectrometry.

Final rept.
I. H. Musselman, D. S. Simons, and R. W. Linton.
1988, 9p
Pub. in *Microbeam Analysis*, p356-364 1988.

Keywords: Geometry, Shape, Thin films, Spheres, Glass, Reprints, *Laser microprobe mass spectroscopy.

Over the past decade, many studies have been conducted to address the prospect of multi-element quantification by laser microprobe mass spectrometry (LAMMS). The present paper assesses the effects of sample geometry on elemental quantification by LAMMS using the relative sensitivity factor approach. The experiments described within address the most important aspects of the laser and spectrometer optimization procedure for quantitative elemental analysis which is discussed in detail by Musselman. These experiments include determining an einzel lens potential for the selective transmission of atomic ions as opposed to cluster ions, correcting ion intensities for detector saturation, and determining a laser energy for the reproducible ionization of all elements present in the sample. Unique from other quantitative studies, data were collected under identical, optimized laser and spectrometer conditions from three distinct geometries (thin film, spheres, and shards) of glass samples bearing the same nominal elemental compositions.

000,220
PB90-152596 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Redetermination of X-Ray Loss Due to Electron Backscatter by Monte Carlo Simulation.

Final rept.

R. L. Myklebust, and D. E. Newbury, 1988, 2p

Pub. in *Microbeam Analysis*, p261-262 1988.

Keywords: *X rays, Electron scattering, Monte Carlo method, Backscattering, Simulation, Losses, Microanalysis, Reprints, Electron microprobe analysis.

Values of x-ray loss due to electron backscatter (1-R) have been recomputed with the aid of a Monte Carlo simulation of electron scattering in solids. The values obtained have been compared to previous computations. The method of calculating R for multi-element specimens by computing the mass concentration average of the R-factors of the pure elements was examined and found to be satisfactory.

000,221

PB90-152604

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Background Correction in Electron Microprobe Compositional Mapping with Wavelength-Dispersive X-Ray Spectrometry.

Final rept.

R. L. Myklebust, D. E. Newbury, R. B. Marinenko, and D. S. Bright, 1987, 3p

Pub. in *Microbeam Analysis*, p25-27 1987.

Keywords: *X ray analysis, *X ray spectroscopy, Microanalysis, Background, Mapping, Correction, Reprints, *Electron microprobe analysis.

Quantitative compositional mapping by electron probe microanalysis requires accurate correction for spectral background if useful maps are to be obtained for minor (1-10 weight percent) and trace (< 1 weight percent) constituents. Previous methods for background correction with wavelength-dispersive x-ray spectrometry relied upon the measurement of a background channel with a spectrometer. A new method is proposed which increases efficiency by eliminating the need for a spectrometer measurement of background at each pixel in an image. The new method takes advantage of the lack of spectrometer defocusing for the background. The composition calculated for the major elements at each pixel combined with the atomic number dependency of the x-ray bremsstrahlung is used to calculate an appropriate background for each pixel. Background correction to better than 0.1 weight percent and comparable to variations expected from counting statistics is demonstrated.

000,222

PB90-152612

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Applications of Compositional Mapping in Materials Science.

Final rept.

D. E. Newbury, 1987, 4p

Pub. in *Microbeam Analysis*, p33-36 1987.

Keywords: *Chemical composition, *Mapping, *Quantitative analysis, Microanalysis, Materials tests, Electron probes, Grain boundaries, X ray analysis, Reprints, Characterization, Image processing.

Quantitative compositional mapping by electron probe microanalysis provides new capabilities for materials characterization. Compositional contrast can be detected to trace levels of 0.1 weight percent or lower. Small changes in concentration can be detected, even when the levels reside on a high background. Compositional images can be modified by a variety of image processing techniques to enhance the visibility of selected concentration ranges of interest. The new capabilities can reveal unexpected structures which might be missed by conventional microanalysis procedures.

000,223

PB90-152620

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Monte Carlo Electron Trajectory Simulations for Scanning Electron Microscopy and Microanalysis: An Overview.

Final rept.

D. E. Newbury, 1987, 5p

Pub. in *Microbeam Analysis*, p110-114 1987.

Keywords: *X ray analysis, Monte Carlo method, Backscattering, Simulation, Reprints, *Scanning electron microscopy, *Electron probe microanalysis, Electron trajectories, Image analysis.

Monte Carlo electron trajectory simulation provides a tool for calculating parameters of images in scanning electron microscopy and quantitative x-ray microanalysis. The basis for the simulation is the use of electric scattering for modeling the angular deviation in the electron trajectory and the Bethe continuous energy loss equation for inelastic scattering. Statistical fluctuations in the trajectories are incorporated through the use of random numbers for the selection of the scattering angle from the allowable range. Applications are presented which illustrate the calculation of backscattered electron compositional contrast, Type II magnetic contrast, and x-ray depth production.

000,224

PB90-152711

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Neutron Microprobe: Prospects and Potential Applications.

Final rept.

R. M. Lindstrom, R. F. Fleming, and H. L. Rook, 1988, 10p

Pub. in *Microbeam Analysis*, p407-416 1988.

Keywords: *Neutron activation analysis, Chemical analysis, Gamma rays, Sensitivity, Depth, Reprints, Neutron capture, Microprobes, Prompt gamma radiation, Neutron probes.

Prompt gamma rays and charged particles emitted during neutron capture have proven to be valuable for nondestructive chemical analysis. Applications have been somewhat limited by the low intensity of available neutron beams. Long-wavelength neutrons from reactor cold sources can be focused into beams of higher intensity. By applying advanced neutron optics, it appears possible to produce a density of neutrons comparable to that in the sample irradiation position of a research reactor, but confined to a small volume which can be intimately surrounded by radiation detectors. The authors anticipate greatly improved detection sensitivities compared with existing thermal neutron instruments.

000,225

PB90-152729

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Inorganic Cluster Ion Formation in the Laser Microprobe.

Final rept.

R. W. Linton, I. H. Musselman, F. Bruynseels, and D. S. Simons, 1987, 4p

Pub. in *Microbeam Analysis*, p365-368 1987.

Keywords: Nickel, Gold, Sulfur, Films, Reprints, *Laser microprobe mass spectroscopy, *Cluster ions, Multi-layers.

Results for Ni/Au/S sandwich films demonstrate that the observation of cluster ions in the laser microprobe mass spectrum is a sensitive function of sample geometry and orientation, laser power density, and ion focusing lens potential. With appropriate selection of the above parameters, extensive ion recombination is observed involving Ni(x)S(y) clusters. The clusters appear to have narrower kinetic energy distributions that also peak at lower energy in comparison to atomic ions. All of these factors complicate the relationship between the laser microprobe spectrum and the inherent molecular structure of the solid sample.

000,226

PB90-152877

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Calculation of Depth Distributions of X-ray Generation by the Monte Carlo Technique.

Final rept.

K. F. J. Heinrich, D. E. Newbury, and R. L. Myklebust, 1988, 4p

Pub. in *Microbeam Analysis*, p273-276 1988.

Keywords: *X rays, Electron scattering, Particle trajectories, Monte Carlo method, Simulation, Computation, Depth, Microanalysis, Reprints, *Electron microprobe analysis, Electron trajectories.

Depth distributions of x-ray generation have been computed from Monte Carlo simulations of electron trajectories in solids. Measurements of the depth distributions from the literature are compared to the calculations for several examples. Both the measurements and the calculations were normalized to remove the effects of the beam energy, the excitation potential,

and the effect of different atomic numbers. The results of several comparisons of experimental data and Monte Carlo calculations are presented together with a comparison with a mathematical model for the depth distribution.

000,227

PB90-169459

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Isotopic Fractionation of Gallium on an Ion Exchange Column.

Final rept.

L. A. Machlan, and J. W. Gramlich, 1988, 3p

Pub. in *Analytical Chemistry* 60, n1 p37-39 1988.

Keywords: *Gallium, *Isotope separation, Mass spectroscopy, Reprints, *Ion exchange chromatography, *Standard reference materials.

Significant isotopic fractionation of gallium has been observed during elution through an anion exchange resin in the thiocyanate form. Two samples of NBS Standard Reference Material 994 (certified (69)Ga/(71)Ga = 1.50676 plus or minus 0.00039) were passed through the ion exchange columns, and fractions were analyzed for isotopic composition and gallium content using thermal ionization isotope dilution mass spectrometry. The results show a depletion of the light isotope in early fractions from the columns, with a steady increase in the light isotope throughout the elution. A materials balance of the product of the isotopic composition and gallium content of each fraction is in agreement with the isotopic composition of the starting material.

000,228

PB90-170036

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.

Determination of Cyclodextrin Formation Constants Using Dynamic Coupled-Column Liquid Chromatography.

Final rept.

L. A. Blyshak, K. Y. Dodson, G. Patonay, I. M. Warner, and W. E. May, 1989, 6p

Grant NSF-CHE86-09372

Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA. Pub. in *Analytical Chemistry* 61, n9 p955-960, 1 May 89.

Keywords: *Liquid chromatography, Polycyclic aromatic hydrocarbons, Solubility, Reprints, *Cyclodextrins.

Dynamic coupled-column liquid chromatography is used to determine both aqueous solubilities and cyclodextrin inclusion complex formation constants for a series of polynuclear aromatic hydrocarbons (PAHs). The method is based on the increase in solubility afforded by cyclodextrins upon complexation. Formation constant (K1) values are determined by using α -, β -, and γ -cyclodextrins at various temperatures. The relative precision of the calculated K₁ values is best for cyclodextrin/PAH complexes with large formation constants. The calculated solubilities are comparable to literature values, and in most cases, formation constant data are reproducible within 10%. The resulting K values confirm that the formation of inclusion complexes is based on the relative sizes of host and guest molecules.

000,229

PB90-170044

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Semiconductor Electronics Div.

Evaluation of Instrumental Correction Factors for Infrared Absorption Concentration Measurements.

Final rept.

A. Baghdadi, 1989, 3p

Pub. in *Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Fourier Transform Spectroscopy*, v1145 p168-170 1989.

Keywords: *Infrared spectroscopy, *Silicon, *Oxygen, *Fourier analysis, Measuring instruments, Reprints.

Infrared spectra obtained in a world-wide round-robin measurement of the oxygen content of silicon wafers were evaluated to determine whether instrumental correction factors could be derived from the spectrum of a silicon wafer polished on both sides. The data showed that each instrument could be characterized by its re-

sponse at the oxygen in silicon absorption band. Three parameters were evaluated for possible use as calibration factors: the transmittance of the polished silicon at 2000/cm, the absorption coefficient of the 610/cm lattice absorption band, and the absorption coefficient of the 739/cm lattice absorption band. However, no quantitatively consistent relationship was found between the measured oxygen content and any of these potential internal calibration factors.

000,230

PB90-170192 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD, Organic Analytical Research Div.

Catalytic Oxygen-Scrubber for Liquid Chromatography.

Final rept.

W. A. MacCrehan, S. D. Yang, and B. A. Benner.

1988, 3p

Pub. in Analytical Chemistry 60, n3 p284-286 1988.

Keywords: *Gas scrubbing, *Liquid chromatography, Electrochemistry, Oxygen, Oxidation reduction reactions, Reprints, Methyl alcohol, Fluorescence spectrometry.

A method for the removal of dissolved, mobile-phase oxygen in liquid chromatography is presented. A platinum-on-alumina packed column catalyzes the oxidation of methanol, consuming all oxygen. As little as 1% methanol added to the mobile phase produces substantial reduction of oxygen. The utility of the oxygen-scrubber column is demonstrated for reductive electrochemical and fluorescence detection in liquid chromatography.

000,231

PB90-170200 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD, Organic Analytical Research Div.

Determination of Nitro-PAH (Polycyclic Aromatic Hydrocarbons) in Air and Diesel Particulate Matter Using Liquid Chromatography with Electrochemical and Fluorescence Detection.

Final rept.

W. A. MacCrehan, W. E. May, S. D. Yang, and B. A.

Benner. 1988, 6p

Pub. in Analytical Chemistry 60, n3 p194-199 1988.

Keywords: *Aromatic polycyclic hydrocarbons, *Nitro compounds, *Diesel fuels, *Exhaust emissions, *Chemical analysis, Liquid chromatography, Electrochemistry, Gas scrubbing, Reprints, Standard reference materials, Fluorescence spectrometry.

Three different approaches to the liquid chromatographic detection of nitro-polycyclic aromatic hydrocarbons in air and diesel particulate extracts are presented, based on differential pulse (LCDPD) and amperometric (LCEC) electrochemical detection and fluorescence detection following on-line reduction to the amine. The particulate extraction/fractionation procedure for each detection approach is discussed. The operational advantages of oxygen removal with a platinum oxygen-scrubber (all three types of detection); the use of modulated pulse detection (LCDPD); and wavelength-programmed fluorescence detection (LCFI) are explored. 1-Nitropyrene is determined in Standard Reference Material (SRM) 1650 Diesel Particulate Matter and in several other 'round robin' samples by all three methods. Results are compared to those obtained by other techniques and by other laboratories. Additionally, 2-nitrofluorene, 9-nitroanthracene, 7-nitrobenzo(a)anthracene, and 6-nitrobenzo(a)pyrene are determined in SRM 1650 by LCFI. The detection limits for 1-nitropyrene (expressed as ng/mL injected) are 170 (LCDPD), 2.0 (LCEC), and 0.6 (LCFI).

000,232

PB90-170366 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD, Gas and Particulate Science Div.

New Gas-Phase Nitric Acid Calibration System.

Final rept.

L. Nunnermacker, R. Dickerson, A. Fried, and R.

Sams. 1989, 5p

Pub. in Environmental Science and Technology 23, n1 p106-110 Jan 89.

Keywords: *Gas analysis, *Calibrating, *Nitric acid, Standards, Chemiluminescence, Concentration(Composition), Nitrogen oxide(NO), Nitrogen dioxide, Nitrides, Chromatographic analysis, Atmospheric composition, Reprints, Laser spectroscopy, Air pollution detection.

A new calibration source of gaseous nitric acid, HNO₃(g) has been developed, based on the reaction of gaseous hydrogen chloride, HCl(g), with solid silver nitrate, AgNO₃(g). The concentration of HNO₃ produced by the system has been determined using three independent techniques: tunable diode laser absorption spectroscopy (TDLAS), chemiluminescence detection (CD), and ion chromatography (IC). In addition to HNO₃ the calibration source was also examined for such gases as HONO, NO, and NO₂. The HNO₃ calibration system is also linear with dynamic dilution down to 10 ppbv.

000,233

PB90-170432 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD, Organic Analytical Research Div.

Enhancement of Sensitivity in Capillary Supercritical Fluid Chromatography through Optimization of Injection and Detection Techniques.

Final rept.

A. Munder, and S. N. Chesler. 1989, 6p

Pub. in Jnl. of High Resolution Chromatography 12, p669-674 Oct 89.

Keywords: *Capillary tubes, *Test equipment, *Injection, *Sampling, *Detection, Reproducibility, Column packings, Ultraviolet absorbers, Sensitivity, Explosives, Nitro compounds, Phthalates, Reprints, *Liquid chromatography, *Supercritical fluids, *Liquid injection, Flame ionization.

The reproducibility of peak areas as a function of the technique used for sample injection was investigated in capillary supercritical fluid chromatography (SFC). An injection technique has been developed to increase the volume of sample introduced into the capillary column. Using a modified time-split injection technique, long injection duration times were successfully applied to achieve lower detection limits. Because the on-column focusing was performed only by pressure and temperature programming, no instrumental modifications were necessary. Up to 1.0 microliters of sample solution was injected onto 50 micrometer i.d. columns using the technique, with no observable peak splitting. Dual detection using ultraviolet (UV) absorption and flame ionization detection (FID) was performed in series, thereby avoiding the necessity of splitting the column effluent. For the compounds investigated (five nitro-aromatics and one phthalate ester), the absolute sensitivity of the UV detector was significantly greater than that of the FID.

000,234

PB90-170762 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD, Semiconductor Electronics Div.

Fourier Transform Infrared (FTIR) Determination of Interstitial Oxygen Concentration of Single-Side-Polished Silicon Wafers.

Final rept.

B. Rennex. 1989, 3p

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Fourier Transform Spectroscopy, v1145 p332-334 1989.

Keywords: *Fourier analysis, *Infrared spectroscopy, *Silicon, Integrated circuits, Algorithms, Reprints.

The paper evaluates a new algorithm developed by the author for calculating interstitial oxygen concentration in silicon wafers, using infrared transmission data. These silicon wafers have a backside-damaged surface and are referred to as being single-side-polished (SSP). This evaluation is carried out for various backside surface types, which are typical of surfaces used by the integrated circuit industry. Accurate measurement of oxygen content is important for reduction of the cost of quality control in the manufacture of integrated circuits. A systematic offset in oxygen concentration is found for (100) causal surfaces of surface category SCI. This offset is small (~1.5%), and it exhibits a small dispersion (sigma=0.9%), when calculated with a new algorithm which features an interpolation procedure for the forward scattering parameter, F. This result is promising for development of a calibration approach for this surface category, which would have a 2 sigma uncertainty of about plus or minus 1.8%.

000,235

PB90-170788 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD, Surface Science Div.

Surface Sensitivity of Electron Spectroscopies.

Final rept.

C. J. Powell. 1990, 1p

Pub. in Current Contents, Physical Chemical and Earth Sciences 30, n3 1p, 15 Jan 90.

Keywords: *Spectroscopy, *Electrons, *Surface properties, Reprints.

A commentary is presented on a 1974 paper by the author which has been selected as a 'Citation Classic' by Current Contents: Physical, Chemical and Earth Sciences. The commentary addressed the background, circumstances and influence of the original work.

000,236

PB90-188327 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD, Gas and Particulate Science Div.

Microphone Triggering Circuit for Elimination of Mechanically Induced Frequency-Jitter in Diode Laser Spectrometers: Implications for Quantitative Analysis.

Final rept.

R. L. Sams, and A. Fried. 1987, 7p

Pub. in Applied Optics 26, n17 p3552-3558 1987.

Keywords: *Vibration isolators, *Trigger circuits, Timing circuits, Vibration damping, Quantitative analysis, Infrared spectroscopy, Semiconductor lasers, Reprints, *Laser spectrometers, High resolution.

An electronic timing circuit using a microphone triggering device has been developed for elimination of frequency-jitter in diode laser spectrometers employing closed-cycle refrigerators. Mechanical compressor piston shocks are detected by the microphone and actuate an electronic circuit which ultimately interrupts data acquisition until the mechanical vibrations are completely quenched. In this way, laser sweeps contaminated by compressor frequency-jitter are not co-averaged. Employing this circuit, measured Doppler halfwidths were greatly reduced by as much as 20%. The importance of eliminating the mechanically-induced frequency-jitter when carrying out quantitative diode laser measurements is further discussed.

000,237

PB90-188350 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD, Organic Analytical Research Div.

Effect of Phase Length on Column Selectivity for the Separation of Polycyclic Aromatic Hydrocarbons by Reversed-Phase Liquid Chromatography.

Final rept.

L. C. Sander, and S. A. Wise. 1987, 5p

Pub. in Analytical Chemistry 59, n18 p2309-2313 1987.

Keywords: *Column packings, *Liquid phases, *Length, *Separation, *Aromatic polycyclic hydrocarbons, Silanes, Haloalkanes, Polymers, Absorption, Chemical analysis, Reprints, *Liquid chromatography, *Reversed flow, Chain length.

A series of monomeric and polymeric alkyl phases of different phase lengths were prepared by reaction with appropriate mono- and trichlorosilanes. Selectivity changes with alkyl phase length were examined for phases ranging in length from C8 to C30. The retention behavior of polycyclic aromatic hydrocarbons (PAH) was observed to vary significantly with alkyl length. Using PAH probe solutes, phase selectivity of long chain length monomeric phases was found to approach that observed for C18 polymeric phases. Retention behavior is discussed in terms of a schematic representation of bonded phase structure.

000,238

PB90-188442 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD, Organic Analytical Research Div.

Determination of Hydrophilic Thiols in Sediment Porewater Using Ion-Pair Liquid Chromatography Coupled to Electrochemical Detection.

Final rept.

D. Shea, and W. A. MacCrehan. 1988, 6p

Pub. in Analytical Chemistry 60, n14 p1449-1454 1988.

Keywords: *Electrochemistry, *Thiols, *Sediments, *Water chemistry, Chesapeake Bay, Oxidation, Electrical measurement, Electrodes, Mercury, Gold, Carbon, Reprints, Hydrophilicity, Ion pairs, Liquid chromatography, Reversed flow.

CHEMISTRY

Analytical Chemistry

Reversed-phase high performance liquid chromatography coupled to amperometric detection at a Hg/Au-film electrode was used to determine 9 hydrophilic thiols in sediment porewater samples from the Chesapeake Bay. The detection limit is about 2 pmol and the precision is better than 3% at the 100 pmol level. Glassy carbon and bare Au electrodes were also examined, but were found to have higher residual currents and more interferences than the Hg/Au-film. The stability of thiols with respect to oxidation, in both standard solutions and samples, was also investigated under various conditions.

000,239

PB90-190679 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div. **Determination of Thimerosal in Biological Products by Liquid Chromatography with Inductively Coupled Plasma Mass Spectrometric Detection.** Final rept.

D. S. Bushee, J. R. Moody, and J. C. May. 1989, 3p
Pub. in Jnl. of Analytical Atomic Spectrometry 4, p773-775 Dec 89.

Keywords: *Vaccines, *Preservatives, Liquid chromatography, Mass spectroscopy, Plasma(Physics), Mercury organic compounds, Reprints, *Thimerosal, *Toxoids.

A liquid chromatography system has been interfaced to an inductively coupled plasma mass spectrometer in order to analyze injectable biological products for thimerosal. Thimerosal is a mercury containing antimicrobial agent used as a preservative in these materials. Sample types analyzed ranged from vaccines and toxoids (influenza virus vaccine and tetanus toxoid) to diluents, containing only the preservative in a saline solution. Samples were analyzed quantitatively for thimerosal content and qualitatively for the presence of decomposition products detectable by this method, such as methylmercury chloride, dimethylmercury and mercury(II) chloride. Flow injection was used to confirm that all mercury species in the samples were determined by liquid chromatography.

000,240

PB90-192345 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Semiconductor Electronics Div. **Measurement of Vanadium Impurity in Oxygen-Implanted Silicon by Isotope Dilution and Resonance Ionization Mass Spectrometry.** Final rept.

S. Mayo, J. D. Fassett, H. M. Kingston, and R. J. Walker. 1990, 5p
Pub. in Analytical Chemistry 62, n3 p240-244, 1 Feb 90.

Keywords: *Oxygen, *Silicon, *Vanadium, Mass spectroscopy, Ionization, Impurities, Reprints, Isotope dilution.

The combined analytical capabilities of isotope dilution, laser-induced resonance ionization spectroscopy, and mass spectrometry, integrated in the resonance ionization mass spectrometry technique (RIMS), have been evaluated as a tool for quantitative elemental impurity analysis of SIMOX (separation by implanted oxygen), a new silicon-based material prepared by oxygen implants. The vanadium impurity content was measured in the top crystalline SIMOX film and the oxygen-synthesized buried oxide layer in commercial wafers, resulting in 0.14 microg/g \pm or -20%, or 1.7×10^{15} (sup 15) atoms/cubic cm. A similar analysis on the substrate bulk shows about 30 times lower vanadium impurity levels. The origin of this contamination may be linked to the oxygen implant, although no modeling for it is offered here. The sensitivity of RIMS to vanadium is in the pg/g range. The accuracy of results is limited by the uncertainty in the blank, in view of the low total vanadium content in the specimen.

000,241

PB90-193384 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div. **Preparation of Microgram Samples on Iron Wool for Radiocarbon Analysis via Accelerator Mass Spectrometry: A Closed-System Approach.** Final rept.

R. M. Verkouteren, L. A. Currie, D. J. Donahue, A. J. T. Jull, G. A. Klouda, and T. W. Linick. 1987, 4p
Pub. in Nuclear Instruments and Methods in Physics Research 29, n1-2 p41-44 1987.

Keywords: *Targets, Carbon 14, Samples, Preparation, Reprints, *Accelerator mass spectroscopy, Iron wool.

A technique has been developed at NBS for the high quality production of Accelerator Mass Spectrometry (AMS) targets with optimization of chemical yields, ion currents, blanks and throughput. The approach encompasses sample combustion to CO₂, catalytic reduction of CO₂ to elemental carbon on high-purity iron wool and 'in situ' formation of a homogeneous iron-carbon bead; all steps are performed in a closed system. The total measurement system blank and variability are considered in light of contributions from combustion, iron wool, reduction, beading and machine blank. Use of this approach provides effective management of large numbers of specialized samples. Chemical yields for 50-700 microgram-C samples deposited on 15 mg iron wool were greater than 90%.

000,242

PB90-198458 PC A09/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology. **Basics of Chemical Instrumentation. Volume 1. Separation Methods.** T. J. Bruno. Feb 90, 190p NISTIR-89/3933

Keywords: *Laboratory equipment, Gas chromatography, Electrophoresis, *Separation processes, Calibration, High pressure liquid chromatography, Supercritical fluid chromatography.

The report is intended to provide an introduction to chemical instrumentation to workers whose training lies outside the area of experimental chemistry. It is especially geared toward scientific managers in government and industrial laboratories who must interact on a daily basis with chemical professionals, and who often have highly sophisticated analytical chemistry laboratories under their jurisdiction. The first report deals with instrumental separation methods. After an introduction to the nature of mixtures, the topics of gas chromatography, high performance liquid chromatography, supercritical fluid chromatography, and electrophoresis are discussed. These sections are followed by an appendix covering calibration methods. A glossary is provided in which terms not covered in the body of the report are defined.

000,243

PB90-217720 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Fire Measurement and Research Div. **Use of FTIR Spectroscopy for Multi-Component Quantitation in Combustion Toxicology.** Final rept.

M. R. Nyden, and V. Babrauskas. 1987, 4p
Pub. in Chem. Phys. Processes Combust., p107/1-107/4 1987.

Keywords: *Chemical analysis, *Infrared spectroscopy, *Toxicology, *Combustion, *Gases, Mixtures, Fourier analysis, Reprints.

A method for using FTIR spectroscopy for obtaining multi-component gas quantitation is presented. The method is a real-time operating technique and is robust against interferences from uncharacterized species.

000,244

PB90-217902 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div. **Quantitative Isotope and Elemental Ratio Measurements with a Camera-Based Imaging System on an Ion Microscope.** Final rept.

D. E. Newbury, and D. S. Bright. 1988, 4p
Pub. in Proceedings of International Conference on Secondary Ion Mass Spectrometry (6th), p389-392 1988.

Keywords: Quantitative analysis, Mass spectroscopy, Digital techniques, Isotopes, Reprints, *Image analysis, *Ion microprobe analysis.

The direct-imaging ion microscope offers the possibility of performing quantitative analysis in parallel for a large array of locations imaged simultaneously on a specimen. Digitization of the television signal offers certain advantages. (1) High secondary ion intensities can be measured. (2) Because each location in the image is measured separately and simultaneously, even if one portion of the image saturates, useful

measurements can be obtained in the unsaturated portion of the image. (3) Real time analog imaging is directly available during the digitization for continuous monitoring of the sample. The work examines TV digitization of secondary ion mass spectrometry (SIMS) images with respect to the accuracy, precision, and dynamic range which can be achieved in measuring isotopic and elemental ratios.

000,245

PB90-218231 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div. **Fluorescence Spectrometry in Analytical Chemistry and Color Science.** Final rept.
K. D. Mielenz. 1987, 20p
Pub. in Anal. Spectrosc. Libr. Adv. Stand. Methodol. Spectrophotom. 2, p49-68 1987.

Keywords: Chemical analysis, Colorimetry, Spectra, Reprints, *Fluorescence spectroscopy.

Fluorescence spectrometry is used extensively in analytical chemistry as well as in color science. Although the objectives of the measurement and the instrumentation and methodologies used are different, it will be shown that the underlying concepts are essentially the same in chemistry and colorimetry, and that theoretical descriptions applicable in one discipline are also objectives and experimental techniques, a unified description of fluorescence measurements will be developed. The starting point for the discussion are radiometric definitions which are useful for the phenomenological characterization of colorimetric samples. The definitions are then reduced to the analogous molecular quantities which are of interest in photochemistry.

000,246

PB90-233891 PC A09/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Center for Analytical Chemistry. **Technical Activities 1986, Center for Analytical Chemistry.** R. A. Durst, H. S. Hertz, J. K. Taylor, and R. A. Velapoldi. Nov 86, 185p NBSIR-86/3468
See also PB86-178902.

Keywords: *Chemical analysis, Research projects, Inorganic compounds, Organic compounds, Gases, Spectroscopy, Quality assurance, Quantitative analysis, Qualitative analysis, US NBS, US NIST, Calibration standards, Particulates.

The report summarizes the technical activities of the Center for Analytical Chemistry at the National Bureau of Standards. It emphasizes activities over the Fiscal Year 1986 in the Inorganic Analytical Research Division, the Organic Analytical Research Division, and the Gas and Particulate Science Division. In addition, it describes certain special activities in the Center including quality assurance and voluntary standardization coordination.

000,247

PB90-241332 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div. **Behavior of Liposomes in Flow Injection Systems.** Final rept.
L. Locascio-Brown, A. L. Plant, and R. A. Durst. 1988, 6p
Pub. in Analytical Chemistry 60, n8 p792-797 1988.

Keywords: *Chemical analysis, Fluorescein, Fluorescent dyes, Lipids, Injection, Bioassay, Fluid flow, Diffusion coefficient, Hydrodynamics, Reprints, *Liposomes, *Fluorescence spectroscopy, Carriers, Column packing.

The hydrodynamic behavior and stability of liposomes in flow injection analysis have been examined, in order to evaluate their usefulness as analytical reagents in continuous flow systems. It was found that liposomes containing the fluorescent self-quenching dye, carboxyfluorescein, are stable in the flow system and do not release their trapped contents even at flow rates of 2 mL/min. Differences in concentration profiles for solution and liposome samples have been examined under conditions of induced radial mixing in a knitted delay tube and a packed bead column. No aspects of liposome behavior have been observed that are not explained by their small diffusion coefficient. Under conditions of appropriate assay formats, liposomes will be

important signal enhancement tools for flow injection analysis.

000,248

PB90-241555 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Liquid Chromatography Element-Specific Detection Systems for Analysis of Molecular Species.
Final rept.

K. J. Irgolic, and F. E. Brinckman. 1986, 18p
Pub. in the Importance of Chemical 'Speciation' in Environmental Processes, p667-684 1986.

Keywords: *Environmental surveys, *Chemical analysis, Mass spectroscopy, Atomic spectroscopy, Absorption spectra, Performance evaluation, Laboratory equipment, Reprints, *Liquid chromatography, Biological effects.

Systems for the separation of inorganic compounds of environmental interest are described. They consist of a high-pressure liquid chromatograph linked to a graphite furnace atomic absorption or inductively coupled plasma spectrometer as the element-specific detector. The possibility of correlating the elution rates of compounds from columns with their biological activity is discussed.

000,249

PB90-254426 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.

NBS/EPA Data Base of Evaluated Electron Ionization Mass Spectra.
Final rept.

W. L. Budde, S. G. Lias, S. R. Heller, and G. W. A. Milne. 1989, 2p
Pub. in the Wiley/NBS (National Bureau of Standards) Registry of Mass Spectral Data, v1 pxxii-xxiii 1989.

Keywords: *Organic compounds, *Mass spectroscopy, Ionization, Spectrum analysis, Molecular weight, Molecular structure, Reprints, CAS number, Chemical nomenclature.

The publication presents a collection of 44,205 evaluated electron ionization mass spectra of individual substances. The spectra are given in bar graph format over the full mass range. Each spectrum is accompanied by a Chemical Abstracts Service Registry Number, a Chemical Abstracts Collective Index substance name, a molecular formula, a molecular weight, and a structural formula.

000,250

PB90-254459 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Detection: Overview of Historical, Societal, and Technical Issues.
Final rept.

L. A. Currie. 1988, 62p
Pub. in ACS (American Chemical Society) Symposium Series Detect. Anal. Chem., v361 p1-62 1988.

Keywords: *Chemical detection, *Hazardous materials, *Social psychology, Measurement, Chemical analysis, Hazards, Errors, Regulations, Reprints, Social factors.

Practical societal needs and basic scientific advances frequently rely on Measurement Processes possessing specified detection capabilities with acceptable probabilities of false positives and false negatives. The first part of the overview introduces the basic concept of (chemical) detection, together with its applicability to selected societal problems such as the detection of natural hazards and the implementation of certain regulations. Basic scientific measurement issues related to assumptions and their validity, and hypothesis testing in relation to analyte detection are next introduced. Part two comprises a brief historical review, highlighting major contributions to the concept and realization of detection in chemical applications primarily over the last two decades. The current state-of-the-art in chemistry is then considered. Part three is the most extensive, as it seeks to expose most of the technical issues involved in deriving meaningful detection decisions and detection limits, considering the overall Chemical Measurement Process.

000,251

PB90-271206 Not available NTIS
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Thermophysics Div.

Physicochemical Applications of Supercritical Fluid Chromatography.

Final rept.

T. J. Bruno. 1987, 9p
Pub. in Proceedings of Symposium on Energy Engineering Sciences (5th), Argonne, IL., June 17, 1987, p52-60.

Keywords: *Chromatography, Diffusion coefficient, Reprints, *Supercritical fluid chromatography.

Supercritical fluid chromatography is a technique which offers many unique advantages and opportunities when implemented as a physicochemical measurement technique. A logical intermediary between gas chromatography (G.C.) and high performance liquid chromatography (H.P.L.C.), supercritical fluid chromatography (S.F.C.) finds a natural place in thermophysics research. In the paper, a brief overview of S.F.C. is given (with reference to a newly constructed instrument), followed by a general description of the measurements made possible by this tool. In addition, some preliminary measurements are presented.

000,252

PB91-107128 PC A09/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Spectroscopic Library for Alternative Refrigerant Analysis.
Special pub. (Final).

T. J. Bruno. Aug 90, 192p NIST/SP-794
Also available from Supt. of Docs. as SN003-003-03036-8. Sponsored by Department of Energy, Washington, DC. Office of Buildings and Community Systems.

Keywords: *Refrigerants, *Mass spectra, *Infrared spectra, Chemical analysis, Air pollution abatement, Halogen organic compounds, Chemical reactions, Decomposition reactions, Physical properties, Safety, *Environmental chemical substitutes, Air pollution detection, Ozone layer.

The Special Publication contains infrared and mass spectra for a wide range of chlorofluoro-bromo ethanes and ethylenes that are relevant to research on alternative refrigerants. Alternative refrigerants are working fluids that are thought not to contribute significantly to atmospheric ozone depletion. In addition to the spectroscopic data, some physical property and safety information is included for each fluid as well. Not all of the compounds covered in the publication can be used as refrigerants. Indeed, some of them are in fact solids under ambient conditions, and others are fully halogenated, thus making them unfavorable from an ozone depletion standpoint. The study of all of these materials is important, however, since many will be found as impurities or reaction/decomposition products of refrigerant fluids. The publication provides a signal source for some particularly useful analytical information needed in the identification of these compounds.

000,253

PB91-112151 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.

Determination of Serum Uric Acid by Isotope Dilution Mass Spectrometry as a New Candidate Definitive Method.
Final rept.

P. Ellerbe, A. Cohen, M. J. Welch, and E. White V. 1990, 5p
Pub. in Analytical Chemistry 62, n20 p2173-2177, 15 Oct 90.

Keywords: *Uric acid, *Mass spectroscopy, Blood serum, Accuracy, Precision, Anion exchanging, Chemical reactions, Gas chromatography, Reprints, *Isotope dilution, Calibration standards.

A new isotope dilution mass spectrometric method for uric acid is described. A known weight of (1,3-(15)N2) uric acid is added to a known weight of serum, and the mixture is allowed to equilibrate. The serum is put through an anion-exchange resin, and the isolated uric acid is converted to the tetrakis(tert-butylidimethylallyl) derivative of uric acid. For measurement, the derivative is injected into a gas chromatograph interfaced with a low-resolution, magnetic sector mass spectrometer. Isotope ratio measurements are made from the abundances of the (M-tert-butyl)(+) ions at m/e 567 and 569. Bias is investigated by measuring the uric acid level in the same samples under different chromatographic conditions and with different ionization tech-

niques. Uric acid was determined in three lyophilized human serum pools by this method. For Standard Reference Material (SRM) 909, four sets of six samples each were prepared. For Candidate SRM 909a, which consisted of two pools, each with a different level of uric acid, six sets of two samples of each level were prepared. The coefficient of variation for a single measurement ranged from 0.34% to 0.42%, while the relative standard error of the mean ranged from 0.06% to 0.14%. The combination of high precision and absence of significant bias in the results qualifies this method as a candidate definitive method as defined by the National Committee for Clinical Laboratory Standards.

000,254

PB91-112201 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Tunable Diode Laser Absorption Spectrometry for Ultra-Trace Measurement and Calibration of Atmospheric Constituents.
Final rept.

A. Fried, and R. Sams. 1987, 11p
Pub. in Sampling and Calibration for Atmospheric Measurements, ASTM STP 957, p121-131 1987.

Keywords: *Hydrogen chloride, *Nitrogen dioxide, *Nitrogen oxide(NO), *Ozone, *Infrared spectroscopy, Reprints, *Tunable lasers, Atmospheric chemistry, Trace gases.

There has been an ongoing quest for development of ever more sensitive and selective detection methods for studying various gas molecules of atmospheric importance. Both laboratory and ambient studies often require instrumentation capable of measuring ultra-trace concentrations of such gases at, and below, the part-per-billion range. Concurrently, accurate calibration standards, particularly those verified by independent techniques, are also required. The sensitive, selective and versatile technique of infrared tunable diode laser absorption spectrometry is especially well suited for ultra-trace gas measurements. This combination which is not shared by many other measurement techniques, results from the fact that diode laser spectrometers can be operated in an absolute mode as well as a more sensitive relative mode. In the paper, the authors discuss these capabilities and present specific examples for the measurement and calibration of ultra-trace levels of the important atmospheric gases NO2 and HCl. In addition, The authors further discuss the application of tunable diode laser absorption spectrometry in the verification of NO2 permeation standards using the gas-phase titration reaction between NO and O3.

000,255

PB91-112417 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.

Precision and Accuracy of Mass Flow Measurement in the NIST-Boulder Nitrogen Flow Facility.
Final rept.

S. E. McFaddin, J. A. Brennan, and C. F. Sindt. 1989, 12p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in Proceedings of International Conference on Mass Flow Measurement: Direct and Indirect, London W1, England, February 21-22, 1989, 12p.

Keywords: *Mass flow, *Nitrogen, *Accuracy, *Precision, Flow measurement, Chemical laboratories, Boulder(Colorado), Condensing, Vaporizing, Cryoscopy, Reprints.

The mass flow measurement facility at the National Institute of Standards and Technology (NIST) in Boulder, Colorado, U.S.A., has been upgraded and an analysis of the precision and accuracy has been performed. The facility uses nitrogen as the process fluid which circulates through two flow measurement test sections. The first test section is used to test cryogenic flowmeters and operates at temperatures between 80 and 90 K and at pressures between 0.1 and 0.8 MPa. The second test section is used to test gas flowmeters and operates near ambient temperature and pressures between 3.8 and 4.1 MPa. The gas, at a density of 48 kg/cu m, is converted back to liquid, at a density of 800 kg/cu m, and the mass is measured with a load cell. The paper describes the operation and capabilities of this nitrogen mass flow measurement facility. The precision and accuracy of mass flow measurement in both the gas and liquid test sections are documented. Per-

formance of several flowmeters in the gas and liquid test sections are shown.

000,256

PB91-112730 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Anomalous Behavior of Selected Methyl-Substituted Polycyclic Aromatic Hydrocarbons in Reversed-Phase Liquid Chromatography.
Final rept.

S. A. Wise, L. C. Sanders, R. Lapouyade, and P. Garrigues. 1990, 12p
Pub. in *Jnl. of Chromatography* 514, p111-122 1990.

Keywords: *Aromatic polycyclic hydrocarbons, Chemical analysis, Molecular structure, Chromatographic analysis, Isomerization, Reprints, *Liquid chromatography, *Anomalous dimension.

In the reversed-phase liquid chromatographic separation of polycyclic aromatic hydrocarbons (PAHs) on C18 phases, methyl-substituted PAHs are expected to elute after the unsubstituted parent PAH based on the increase in hydrocarbonaceous contact area of the methyl-substituted PAHs. However, the authors have observed that several methyl-substituted PAHs elute prior to the parent compound, e.g., 1-methylperylene, 1-methylpicene and 13-methylpicene. To investigate this anomalous retention behavior, the retention characteristics of all methyl-substituted isomers of chrysene, picene and perylene were compared on a series of sixteen commercially prepared C18 phases. The anomalous retention behavior was observed only on polymeric C18 phases (i.e., those prepared using trifunctional silanes) whereas the methyl-substituted PAHs elute after the parent PAH, as would be expected, on monomeric C18 phases (i.e., those prepared using monofunctional silanes). The early elution of some of these methyl-substituted isomers is related to the non-planarity of these PAHs due to the presence of the methyl group in the so-called 'bay-region' of the PAH structure. The non-planarity of these methyl-PAHs can be characterized by the dihedral angle of distortion between the aromatic rings.

000,257

PB91-118059 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Atom Probe Field-Ion Microscopy Applications.
Final rept.

P. P. Camus. 1990, 12p
Pub. in *High Temperature Science* 26, p131-142 1990.

Keywords: Chemical analysis, Mass spectrometry, Reprints, *Field ion microscopy, *Ion microscopy, *Atom probes, Time-of-flight mass spectrometers, Uses.

Field-ion microscopy is a real-space atomic resolution microscopy that has the unique ability of serial sectioning a specimen in a controlled manner. Thus, the true three-dimensional structure of defects and particles may be obtained. Atom probe analysis is a powerful chemical analysis technique that possesses both high spatial (<2nm) and depth (0.2 nm) resolutions. Light elemental analyses are routine because there is no mass limitation for this mass spectrometric technique. The paper first presents a general description of the physics of these techniques, followed by a selected review of applications.

000,258

PB91-118117 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Certification of Bilirubin SRM 916a.
Final rept.

A. Cohen, E. White, V. B. Coxon, R. G. Christensen, M. J. Welch, R. C. Paule, and D. A. Becker. 1990, 4p
Pub. in *Fresenius Jnl. Analytische Chemie* 338, n4 426-429 1990.

Keywords: *Chemical analysis, *Bile pigments, Blood analysis, Impurities, Blood serum, Sample preparation, Stereochemistry, Molecular isomerism, Reprints, *Standard reference materials, Bilirubin, High performance liquid chromatography, Thin layer chromatography.

The process used to certify Standard Reference Material (SRM) 916a Bilirubin is described. The certification involved the use of various analytical techniques to detect or quantitate impurities, as well as to characterize the SRM itself. Bilirubin (BR) is believed to exist, in human serum, as the IX alpha isomer. Samples pre-

pared commercially, including this SRM, also contain the III alpha and XIII alpha isomers which are believed to be formed during purification. For the SRM, the three isomers were measured by HPLC and TLC. 1H NMR was used to detect and quantitate chloroform in the BR. Biliverdine and mesobilirubin were not detected. Impurities insoluble in chloroform, the residue from the ashing of BR, and volatiles were measured, in addition to non-acidic impurities and impurities more acidic than BR. The absorptivity of BR in chloroform was measured. A pink fluorescent impurity was detected and measured by TLC. From these analyses, a best estimate of the total amount of impurities was determined, and the BR was issued as SRM 916a with a certified purity of 98.3 + or - 0.3%.

000,259

PB91-118125 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Thermal Analysis of Ba₂YCu₃O (sub 7-x) at 700-1000C in Air.
Final rept.

L. P. Cook, J. Blendell, C. K. Chiang, and W. Wongng. 1987, 6p
Pub. in *Advanced Ceramic Materials* 2, n3B p656-661 1987.

Keywords: *Differential thermal analysis, *Inorganic polymers, Platinum, Chemical reactions, Reprints, *Barium yttrium cuprates.

Thermal analysis of Ba₂YCu₃O_x using conventional platinum cells yields a series of well-defined reversible thermal events between 850 and 1000 C. These are interpreted as being due to the products of platinum reaction. A potential solution to this problem is the use of MgO cells.

000,260

PB91-134304 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Nuclear Analytical Methods in Standards Certification.
Final rept.

R. M. Lindstrom. 1987, 7p
Pub. in *Proceedings of Advisory Group Meeting on Comparison of Nuclear Analytical Methods with Competitive Methods*, Oak Ridge, TN., October 3-7, 1986, p187-193 1987.

Keywords: *Standards, *Quantitative chemical analysis, *Neutron activation analysis, Trace elements, Reprints.

Nuclear methods of chemical analysis have played a prominent role in the accurate determination of the composition of Standard Reference Materials and other standards. The characteristic sensitivity, multielement capability, and freedom from chemical biases unique to nuclear methods assure them a continuing role in the standards laboratory.

000,261

PB91-134367 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Determination of Tributyltin in Estuarine Water Using Bonded C-18 Silica Solid Phase Extraction, Hydride Derivatization and GC-FPD.
Final rept.

C. L. Matthias, J. M. Bellema, and F. E. Brinckman. 1987, 4p
Pub. in *Proceedings of Organotin Symposium (2nd) Oceans '87*, Halifax, Nova Scotia, Canada, September 28-October 1, 1987, p1344-1347.

Keywords: *Gas chromatography, Flame photometry, Chemical reactions, Estuaries, Trace amounts, Simulation, Reprints, *Organotin compounds.

An analytical method for the determination of butyltin compounds in simulated estuarine water using bonded octadecyl silica as a solid phase adsorbent, followed by hydride derivatization and gas chromatography coupled with a tin selective flame photometric detection is described. The method is amenable to automation and has detection limits of about 5 ng/L for each of the four butyltin species. Relative standard deviations for eight replicate analyses of samples spiked a 100 ng/L range from 4-20% depending on the butyltin species.

000,262

PB91-134395 Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Determination of Dibutyltin and Tributyltin in Sediment and Microbial Biofilms Using Acidified Methanol Extraction, Sodium-Borohydride Derivatization and Gas Chromatography with Flame Photometric Detection.
Final rept.

C. L. Matthias, G. J. Olson, J. M. Bellema, and F. E. Brinckman. 1989, 8p
Pub. in *International Jnl. of Environmental Analytical Chemistry* 35, n2 p61-68 1989.

Keywords: *Gas chromatography, Sediments, Chesapeake Bay, Flame photometry, Chemical reactions, Reprints, *Organotin compounds, Microbial biofilms.

A method for the relatively rapid determination of di- and tributyltin species in sediment and microbial biofilms is presented. Di- and tributyltin species were detected in Chesapeake Bay sediments using this method. Microbial biofilms grown on glass slides exhibited substantial accumulation of tributyltin species from solution. This method should have useful application to sediment analysis of di- and tributyltin species and for studies on the accumulation and fate of tributyltin in microbial biofilms.

000,263

PB91-134833 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Gas Isotope Dilution Mass Spectrometry: Use of Multiple Fractional Abundance Ratios.
Final rept.

R. M. Verkouteren, and W. D. Dorko. 1990, 2p
Sponsored by Department of Energy, Washington, DC. Carbon Dioxide Research Div.
Pub. in *Proceedings of ASMS Conference on Mass Spectrometry and Allied Topics (38th)*, Tucson, AZ., June 3-8, 1990, p71-72.

Keywords: *Carbon dioxide, *Mass spectrometry, Isotope effect, Reprints, *Isotope dilution, Fractional abundance ratios.

Isotope dilution mass spectrometry (IDMS) can provide concentration and isotopic information of high quality for analytes in a variety of matrices. However, the IDMS technique has been underutilized for gaseous analytes, and many effects on analytical precision and accuracy are not well understood. The authors have recently developed manometry-based gas IDMS for the analysis of CO₂-in-air. Here, the authors report results from that study to understand the practical isotopic effects that occur when blending isotopically different pools of a molecular analyte, and the use of multiple fractional abundance ratios as a way to monitor these isotopic effects.

Basic & Synthetic Chemistry

000,264

AD-A181 189/2 PC A02/MF A01
Air Force Geophysics Lab., Hanscom AFB, MA.
Ion Chemistry of Cyanides and Isocyanides. 1. The Carbon Lone Pair as Proton Acceptor: Proton Affinities of Isocyanides, Alkyl Cation Affinities of N, O, and C Lone-Pair Donors.
M. M. Mautner, Z. Karpas, and C. A. Deakyne. 1986, 8p
Rept no. AFGL-TR-87-0170
Pub. in *Jnl. of the American Chemical Society*, v108 n4 p3913-3919 1986.

Keywords: *Alkyl radicals, *Cyanides, Carbon, Chemistry, Electron acceptors, Hydrogen, Ions, Protons, Sources, Stability, *Isocyanides.

The present paper consists of three parts. The first part presents the experimental results and a qualitative discussion of some aspects of the results and a qualitative discussion of some aspects of the results. The second part deals with alkyl ion affinities. For this purpose we note that protonated isocyanides may be considered alkylated hydrogen cyanides, i.e., HCN-R(+). We, therefore, use the present data to derive the alkyl cation affinities of HCN, i.e., the bond-dissociation energies D (R-NCH(+)). These results are compared with the alkyl cation affinities of other lone-pair donors, specifically, H₂O, NH₃, and HNC. The point of interest here is whether the alkyl cation affinities correlate with

stabilities of the ions as measured by the hydride affinities of R+. The last part presents a theoretical examination of the trends observed in the experimental data. Specifically, we look into the following questions: (1) Why is the proton affinity of RNC higher than that of the corresponding RCN isomer and why are these differences independent of R. (2) What bond length changes occur in RNC upon protonation and what are the origins of these changes. (3) What is the source of the alkyl substituent effect on the observed proton affinities. Keywords: Protons; Affinities; Cyanides; Iso-cyanides; Alkyl compounds; Effects.

000,265

PB90-136367

Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div. Interaction of Cytidine 3'-Monophosphate and Uridine 3'-Monophosphate with Ribonuclease α at the Denaturation Temperature.

Final rept.

F. P. Schwarz. 1988, 8p

Pub. in *Biochemistry* 27, n22 p84 29-8436, 1 Nov 88.

Keywords: *Ribonuclease, Temperature, pH, Nucleic acid denaturation, Reprints, *Differential scanning calorimetry, *Cytidine monophosphate, *Uridine monophosphate, Enthalpy.

Differential scanning calorimetry (DSC) measurements were performed on the thermal denaturation of ribonuclease α and ribonuclease α complexed with an inhibitor, cytidine or uridine 3'-monophosphate, in sodium acetate buffered solutions. Thermal denaturation of the complex results in dissociation of the complex into denatured ribonuclease α and free inhibitor. Binding constants of the inhibitor to ribonuclease α were determined from the increase in the denaturation temperature of ribonuclease α in the complexed form and from the denaturation enthalpy of the complex. Binding enthalpies of the inhibitor to ribonuclease α were determined from the increase in the denaturation enthalpy of ribonuclease α complexed with the inhibitor. For the cytidine inhibitor in 0.2 M sodium acetate buffered solutions, the binding constants increase from 87 + or - 8 M(-1) (pH 7.0) to 1410 + or - 54 M(-1) (pH 5.0), while the binding enthalpies increase from 17 + or - 13 kJ/mol(-1) (pH 4.7) to 79 + or - 15 kJ/mol(-1) (pH 5.0). For the uridine inhibitor in 0.2 M sodium acetate buffered solutions, the binding constants increase from 104 + or - 1 M(-1) (pH 7.0) to 402 + or - 7M(-1) (pH 5.5), while the binding enthalpies increase from 16 + or - 5 kJ/mol(-1) (pH 6.0) to 37 + or - 4 kJ/mol(-1) (pH 5.0). The binding constants and enthalpies of the cytidine inhibitor in 0.05 M sodium acetate buffered solutions increase respectively from 328 + or - 37/M(-1) (pH 6.5) to 2200 + or - 364 M(-1) (pH 5.5) and from 22 kJ/mol(-1) (pH 5.5) to 45 + or - 7kJ/mol(-1) (pH 6.5).

000,266

PB90-149295

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Gas Phase Reactions of Phenyl Radicals with Aromatic Molecules.

Final rept.

A. Fahr, and S. E. Stein. 1988, 5p

Pub. in *Jnl. of Physical Chemistry* 92, n17 p4951-4955 1988.

Keywords: *Benzenes, *Aromatic polycyclic hydrocarbons, *Gases, *Reaction kinetics, Chemical analysis, Toluene, Phenols, Cycloalkane hydrocarbons, Reprints, *Phenyl radicals.

Relative rates of reactions of phenyl radicals with a series of aromatic and polycyclic aromatic compounds are reported. Most studies were done in static reactors at 450 C using diphenyldiketone (benzil) as the phenyl radical source. Reactions with the following molecules are reported: benzene, toluene, p-xylene, 1,3,5-trimethylbenzene, phenol, bromobenzene, naphthalene, biphenyl, anthracene, 9-methylanthracene and triphenylene. For reactions with substituted benzenes, H-abstraction is the dominant reaction. Relative rates of phenylation at different sites do not closely follow established trends for rates of radical attack. It is proposed that these deviations are primarily due to a dependence of the degree of reversibility on the phenylation site.

000,267

PB90-149311

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

New Applications of Tetracyanoethylene in Organometallic Chemistry.

Final rept.

A. J. Fatiadi. 1987, 20p

Pub. in *Synthesis* 11, p959-978 1987.

Keywords: *Organometallic compounds, *Chemical reactions, Chelation, Platinum, Transition metals, Chemical bonds, Ligands, Molecular structure, Reprints, *Tetracyanoethylene, *Synthesis(Chemistry), Metallocenes, Tetracyanoethylene, Alkene compounds, Alkyne compounds.

Recent applications of tetracyanoethylene (TCNE) in organometallic chemistry are reviewed, the survey is mainly concerned with selected reactions of tetracyanoethylene which have use or potential use in organometallic synthesis. Among other topics, it includes discussion on structure and bonding of metal-tetracyanoethylene complexes, reactions of main-group organometallics with TCNE, reactions of metallocenes with TCNE, and reactions of transition-metal complexes with TCNE; also reactions of metal-coordinated alkenes and alkynes with TCNE, and reactions of platinum-family complexes with TCNE.

000,268

PB90-149469

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Tracking Chemical Transformations of Particles in the Raman Microprobe.

Final rept.

E. S. Etz. 1987, 5p

Pub. in *Microbeam Analysis*, p158-162 1987.

Keywords: *Raman spectra, *Electron probes, *Aerosols, Particle interactions, Chemical reactions, Reaction kinetics, Carbon dioxide, Ammonia, Water, Air pollution, Sulfates, Uranium oxides, Oxidation, Lithium oxides, Lithium hydroxide, Reprints.

Chemical transformations of microparticles are conveniently studied in the Raman microprobe. The analysis can be performed under ambient conditions, without the constraints of an evacuated sample chamber, permitting the analyst to study compositional changes undergone by reactive particles. Furthermore, Raman microspectroscopy provides for molecular speciation, thus discerning compositional transformations that would ordinarily not be detected by any of the elemental microprobe techniques. The attributes have allowed the study of various types of particle systems which undergo rapid, moderately fast, and slow, long-term chemical modifications when in contact with the reactive components of ambient air. Discussed are examples from various areas of NBS research related to the study of sulfate aerosols with relevance to atmospheric reactions, characterization of microparticle transformations in the lithium oxide/hydroxide system, and investigation of the long-term stability of uranium oxide reference materials. The chemical transformations in the particle systems are governed by the reactivities to concentrations of H₂O, CO₂ and NH₃ in ambient air.

000,269

PB90-152638

Not available NTIS National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Reactions between Silicon and Nitrogen. Part 2. Microstructure.

Final rept.

H. M. Jennings, B. J. Dalgleish, and P. L. Pratt. 1988, 11p

Pub. in *Jnl. of Materials Science* 23, n7 p2573-2583 1988.

Keywords: *Chemical reactions, *Silicon, *Nitrogen, *Silicon nitrides, *Microstructure, Impurities, Gas flow, Single crystals, Surface chemistry, Reprints, Temperature dependence.

The silicon nitride that forms as a result of reaction between solid silicon and nitrogen has several morphologies and occurs in the two phases, alpha and beta. Reasons are proposed to account for certain reaction conditions to particular microstructural features of the product. The reaction conditions considered were temperature, addition of other gases to the nitrogen, and whether or not the gas is flowing over the reacting surface. Both the morphology and the phase composition of each microconstituent in the product were examined. The observations were made using high purity single crystal silicon slices and purified nitrogen at temperatures below the melting point of silicon.

000,270

PB90-152737

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rate Constants for One-Electron Oxidation by the CF(sub 3)O(sub 2)-, CCl(sub 3)O(sub 2)-, and CBr(sub 3)O(sub 2)- Radicals in Aqueous Solutions.

Final rept.

R. E. Huie, D. Brault, and P. Neta. 1987, 9p

Pub. in *Chemico-Biological Interactions* 62, n3 p227-235 1987.

Keywords: *Oxidation tests, *Radiolysis, *Free radicals, *Peroxy organic compounds, Spectrophotometry, Kinetics, Alcohols, Substrates, Toxicity, Chemical analysis, Solutions, Water, Reprints, Cytochrome P-450, Porphyrin.

The peroxy radicals CF₃O₂, CCl₃O₂, and CBr₃O₂ were produced by radiolysis of aerated aqueous-alcohol solutions of CF₃Br, CCl₃Cl, CCl₄, or CBr₄. Kinetic spectrophotometric presence of various substrates: urate, ascorbate, xanthine, hydroquinone, p-methoxyphenol, phenol, and chlorpromazine. Absolute rate constants for one-electron oxidation of these substrates by the alkylperoxy radicals were found to vary from 10(sup 5) to 10(sup 9)/M/s, depending to some extent on the order of reactivity of CF₃O₂, which may have deleterious effects on biological systems. Its likely environmental precursor, CF₂Br, which is used as a fire extinguisher and a refrigerant, was found to be reduced by a ferrous porphyrin model for cytochrome P450, only very slowly and thus is not expected to have major toxic effect if inhaled.

000,271

PB90-169715

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Formation and Decay of Zinc Tetrakis(N-methyl-4-pyridinio)porphyrin pi-Radical Cation in Aqueous Solutions Containing Azide Ions and Polyelectrolyte.

Final rept.

G. S. Nahor. 1988, 8p

Sponsored by Department of Energy, Washington, DC. Pub. in *Jnl. of Physical Chemistry* 92, p4359-4366 1988.

Keywords: *Reaction kinetics, *Porphyrins, *Zinc organic compounds, Cations, Free radicals, Solutions, Electrolytes, Inorganic azides, Radiolysis, Reprints, Porphyrin/zinc tetrakis(N-methyl-4-pyridinio), Osmolar concentration.

The formation and decay of the pi-radical cation of zinc tetrakis(N-methyl-4-pyridinio)porphyrin (ZnTMPyP4+) were studied by using the pulse radiolysis technique. The radical cation (ZnTMPyP5+) was produced in N₂O-saturated, aqueous solutions containing azide ions. Its formation and decay kinetics were monitored by following its absorbance at 700 nm. The formation kinetics and the initial absorbance were found to depend on both ZnTMPyP4+ and azide concentrations. The decay kinetics were second order with respect to (ZnTMPyP5+) and depended on (N₃ minus), (ZnTMPyP4+), and the ionic strength. The results are explained by multicomplexation of ZnTMPyP5+ with azide and by a decay via an equilibrium process involving the ZnTMPyP5+/N₃ minus complexes, ZnTMPyP4+, and the dication ZnTMPyP6+. When a negatively charged polyelectrolyte, poly(styrenesulfonate) (PSS), was added, a decrease in the rate of the ZnTMPyP5+ formation was observed as well as a decrease in the initial absorbance. These results are related to the binding of the porphyrin to the oppositely charged polyelectrolyte. A slight increase in the decay rate was also observed, which was interpreted by dynamics of the binding process, or aggregation. Optimal conditions are suggested for utilization of ZnTMPyP4+ in the photooxidation of water.

000,272

PB90-188244

Not available NTIS National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Modular Magnetically Coupled High Speed Stirrer for Hermetically Sealed Chemical Reactors.

Final rept.

J. J. Ritter. 1988, 3p

Pub. in *Review of Scientific Instruments* 59, n2 p374-376 1988.

CHEMISTRY

Basic & Synthetic Chemistry

Keywords: *Stirrers, *Hermetic seals, *Chemical reactors, Magnetic modulators, Modules, Contamination, Vacuum seals, Reprints.

A research scale, magnetically coupled, hermetically sealed stirrer module is described. The unit is capable of providing efficient, high shear stirring within chemical reactors with the rigorous exclusion of atmospheric contaminants.

000,273

PB90-192683

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD, Reactor Radiation Div.

Synthesis, Characterization and Inelastic Neutron Scattering Spectra of Hydrogen Insertion Compounds of the Mixed V/Mo Oxide V(sub 9)Mo(sub 6)O(sub 40).

Final rept.

R. C. T. Slade, A. Ramanal, J. M. Nicol, and C.

Ritter, 1988, 5p

Pub. in Materials Research Bulletin 23, n5 p647-651 1988.

Keywords: Neutron scattering, Vibrational spectra, Hydrogen, Reaction kinetics, Vanadium oxides, Molybdenum oxides, Inelastic scattering, Reprints, *Vanadium molybdates, Synthesis(Chemistry), Characterization, Insertion compounds.

Hydrogen insertion compounds of V9Mo6O40 have been synthesized and investigated using incoherent inelastic neutron scattering (IINS) vibrational spectroscopy. IINS spectra of H(x)V9Mo6O40 (x = 7.8 and 17.5) confirm that in both phases H is present in coordinated hydroxyl groups. There is no evidence for the presence of coordinated water in contrast to the hydrogen insertion compounds of MoO3 and V2O5.

000,274

PB90-193475

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.

Flash Photolysis Resonance Fluorescence Investigation of the Gas Phase Reactions of Hydroxyl Radicals with a Series of Aliphatic Ketones Over the Temperature Range 240-440 K.

Final rept.

T. J. Wallington, and M. J. Kurylo, 1987, 5p

Pub. in Jnl. of Physical Chemistry 91, n19 p5050-5054 1987.

Keywords: *Fluorescence, *Ketones, *Aliphatic hydrocarbons, *Photolysis, Temperature, Reprints, *Gas phase.

Absolute rate constants have been determined for the gas phase reactions of OH radicals with a series of aliphatic ketones using the flash photolysis resonance fluorescence measurement technique. Experiments were performed over the temperature range 240 - 440K at total pressures (using Ar diluent gas) between 25-50 torr. The rate constant data for acetone (k1), 2-butanone (k2), and 3-pentanone (k3) were used to derive the Arrhenius expressions: $k_1 = (1.7 \text{ plus or minus } 0.4) \times 10^{10} (\text{sup } -12) \text{ exp } (-600 \text{ plus or minus } 75) / \text{T} / \text{cubic cm/molecule/s}$; $k_2 = (2.3 \text{ plus or minus } 1.1) \times 10^{10} (\text{sup } -12) \text{ exp } (-170 \text{ plus or minus } 120) / \text{T} / \text{cubic cm/molecule/s}$; and $k_3 = (2.8 \text{ plus or minus } 0.3) \times 10^{10} (\text{sup } -12) \text{ exp } (10 \text{ plus or minus } 35) / \text{T} / \text{cubic cm/molecule/s}$. These results are discussed in terms of reactivity trends for C-H bonds located in the alpha, beta, and gamma positions with respect to the carbonyl group.

000,275

PB90-193483

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.

Kinetics of the Gas Phase Reaction of Hydroxyl Radicals with Ethane, Benzene, and a Series of Halogenated Benzenes Over the Temperature Range 234-438 K.

Final rept.

T. J. Wallington, M. J. Kurylo, and D. M. Neuman,

1987, 15p

Pub. in International Jnl. of Chemical Kinetics 19, n8 p725-739 1987.

Keywords: *Reaction kinetics, *Benzene, *Ethane, Temperature, Reprints, *Gas phase, *Halogenated aromatic hydrocarbons, *Hydroxyl radical.

Absolute rate constants for the gas phase reactions of OH radicals with ethane, benzene, fluorobenzene, chlorobenzene, bromobenzene, iodobenzene, and

hexafluorobenzene have been measured over the temperature range 234-438K using the flash photolysis resonance fluorescence technique. At elevated temperatures and under pseudo-first-order reaction conditions, non-exponential hydroxyl radical decays were observed for benzene and the monosubstituted halo-aromatics. For ethane and hexafluorobenzene, exponential decays were observed over the complete temperature range and the data were fit by the Arrhenius expressions: $k_1 = (8.4 \text{ plus or minus } 3.1) \times 10^{10} (\text{sup } 12) \text{ exp } (-1050 \text{ plus or minus } 100) / \text{T}$ and $k_7 = (1.3 \text{ plus or minus } 0.3) \times 10^{10} (\text{sup } -12) \text{ exp } (-610 \text{ plus or minus } 80) / \text{T}$ respectively. The results are compared with previous literature data and the mechanistic implications are discussed.

000,276

PB90-193491

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.

Gas Phase Reactions of Hydroxyl Radicals with a Series of Aliphatic Ethers Over the Temperature Range 240-440 K.

Final rept.

T. J. Wallington, R. Liu, P. Dagaut, and M. J. Kurylo,

1988, 9p

Pub. in International Jnl. of Chemical Kinetics 20, n1 p41-49 1988.

Keywords: *Chemical reactions, *Ethers, *Aliphatic hydrocarbons, Temperature, Pressure, Fluorescence, Reprints, *Gas phase.

Absolute rate constants have been determined for the gas phase reactions of OH radicals with a series of aliphatic ethers using the flash photolysis resonance fluorescence technique. Experiments were performed over the temperature range 240 - 440K at total pressures (using Ar diluent gas) between 25-50 torr. The kinetic data for dimethylether (k1), diethylether (k2), and dipropylether (k3) were used to derive the Arrhenius expressions: $k_1 = (6.7 \text{ plus or minus } 1.5) \times 10^{10} (\text{sup } -12) \text{ exp } (-300 \text{ plus or minus } 70) / \text{T} / \text{cubic cm/molecule/s}$; $k_2 = (5.6 \text{ plus or minus } 1.7) \times 10^{10} (\text{sup } -12) \text{ exp } ((270 \text{ plus or minus } 100) / \text{T}) / \text{cubic cm/molecule/s}$; and $k_3 = (11 \text{ plus or minus } 3) \times 10^{10} (\text{sup } -12) \text{ exp } ((150 \text{ plus or minus } 80) / \text{T}) / \text{cubic cm/molecule/s}$. At 296K, the measured rate constants (in units of $10^{10} (\text{sup } -13) / \text{cubic centimeter/molecule/s}$) were: $k_1 = (24.9 \text{ plus or minus } 2.2)$, $k_2 = (136 \text{ plus or minus } 9)$, and $k_3 = (180 \text{ plus or minus } 22)$. Room temperature rate constants for the OH reactions with several other aliphatic ethers were also measured. These were (in the above units): di-n-butylether, (278 plus or minus 36); di-n-pentylether, (347 plus or minus 20); ethyleneoxide, (0.95 plus or minus 0.05); propyleneoxide, (4.95 plus or minus 0.52); and tetrahydrofuran, (178 plus or minus 16).

000,277

PB90-205949

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Spatial Distribution of a-Si:H Film-Producing Radicals in Silane rf Glow Discharges.

Final rept.

D. A. Doughty, and A. Gallagher, 1990, 7p

Pub. in Jnl. of Applied Physics 67, n1 p139-145, 1 Jan 90.

Keywords: *Chemical radicals, *Glow discharges, *Silane, Glass fibers, Films, Substrates, Reprints, *Amorphous silicon, Silyl radicals.

Film growth on glass fibers (40 micrometers diameter) is used to probe the distribution of SiH4 decomposition products that produce alpha-Si:H films in silane rf glow discharges. The film thickness on fibers spanning the electrodes is measured versus position to map the spatial variation of the film-precursor (radical) density. The optical emission from the discharge, which is shown to be essentially equivalent to the distributed source of SiH4 decomposition products, is compared to the density maps. The comparison shows that the SiH3 radical dominates deposition, that the SiH3 is produced in the optically bright regions of the discharge, and that H atoms react rapidly with SiH4 before diffusing significant distances in the discharge. The perturbative nature of the probes on the discharge environment is also addressed.

000,278

PB90-260951

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD, Chemical Process Metrology Div.

Preparation of Well-Ordered, Oxygen-Rich SnO2(110) Surfaces via Oxygen Plasma Treatment.

Final rept.

R. E. Cavicchi, M. J. Tarlov, and S. Semancik, 1990,

7p

Pub. in Jnl. of Vacuum Science and Technology A 8,

n3 p2347-2352 May/ Jun 90.

Keywords: *Tin oxides, Surfaces, Stoichiometry, Oxidation, Energy gap, Vacancies(Crystal defects), Reprints, Low energy electron diffraction, Ion scattering, Photoemission, Oxygen plasma, Band theory.

The problems involved in preparing well-defined metal oxide surfaces are well known. The authors are investigating low power rf oxygen plasma treatment as a method for producing metal oxide surfaces of controlled stoichiometry and structure. The effects of exposing a 300 K oxygen deficient SnO2(110) - 4X1 surface to an oxygen plasma (0.1 Torr) have been examined using low-energy electron diffraction (LEED), x-ray photoemission spectroscopy (XPS), ultraviolet photoemission spectroscopy (UPS), ion scattering spectroscopy (ISS), and surface conductivity measurements. Results from the plasma-exposed surface have been compared to those obtained from a thermally oxidized (1 Torr O2, 700 K)SnO2(110) surface.

000,279

PB90-271297

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Surface Reaction Probability of Film-Producing Radicals in Silane Glow Discharges.

Final rept.

D. A. Doughty, J. R. Doyle, G. H. Lin, and A.

Gallagher, 1990, 9p

Contract DB-4-04078-1

Sponsored by Solar Energy Research Inst., Golden, CO.

Pub. in Jnl. of Applied Physics 67, n10 p6220-6228, 15 May 90.

Keywords: *Silane, Glow discharges, Chemical radicals, Reprints, *Amorphous silicon, *Silicon films, *Surface reactions.

A sensitive and straightforward technique is developed to measure the surface reaction probability beta for radicals that produce alpha-Si:H films in silane glow discharges. This technique is used to measure beta for both rf and dc discharges under a variety of conditions. Under conditions in which device-quality alpha-Si:H film is produced, $\beta = 0.37 \pm 0.04$. There is no discernible temperature dependence of beta between 20 and 250 C. This relatively large value of beta is inconsistent with previous ideas that a small beta was necessary to produce high-quality film. It is concluded that although beta is correlated with film quality it does not determine film quality. The authors propose that the ability of the film-producing radical to diffuse on the surface determines film quality.

000,280

PB91-112326

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Chemical Kinetics Div.

Chemistry of Dioxymethylenes and Dioxiranes.

Final rept.

S. A. Kafafi, R. I. Martinez, and J. T. Herron, 1988,

28p

Pub. in Mol. Struct. Energ., v6 p283-310 1988.

Keywords: *Heat of formation, *Epoxy compounds, Chemical reactions, Computation, Thermochemistry, Reprints, *Dioxymethylenes, Literature surveys.

The chemistry of the dioxiranes and dioxymethylenes are reviewed. On the basis of ab initio and thermochemical estimation methods, the enthalpies of formation of these species and the isomeric methylenebis(oxy)s are calculated. The reactions leading to the formation and unimolecular loss of these isomeric forms are discussed.

Industrial Chemistry & Chemical Process Engineering

000,281

PB90-217837

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Steady State Coupled Transport of Nitric Acid through a Hollow Fiber Supported Liquid Membrane.

Final rept.
R. D. Noble, and P. R. Danesi. 1987, 6p
Pub. in ACS (American Chemical Society) Symposium Series in Liquid Membrane 347, p56-61 1987.

Keywords: *Nitric acid, *Membranes, Separation, Water, Extraction, Mathematical models, Liquid phases, Reprints, *Supported liquid membranes, Aqueous solutions, Hollow fibers.

Nitric acid removal from an aqueous stream was accomplished by continuously passing the fluid through a hollow-fiber-supported liquid membrane (SLM). The nitric acid was extracted through the membrane wall by coupled transport. The system was modeled as a series of (SLM)-continuous stirred tank reactor (CSTR) pairs. An approximate technique was used to predict the steady state nitric acid concentration in the system. The comparison with experimental data was very good.

Photo & Radiation Chemistry

000,282
PB90-149089 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Photochemistry of Diacetylene.

Final rept.
S. Glicker, and H. Okabe. 1987, 4p
Pub. in Jnl. of Physical Chemistry 91, n2 p437-440 1987.

Keywords: *Photochemistry, Far ultraviolet radiation, Metastable state, Quantum efficiency, Reprints, *Diacetylene, Absorption coefficients, Satellite atmospheres, Titan.

The photochemistry of diacetylene has been studied at 147.0, 184.9, 228.8 and 253.7nm. The quantum yields of products and of reactant disappearance were measured in pure C₄H₂, C₄H₂ and N₂ mixtures, and C₄H₂ and D₂ mixtures. The primary photochemical process has been deduced from the photolysis of C₄H₂ and D₂ mixtures. Three dissociative processes are found important at 147.0 nm in addition to the excited state reactions; they are in order of decreasing importance, C₄H₂ + h(ν) -> C₄H + H, C₄H₂ + h(ν) -> C₂H₂ + C₂, and C₄H₂ + h(ν) -> 2C₂H + h(ν) -> 2C₂H. At longer wavelengths, reactions involving excited metastable states become predominant. The long wavelength photochemistry of diacetylene may play an important role in the formation of the stratospheric haze layer in Titan's atmosphere. Absorption coefficients of C₄H₂ have been measured in the 190 to 260 nm region.

000,283
PB90-153453 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Interfacial Electron Transfer Reactions between Platinum Colloids and Reducing Radicals in Aqueous Solution.

Final rept.
A. Harriman, G. R. Millward, P. Neta, M. C. Richoux, and J. M. Thomas. 1988, 5p
Pub. in Jnl. of Physical Chemistry 92, n5 p1286-1290 1988.

Keywords: *Reduction(Chemistry), *Oxidation, *Electron transfer, *Platinum, *Interfaces, *Colloids, *Free radicals, Voltammetry, Electrode potentials, Diffusion coefficient, Electrochemistry, Electron microscopy, Absorption spectra, Pyridines, Pulse analyzers, Reaction kinetics, Radiolysis, Reprints, *Aqueous solutions.

Cyclic voltammetry has been used to evaluate redox potentials, diffusion coefficients and heterogeneous electrochemical rate constants for reducing radicals derived from various N-methyl-bipyridinium ions, N-methylpyridinium ions, aryl ketones and p-nitrobenzoic acid in aqueous solution. The absorption spectra, rates of formation and stabilities of the radicals have been determined by pulse radiolytic techniques. All the above radicals transfer an electron to colloidal Pt particles (characterized by high resolution electron micros-

copy) and the bimolecular rate constants for such interfacial reactions have been measured under pulse radiolytic conditions. The magnitude of the rate constants is found to depend upon a number of factors related to both mass transfer and surface processes.

000,284
PB90-161282 Not available NTIS
North Carolina State Univ. at Raleigh. Dept. of Physics.
Photoemission Cross Sections for Atomic Transitions in the Extreme Ultraviolet Due to Electron Collisions with Atoms and Molecules.
P. J. M. van der Burgt, W. B. Westerveld, and J. S. Risley. c1989, 49p
Prepared in cooperation with American Chemical Society, Washington, DC., American Inst. of Physics, New York, and National Inst. of Standards and Technology, Gaithersburg, MD.
Included in Jnl. of Physical and Chemical Reference Data, v18 n4 p1757-1806 1989. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Ultraviolet spectra, *Atoms, *Photoelectric emission, Electron scattering, Ions, Cross sections, Atomic transitions.

Cross sections for photoemission in the extreme ultraviolet from excited atoms produced by electron collisions with atoms and small molecules are reviewed. Methods of normalization of cross sections determined from relative measurements are discussed. The data are presented in tabular and graphical form.

000,285
PB90-169269 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Measurements of the Ultraviolet Absorption Cross-Sections for HO(sub 2) and CH(sub 3)O(sub 2) in the Gas Phase.

Final rept.
M. J. Kurylo, P. A. Ouellette, and T. J. Wallington. 1987, 15p
Pub. in Jnl. of Photochemistry 39, n2 p201-215 1987.

Keywords: *Photochemical reactions, *Ultraviolet radiation, *Absorption cross sections, *Vapor phase, *Free radicals, *Hydrogen peroxide, *Gases, Wavelengths, Optical density, Photolysis, Methylation, Reprints, *Hydroperoxy radicals, *Methylperoxy radicals.

Relative values of the gas phase absorption cross-sections for hydroperoxy (HO₂) and methylperoxy (CH₃O₂) radicals were determined at 298 K over the wavelength ranges 210 - 250 nm and 210 - 280 nm respectively. The determinations were based on measurements of the initial optical density of each radical versus wavelength immediately following its flash photolytic generation.

000,286
PB90-169673 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Effect of X-rays on the Polycarbonate Substrate of X-ray Calibration Standards.

Final rept.
G. A. Sleater, J. M. Crissman, J. C. Humphreys, and P. A. Pella. 1987, 3p
Pub. in Analytical Chemistry 59, n6 p826-828 1987.

Keywords: *X rays, *Polycarbonate resins, Tensile properties, Reprints, *Reference standards.

The effect of x-rays on the polycarbonate film substrate of x-ray calibration standards is described. Tensile measurements of polycarbonate specimens indicate that deterioration of the polycarbonate is proportional to the x-ray energy to which the film is exposed.

000,287
PB90-170424 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Cluster Ion Formation under Laser Bombardment - Studies of Recombination Using Isotope Labeling.

Final rept.
I. H. Musselman, R. W. Linton, and D. S. Simons. 1988, 5p
Pub. in Analytical Chemistry 60, n2 p110-114 1988.

Keywords: *Photochemical reactions, *Recombination reactions, *Ionization, *Laser beams, *Irradiation, *Isotope labelling, Mass spectroscopy, Pulsation, Thin

films, Plasmas(Physics), Reprints, *Nickel sulfides, *Sulfur 34, Electron microprobe analysis.

The analysis of natural abundance NiS particles mounted on an isotopically enriched (34)S film using a transmission geometry laser microprobe mass spectrometer provides a means for observing recombination reactions in the laser-induced plasma. It is apparent that (34)S from the isotopically enriched thin film is extensively combining in the plasma with nickel from the NiS particle. In addition, the data suggest that the recombination phenomenon occurs to a similar extent for the three cluster ions NiS(+), NiS₂(+), and Ni₂S(+). One exception for the NiS₂(+) case is the (58)Ni(34)S(34)S(+) ion which has a much larger contribution to recombination by the (34)S film. It probably reflects Ni attachment to (34)S(34)S dimers which are formed almost exclusively by contributions from the (34)S film.

000,288
PB90-187659 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Plasma Chemistry in Silane and Silane-Germane Discharge Deposition.

Final rept.
A. Gallagher, J. Doyle, and D. Doughty. 1989, 9p
Sponsored by Solar Energy Research Inst., Golden, CO.

Pub. in Materials Research Society Symposia Proceedings 149, p23-31 1989.

Keywords: *Plasma spraying, *Deposits, *Coating processes, *Plasma jets, *Germanium hydrides, *Silanes, *Silane, Free radicals, Thin films, Reprints, *Plasma chemistry.

The spatial and energetic characteristics of rf and dc parallel-plate deposition discharges are discussed, along with the implications to plasma chemistry. The results and interpretation of recent measurements of silane, disilane, germane, and mixed-gas stoichiometry are discussed. The results yield the initial dissociation branching between even and odd dangling-bond radicals, as well as the relative roles of higher silanes and silyl germanes (produced by the discharge) in the chemistry. The deposition model and supporting data are discussed as are various causes of film-quality variations.

000,289
PB90-218207 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Free Radical Chemistry of Aqueous-Phase SO(sub 2).

Final rept.
R. E. Huie. 1987, 6p
Pub. in Acid Rain, p29-34 1987.

Keywords: *Sulfur dioxide, *Air pollution, Free radicals, Photochemical reactions, Oxidation, Reprints, *Acid rain, Aqueous solutions.

A major mode of oxidation of SO₂ in atmospheric droplets involves a free radical chain. The free radical chain contributes both to the acidification of precipitation and to other possible chemical effects of atmospheric SO₂. The article reviews present understanding of the aqueous-phase radical chemistry of SO₂ and discusses some of the important reactions in that complex chain.

000,290
PB90-241316 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Reactions of Iron Porphyrins with CF₃, CF₃O₂, and CBr₃O₂ Radicals.

Final rept.
D. Braut, and P. Neta. 1987, 5p
Pub. in Jnl. of Physical Chemistry 91, n15 p4156-4160 1987.

Keywords: *Porphyrins, Metal containing organic compounds, Spectrophotometry, Iron organic compounds, Reaction kinetics, Free radicals, Alcohols, Radiolysis, Haloalkanes, Linolenic acid, Reprints, Iron ions, Peroxy radicals, Pulsed irradiation, Carbenes.

The reactions of ferric and ferrous deuteriochlorophyllin (PFe(+3), PFe(+2)) with alkyl and peroxy radicals derived from CF₃Br and CBr₄ were studied by kinetic spectrophotometric pulse radiolysis in aqueous solu-

hol solutions. The fenous compound reacts with CF3 radical at nearly diffusion controlled rate ($k=2 \times 10(\text{sup } 9)/\text{M/s}$) to form a metal-carbon bonded complex. The $\text{PFe}(\text{+}3)\text{CF}_3$ adduct subsequently reacts with another $\text{PFe}(\text{+}2)$ ($k=5 \times 10(\text{sup } 6)/\text{M/s}$) presumably to form the carbene intermediate $\text{PFe}(\text{+}2)\text{CF}_2$ which further hydrolyzes. The final products are $\text{PFe}(\text{+}3)$ and $\text{PFe}(\text{+}2)\text{CO}$. CF_3 radicals react also with $\text{PFe}(\text{+}3)$ ($k=4.5 \times 10(\text{sup } 8)/\text{M/s}$) to yield an oxidized product. The initial product undergoes a slow reaction ($k=2.8 \times 10(\text{sup } 3)/\text{s}$) ascribed to ligand exchange. CF_3 radicals do not react with $\text{PFe}(\text{+}3)$ on the pulse radiolysis time scale ($k < 10(\text{sup } 6)/\text{M/s}$). The peroxy radicals CF_3O_2 and CBr_3O_2 oxidize $\text{PFe}(\text{+}3)$ with reaction rate constants of 3.9×10 (sup 8) and 2.8×10 (sup 8)/M/s, respectively. The rate constant for the reaction of linolenic acid with CF_3O_2 radicals and CBr_3O_2 radicals are 6.9×10 (sup 6) and 1.2×10 (sup 6)/M/s, respectively.

000,291

PB90-271172

Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div. Effects of Boron Implantation on Silicon Dioxide Passivated HgCdTe.

Final rept.

R. C. Bowman, J. Marks, R. G. Downing, J. F. Knudsen, and G. A. To. 1987, 8p
Pub. in Materials Research Society Symposium Proceedings, v90 p279-286 1987.

Keywords: *Dielectric films, *Silicon dioxide, *Boron, Photodiodes, Ions, Refractivity, Infrared spectra, Crystal structure, Passivity, Densification, Reprints, Ion implantation.

The influence of boron ion implants on the optical and physical properties of Photochemically deposited SiO_2 films on $\text{Hg}_{0.7}\text{Cd}_{0.3}\text{Te}$ and silicon has been investigated. The distributions of the boron atoms between the SiO_2 film and substrate have been determined by a nondestructive neutron depth profiling method. The implants produce an apparent densification of SiO_2 films, which is accompanied by an increase in refractive index and changes in the infrared vibrational spectra for these films.

000,292

PB91-101048

Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

High-Dose Intercomparison Study Involving Red 4034 Perspex and FWT-60-00 Radiochromic Dye Films.

Final rept.

J. H. Barrett, K. M. Glover, W. L. McLaughlin, P. H. G. Sharpe, M. F. Watts, and B. Whittaker. 1990, 4p
Pub. in Radiation Physics and Chemistry 36, n3 p505-507 1990.

Keywords: Dosimetry, Reprints, *Radiochromic films, Interlaboratory comparisons, Gamma radiation.

The results of a dosimetry intercomparison exercise involving red 4034 Perspex and FWT-60-00 dye film, used in commercial radiation processing are reported. Spectrophotometric measurements, irradiations, and thickness measurements were compared by the participating laboratories. Good agreement was obtained for all the measurements undertaken.

000,293

PB91-118331

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Pulse Radiolysis and Flash Photolysis Study of the Radicals $\text{SO}_2(1-)$, $\text{SO}_3(1-)$, $\text{SO}_4(1-)$, and $\text{SO}_5(1-)$.

Final rept.

R. E. Huie, C. L. Clifton, and N. Altstein. 1989, 10p
Pub. in Radiation Physics and Chemistry 33, n4 p361-370 1989.

Keywords: *Chemical radicals, Photolysis, Radiolysis, Reprints, *Sulfur oxide radicals, Rate constants.

Pulse radiolysis and laser-flash photolysis have been used to generate the radicals $\text{SO}_2(1-)$, $\text{SO}_3(1-)$, $\text{SO}_4(1-)$, and $\text{SO}_5(1-)$. Optical adsorption spectra for these radicals and rate data on their self-reactions have been derived. The decay of SO_2 , SO_3 , and SO_4 follow simple second-order kinetics; the decay of SO_5 is slow and not second-order when the radical is generated by pulse radiolysis, but is second-order when generated by O_2 reacts rapidly with O_2 and a rate constant was derived. SO_3 also reacts rapidly with O_2 and

a rate constant was derived for this reaction. The rate constant for the reaction of H with SO_2 was determined.

000,294

PB91-118422

Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Radiation Chemistry of Quinonoid Compounds.

Final rept.

P. Neta. 1988, 20p
Sponsored by Department of Energy, Washington, DC. Pub. in Chemistry of Quinonoid Compounds, Chapter 14, v2 p879-898 1988.

Keywords: *Quinones, *Radiation chemistry, Reprints, Literature surveys, Redox potential.

Radiation chemical studies of quinones and quinonoid compounds (1970-1985) are reviewed.

Physical & Theoretical Chemistry

000,295

AD-A167 880/4

PC A02/MF A01

Air Force Geophysics Lab., Hanscom AFB, MA.

Multicomponent Cluster Ions. 1. The Proton Solvated by $\text{CH}_3\text{CN}/\text{H}_2\text{O}$.

C. A. Deakayne, M. Meot-Ner, C. L. Campbell, M. G. Hughes, and S. P. Murphy. 1 May 86, 13p AFGL-TR-86-0104

Pub. in Jnl. of Chemical Physics, v84 n9 p4958-4969, 1 May 86.

Keywords: *Acetonitrile, *Complex ions, *Protons, *Solvation, Stratosphere, *Water, Charge transfer, Chemical dissociation, Clustering, Electrons, Electrostatics, Energy, Hydrogen bonds, Interactions, Ions, Isomers, Molecules, Solvents, Molecular structure, Stabilization, Reprints.

Experimental and ab initio dissociation energies of the $(\text{H}_2\text{O})_n(\text{CH}_3\text{CN})_m\text{H}^+(\text{+})$ ions are reported. The experimental energies range from 10-35 K cal/mol. The portion is best stabilized by placing the maximum number of acetonitrile molecules close to the protonated center in such a way that the maximum number of acetonitrile molecules close to the protonated center in such a way that the formation of a network of strong hydrogen bonds is still possible. Other results from this work are: distinct solvent shells can be distinguished in these complex ions; mixtures of several isomeric structures are unlikely for $n < \text{or} = 4$; when a water of an acetonitrile molecule clusters with $(\text{H}_2\text{O})(\text{CH}_3\text{CN})\text{H}^+(\text{+})$, the proton is transferred from the acetonitrile to the water; although electrostatic interactions make the dominate contribution to the bonding in these systems, polarization and charge-transfer effects contribute also; there is a cooperativity effect among the hydrogen bonds that lead to extensive change in geometry and charge distribution also; there is a cooperativity effect among the hydrogen and the relative complexation energies along a series of reactions correlate with many properties of the electron donor and with several properties of the electron donor and with several properties of the proton donor.

000,296

AD-A168 102/2

PC A09/MF A01

National Bureau of Standards, Gaithersburg, MD. Polymers Div.

Exploration of Advanced Characterization Techniques for Molecular Composites.

Final rept. Feb 84-Jan 85.

D. L. VanderHart, F. W. Wang, R. K. Eby, B. M. Fanconi, and K. L. DeVries. Feb 86, 183p AFWAL-TR-85-4137

Contract MIPR-FY1457-84-N-5019

Keywords: *Flexible materials, Polymers, Mixtures, Rigidity, Acids, Annealing, Composite materials, Diffraction, Electron spin resonance, Fibers, Fluorescence, Free radicals, High pressure, High temperature, Measurement, Molecular weight, Patterns, Pressure, Reinforcing materials, Residuals, Rods, Test and evaluation, Water, X ray diffraction, Emission spectroscopy, Nuclear magnetic resonance, Azoles, Nylon, Azole/poly-benzobisthi, Azole/poly-benzemid.

The techniques of solid state nuclear magnetic resonance, fluorescence spectroscopy, electron spin reso-

nance, and x-ray diffraction were applied to characterize aspects of the solid state structures of rigid rod polymers and their blends with flexible polymers. NMR and fluorescence spectroscopies were used to investigate the degree to which the rigid rod - flexible polymers blends exist as phase separated systems. It was found that these materials form primarily phase segregated structures, a condition which limits the reinforcing potential of rigid rod polymers in molecular composites. Most specimens also reinforcing potential of rigid rod polymers in molecular composites. Most specimens also exhibited NMR signals indicative of mobile, and presumably lower molecular weight, species. It is postulated that these mobile species are either water or residual acid from which the materials are processed. Information regarding the location of the mobile species in the structures exhibited by rigid rod polymers and their blends with flexible polymers is deduced from NMR. Electron spin resonance measurements confirmed that free radicals are generated during mechanically stressing rigid rod polymer fibers. The as-processed fibers contained appreciable levels of free radicals and annealing at elevated temperatures caused a decrease in the free radical concentration by a factor of three. X-ray diffraction experiments were conducted at elevated pressure in a diamond anvill cell. The observed diffraction pattern is suggestive of the formation of a more ordered structure at elevated pressures. Keywords: PBT(Poly(Benzobisthiazole)); ABPBI (Poly(2,5(6) Benzimidazole)); Nylon 6.

000,297

AD-A177 536/0

PC A02/MF A01

Colorado Univ. at Boulder.

Energy Transfer Processes of Aligned Excited States of Ca Atoms.

D. Neuschaefer, M. O. Hale, I. V. Hertel, and S. R.

Leone. 1986, 9p AFOSR-TR-87-0244

Contract F49620-83-C-0013

Pub. in Electronic and Atomic Collisions, p585-591 1986.

Keywords: *Calcium, Atoms, Collisions, Cross beam devices, Detection, Energy transfer, Fluorescence, Gates(Circuits), Helium, Krypton, Lasers, Molecular beams, Neon, Polarization, Pulsed lasers, Rare gases, Time, Ultraviolet lasers, Xenon, Molecular orbitals, Reprints, *Atomic energy levels, *Excitation, Energy transfer.

Effects of orbital alignment on the near resonant energy transfer process from Calcium ($4s5p1P_1$) to Calcium ($4s5p3P_J$) induced by collisions with rare gases are studied in a crossed molecular beam. A linearly polarized, pulsed ultraviolet laser is used to introduce the initial orbital alignment, and the relative energy transfer cross sections as a function of alignment are monitored by time-gated fluorescence detection. Differential results are observed with several rare gases; a rare large, 50% enhancement in the rate is observed for the perpendicular vs. parallel approach with helium and neon. A smaller, but opposite effect is observed for xenon and no effect of alignment occurs with krypton.

000,298

AD-A205 450/0

PC A03/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.

High Resolution Inverse Raman Spectroscopy of the CO Q Branch.

G. J. Rosasco, L. A. Rahn, W. S. Hurst, R. E.

Palmer, and J. P. Looney. 1988, 15p MIPR-101-88,

ARO-23356-3-CH

Pub. in SPIE Pulsed Single-Frequency Lasers: Technology and Applications, v912 p171-183 1988.

Keywords: Accuracy, *Carbon monoxide, Continuous wave lasers, Continuous waves, Frequency, High resolution, Inversion, Lasers, Pressure, Pulses, *Raman spectroscopy, Rates, Reprints, Room temperature, Shifting, Sources, Spectra, Spectroscopy, Stimulation(General).

Preliminary results of a high resolution spectroscopic study of the pressure dependence of the Raman vibrational Q-branch spectrum of pure CO are reported. Measurements are made at room temperature over the pressure range 0.5 to 6 atm. The technique of quasi-cw inverse Raman spectroscopy utilizing a pulsed single-frequency laser source is employed. This approach gives enhanced sensitivity compared to earlier work which employed cw lasers, allowing extension of that work to higher accuracy, higher J states,

and higher pressure. The goal of this work is to test the accuracy of a modified exponential-gap rate law model which is used to predict the pressure dependent spectra. Keywords: Pressure broadening; Pressure shifting; Q branch, Stimulated Raman spectroscopy; Rate law analysis, Carbon monoxide, Reprints. (mjmj)

000,299
AD-A209 360/7 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Broadening and Shifting of the Raman Q Branch of HD.
G. J. Rosasco, A. D. May, W. S. Hurst, L. B. Petway, and K. C. Smyth. 15 Feb 89, 11p ARO-23356.4-CH Contract MIPR-ARO-101-88
Pub. in Jnl. of Chemical Physics, v90 n4 p2115-2124, 15 Feb 89.

Keywords: Coefficients, Discrimination, Elastic properties, Energy transfer, Reprints, Room temperature, Molecular rotation, Test and evaluation, *Hydrogen, *Deuterium, *Vibrational spectra, *Line spectra, *Collision broadening, Quantum chemistry, Raman spectra.

The line broadening and shifting of the vibrational Q branch in pure HD has been measured for transitions $J = 0$ to 3 at room temperature over the density range 0.8 to 10.6 amagat. The shifting and broadening coefficients have been determined with an uncertainty of ± 0.002 /cm/amagat, which now provides a discriminating test for various semiclassical and quantum theoretical calculations. The line broadening coefficients are compared with linewidth data from other spectroscopic branches and with measurements of the rates of state-to-state rotational energy transfer. Use of an exponential gap law for the rates of rotational energy transfer allows estimates to be made of the contributions to the linewidths from rotationally inelastic, elastic vibrational dephasing, and elastic reorientation processes. This analysis suggests that rotational energy transfer occurs approximately 30% faster in $v = 1$ than in $v = 0$. Reprints. (AW)

000,300
AD-A210 001/4 PC A02/MF A01
National Bureau of Standards (NML), Washington, DC. Molecular Spectroscopy Div.
Unimolecular Dynamics Following Vibrational Overtone Excitation of HN3 $v_1=5$ and $v_1=6$: HN3(X,v,J,K) Yields HN(x(3)Sigma-v,J,Omega)+N2(X(1)Sigma+g).
B. R. Foy, M. P. Casassa, J. C. Stephenson, and D. S. King. Jul 88, 3p AFOSR-TR-89-0429
Pub. in Jnl. of Chemical Physics, v89 n1 p608-609, 1 Jul 88.

Keywords: Dynamics, Measurement, *Photodissociation, Reports, Reprints, *Molecular vibration, *Hydrazoic acid, Electron transitions, Molecular rotation, Molecular energy levels, Excitation, Vibrational spectra.

We report measurements of the unimolecular vibrational predissociation lifetimes and NH(X(3)Sigma-) product state distributions following excitation of the fourth and fifth NH-stretching overtone transitions of HN3. These state-to-state photodissociation experiments provide an exceptionally detailed view of the dynamics of rovibrationally excited HN3 and complement high resolution spectra and linewidth data for assigned rovibrational levels of $v_1 = 4, 5,$ and 6 . Reprints. (AW)

000,301
AD-A210 250/7 PC A03/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Energetics and Spin- and Lambda-Doublet Selectivity in the Infrared Multiphoton Dissociation DN3 yields DN(X 3 Sigma-), a 1 Delta) + N2(X 1 Sigma g (+)); Experiment.
J. C. Stephenson, M. P. Casassa, and D. S. King. 1 Aug 88, 12p AFOSR-TR-89-0431
Grant AFOSR-ISSA-89-0022
Pub. in Jnl. of Chemical Physics, v89 n3 p1378-1387, 1 Aug 88.

Keywords: *Hydrazoic acid, Distribution, Doppler systems, Electronic states, Energetic properties, Energy transfer, Excitation, Deuterium compounds, Kinetic energy, Laser induced fluorescence, Photons, *Photodissociation, Population, Profiles, Reprints, Molecular rotation, Symmetry, Temperature, Laser pumping, Molecular vibration, *Deuterated Hydrazoic Acid, *Multiphoton Dissociation, Multiphoton Excitation, Deuterated Compounds.

Multiphoton vibrational excitation of deuterated hydrazoic acid, DN3, by a CO2 laser ($I=10$ GW/sq.cm.) leads to dissociation forming DN in both X 3 Sigma(-) (spin forbidden) and a 1 Delta (spin allowed) electronic states. Under collisionless conditions, the nascent DN fragments were probed via laser induced fluorescence, to determine initial product state distributions. The DN(X 3 Sigma(-) molecules are formed predominantly in the symmetric F1 and F3 spin-rotation states with little population ($< 6\%$) in the antisymmetric F2 levels. There is no significant population ($< 3\%$) in excited DN 3-Sigma(-) vibrational levels. The distribution of rotational states is Boltzmann-like, characterized by a rotational temperature of about 920 K for the F1, F3 states and 500 K for F2 levels. Doppler profiles showed a large kinetic energy release of about 100 cm total in the triplet channel. The DN(1 Delta) products are formed preferentially in the symmetric Delta(A'), e-labeled lambda doublet levels: Delta(A')/Delta(A) = 1.44. The DN(1 Delta) is formed with no vibrational excitation ($< 2\%$); the rotational states are populated Boltzmann-like with a rotational temperature of 425 K. Doppler profiles give a total kinetic energy of about 1500/cm in this channel. The observed DN(3 Sigma-) spin- and DN(1 Delta) Lambda-doublet selectivities reflect the symmetry properties of a planar transition state and that the low degree of DN(3 Sigma-) rotational and vibrational excitation is also expected from the transition state geometry. Reprints. (jhd)

000,302
AD-A210 933/8 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Measurement and Prediction of Raman Q-Branch Line Self-Broadening Coefficients for CO from 400 to 1500 K.
G. J. Rosasco, L. A. Rahn, W. S. Hurst, R. E. Palmer, and S. M. Dohne. 15 Apr 89, 11p ARO-23356.5-CH
Contract MIPR-101-88
Pub. in Jnl. of Chemical Physics, v90 n8 p4059-4068, 15 Apr 89.

Keywords: Accuracy, Background, *Band spectra, *Carbon monoxide, Coefficients, Coherence, *Collisions, *Combustion, Diagnosis(General), Directional, Elastic properties, Fittings, Functions, Immunity, *Light scattering, Models, *Molecular rotation, Parameters, Predictions, Pressure, Probes, Purity, *Raman spectra, Raman spectroscopy, Rates, Reprints, Scaling factor, Signals, *Stokes radiation, Strength(General), Temperature, Thermal properties, *Vibrational spectra.

Vibrational and rotational Raman spectra of gases can provide an excellent measure of pressure, temperature, or species concentration when the detailed dependences of the spectra on these variables are known. While spontaneous Raman scattering serves an important role in such measurements, the improved immunity to background, the highly directional signal, and strong (for major species) signal strength of the coherent Raman techniques have made them the method of choice in many applications. Coherent anti-Stokes Raman spectroscopy (CARS) of vibrational Q-branch spectra, in particular, has become an important diagnostic probe in many combustion processes. The J and temperature dependence of the self-broadening coefficients for the Raman Q-branch lines of pure Carbon monoxide have been experimentally determined for Q(J) transitions with $J=0-38$ and for temperatures in the range 400-1500 K. It is shown that a fitting law, based on a modified exponential energy-gap model for the rates of state-to-state rotationally inelastic collisions, can account for the observed J dependence. The two parameters that determine the J dependence are found to be essentially independent of temperature. A temperature scaling function, recently proposed for N2, is added to the basic rate law, and accurate predictions of both the J and the T dependence of these coefficients and those previously reported at 298 K are obtained. This rate law model, used in conjunction with a relaxation matrix description of the Q-branch spectrum, is shown to give good agreement with the observed, partially collapsed spectrum at 2.8 atm and 295 K. Reprints. (AW)

000,303
AD-A212 195/2 PC A02/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Vibrational Spectra of Molecular Ions Isolated in Solid Neon. I. CO2(+) and CO2(-).
M. E. Jacox. 1 Aug 89, 8p ARO-25664.3-CH
Contract MIPR-117-89
Pub. in Jnl. of Chemical Physics, v91 n3 p1410-1416, 1 Aug 89.

Keywords: Acetylene, Argon, Atoms, Energy levels, Ions, Isolation, Matrix theory, *Molecular ions, *Neon, Regions, Reprints, Resonance radiation, Sampling, Solids, *Vibrational spectra, *Matrix isolation technique.

Discharge sampling coupled with matrix isolation has provided a useful tool for obtaining the spectra of small molecular ions. The technique was first used in this laboratory for a study in which excited argon atoms and their resonance radiation interacted with acetylene outside the discharge region and the products were trapped in an excess of argon. In addition to the consistently good yield of HC2 which was stabilized in these experiments, prominent absorptions of C2 appeared. An application of the technique to HCC13 led to the appearance of very prominent absorptions of HCC12, which was shown to undergo photoinduced proton transfer to the argon matrix on subsequent filtered mercury-arc photolysis. Many subsequent studies have been reviewed by Jacox and by Andrews. Common to these studies is the requirement that ions be formed at an energy below 11.8 eV, the position of the highest member of the first group of excited energy levels of the argon atom. Reprints. (JES)

000,304
AD-A212 411/3 PC A06/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Fundamental Molecular Data to Support CARS (Coherent Anti Stokes Resonance Raman Spectrometry) Diagnostics of Temperature, Pressure, and Species Concentration.
Final rept. 17 Dec 85-30 Apr 89.
G. J. Rosasco. 10 Aug 89, 113p ARO-23356.6-CH
Grant MIPR-101-88

Keywords: Air, *Carbon monoxide, Coefficients, Collisions, Computations, Diagnosis(General), *Diatomic molecules, Diffusion coefficient, Experimental data, Functions, *Hydrogen, *Line spectra, Low pressure, Molecules, Optical properties, Shape, Shifting, Velocity, *Collision broadening, Molecular properties, Relaxation, Nitrogen, Deuterium, Cross sections, Spectrometry, *CARS(Coherent Anti Stokes Resonance Raman Spectrometry), Coherent anti stokes resonance raman spectrometry, J Dependence, T Dependence, Line broadening, Line shifting coefficients, Energy gap rate law, Line shape, Dephasing cross sections, Optical diffusion coefficients.

The J-, and T-dependence of line broadening and line shifting coefficients are reported for the A-branch spectra of Carbon Monoxide and various hydrogen diatomics. Experimental studies verify our ability to predict, using an energy-gap rate law description of the relaxation matrix equation, the collisionally narrowed A branch of self-broadened Carbon Monoxide. Line shifting is determined experimentally and accounted for by semi-classical calculation. This calculation also is shown to be very accurate for self-broadening in Carbon Monoxide and is used to predict line broadening in CO:N2 from 295 to 1500K. The Q-branch line shape function for the hydrogen diatomics is studied for a range of collision partners and temperatures. In the low pressure, Dicke narrowed regime, the basic line shape function is understood; however, there is no reliable basis for prediction of the (in some cases complex) optical diffusion coefficient. In the pressure broadened regime, anomalous, asymmetric lineshapes are reported for the H2(D2): Air system. These are ascribed to inhomogeneous broadening associated with the speed dependence of dephasing cross-sections. This lineshape is shown to collisionally narrow and symmetrize with increasing H2(D2) concentration. The J-dependence of the line broadening for the hydrogen diatomics is described. (AW)

000,305
AD-A213 723/0 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Production and Spectroscopy of Molecular Ions Isolated in Solid Neon.

M. E. Jacox, and W. E. Thompson. 1989, 25p ARO-25664.5-CH
Contract MIPR-117-89

Keywords: Chemical bonds, Chemical reactions, Concentration(Composition), Detection, Electronics, Etching, High rate, Ion density, Ionosphere, Lasers, *Mass spectrometry, Microcircuits, Molecular ions, Molecules, *Neon, Probes, Production, Reactivities, Reprints, *Solids, Spectroscopy, Vapor deposition, Vibrational spectra.

Although the mass spectrometric detection of molecular ions is common place, relatively little is known about their structures and the properties of their chemical bonds. Studies of the vibrational and electronic spectra of these species are exceptionally well suited to obtaining this information. Such studies would have the bonus of providing a basis for the development of non-intrusive, in situ laser probes for molecular ions in the lower ionosphere and in such important chemical reaction systems as those of chemical vapor deposition and microcircuit etching. Because of their great chemical reactivity, it has been difficult to maintain sufficiently high ion concentrations for molecular spectroscopic study. Reprints. (jes)

000,306

AD-A214 512/6

PC A03/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Vibrational Spectra of Molecular Ions Isolated in Solid Neon. 2. O4(+) O4(-).

W. E. Thompson, and M. E. Jacox. 1 Oct 89, 13p
Grant MIPR-117-89

See also 1, AD-A212 195. Pub. in Jnl. of Chemical Physics, v91 n7 p3826-3837, 1 Oct 89.

Keywords: Absorption, Atoms, Diatomic molecules, Distribution, Infrared radiation, Ions, Isotopes, Mass spectrometry, *Molecular ions, Molecules, Neon, *Oxygen, Perturbations, Reprints, Shifting, Solids, Substitution reactions, *Vibrational spectra, Clustering, Molecular orbitals, Stability, Exothermic reactions, Isotope effect, Cations, Anions, Deposition, Photolysis, Antibonding Orbitals, Isotopic Substitution, Isotopic Shift.

The spectroscopy of the O4(+) and O4(-) cluster ions is of considerable interest and importance. Both species are formed by the overlap of antibonding orbitals on the neutral and charged O2 species. Mass spectroscopic studies indicate that the resulting bond has considerably stability. Yang and Conway found that the O2 + O2(+) reaction to form O4(+) is exothermic by approx. 10 kcal/mol. When a relatively concentrated Neon:Diatomic oxygen sample is codeposited at approx. 5 K with a beam of excited neon atoms, prominent infrared absorptions appear which are assigned to O4(+) and O4(-). Absorptions of O3 and O3(-) are also present, and their product distributions in isotopic substitution experiments indicate that O-atom production and reaction is a minor channel in this experimental system. Detailed isotopic substitution experiments require that both O4(+) and O4(-) possess two equivalent O2 units. Analysis of the isotopic shifts strongly favors a planar trans configuration (C(2h)) for both molecules. Several combination bands of O4(+) are observed, and give evidence regarding the position of v1(a(g)), which is infrared inactive, and regarding perturbations by combinations of low-frequency fundamentals. The mechanism of photodestruction of the ions in this system is also considered. Reprints. (aw)

000,307

DE86000789

PC A02/MF A01

Los Alamos National Lab., NM.

Calibration of a Monochromator/Spectrometer System for the Measurement of Photoelectron Angular Distributions and Branching Ratios.

S. H. Southworth, A. C. Parr, J. E. Hardis, J. L. Dehmer, and D. M. P. Holland. 1985, 19p LA-UR-85-3113, CONF-850734-13

Contract W-7405-ENG-36

International synchrotron radiation instrumentation conference, Stanford, CA, USA, 29 Jul 1985.

Keywords: *Argon, *Krypton, *Monochromators, *Neon, *Xenon, Angular Distribution, Autoionization, Branching Ratio, *Calibration, EV Range 10-100, Experimental Data, P States, Photoelectron Spectroscopy, Polarized Beams, Synchrotron Radiation, ERDA/640302.

We describe the techniques used in calibrating a monochromator/spectrometer system for gas-phase photoelectron angular distribution and branching ratio measurements. We report a self-consistent set of values for the Ne 2p, Ar 3p, Kr 4p/sub 3/2/ and 4p/sub 1/2/, and Xe 5p/sub 3/2/ and 5p/sub 1/2/ photoelectron asymmetry parameters and for the Kr 4p/sub 3/2/:4p/sub 1/2/ and Xe 5p/sub 3/2/:5p/sub 1/2/ branching ratios for the energy regions from threshold to approximately 15 eV. 22 refs., 7 figs. (ERA citation 11:001554)

000,308

DE89003342

PC A03/MF A01

National Bureau of Standards, Gaithersburg, MD.

Structure and Reactivity of Chemisorbed Species and Reaction Intermediates: Progress Report, 1 December 1987-30 November 1988.

T. E. Madey. 1 Aug 88, 11p DOE/ER/13663-T2
Contract AI01-87ER13663

Portions of this document are illegible in microfiche products.

Keywords: *Catalysis, *Nitrogen Fluorides, *Phosphorus Fluorides, *Platinum, *Ruthenium, *Tungsten, Additives, Adsorption, Chemical Bonds, *Chemisorption, Crystal Structure, Inelastic Scattering, Kinetics, Molecular Structure, Progress Report, Reaction Intermediates, Spectroscopy, Structural Models, Surfaces, ERDA/360602, ERDA/400201.

The areas of work supported under this contract by DOE during the period 12/1/87-11/30/88 have a common theme: the structure and reactivity of chemisorbed species and reaction intermediates of importance to catalysis. A variety of tools have been used to study the structure and chemistry of surface species, and to develop models and concepts of broad utility in chemisorption and catalysis. Results of the research conducted or completed in the last year are described in this report, along with plans for next year. Results, summarized below, are presented in detail: I. Surface Reactions and Catalysis Over Well-Characterized Surfaces. This includes: Adsorption and surface reactions over model thin-film catalysts, e.g., monolayer films of Pt on tungsten; Inelastic Incoherent Neutron Scattering (IINS) as an in situ probe of surface chemistry over high area metal powders. II. Structure and Reactivity of Chemisorbed Species. The aims of this effort include determination of (a) the structure and reactivity of small molecules on single-crystal metal surfaces and the influence of surface "additives" (promoters and poisons) on structure, and (b) the structure and surface chemistry of adsorbed halogen-containing species. 2 figs. (ERA citation 14:006193)

000,309

DE89014113

PC A02/MF A01

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Structure and Reactivity of Chemisorbed Species and Reaction Intermediates: Progress Report, December 1, 1984-November 30, 1985.

T. E. Madey, and R. D. Kelley. 1 Aug 85, 9p DOE/ER/72027-T2

Contract AT01-77ER72027

Portions of this document are illegible in microfiche products.

Keywords: Ammonia, Carbon Monoxide, Hydrogen, *Sulfur, Adsorption, *Catalysis, Chromium, Iron, Kinetics, Methanation, *Molecular Structure, Monocrystals, Platinum, Potassium, Progress Report, Promoters, *Reaction Intermediates, Ruthenium, Scattering, Surfaces, ERDA/400201, ERDA/360102, *Reaction kinetics, *Surface chemistry, *Chemisorption.

The areas of work have supported a common theme: the structure and reactivity of chemisorbed species and reaction intermediate of importance to catalysis. A variety of tools have been used to study the structure and chemistry of surface species, and to develop models and concepts of broad utility in chemisorption and catalysis. Adsorption of carbon monoxide, ammonia, hydrogen, and sulfur are discussed. Results of the research conducted or completed in the last year, as well as plans for the coming year, are summarized in this report. The results will be presented in three sections: (a) Surface Molecular Structure and Reactivity as Studied Using Electron Simulated Desorption Ion Angular Distribution (ESDIAD) and High Resolution Electron Energy Loss Spectroscopy (HREELS); (b) Neutron Inelastic Scattering Studies of Adsorption and Reaction on Catalysts; and (c) Reaction Kinetics at High Pressures over Single Crystal Catalysts.

000,310

DE90003244

PC A03/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Structure and Reactivity of Chemisorbed Species and Reaction Intermediates: Final Report, December 1, 1981-December 4, 1989.

T. E. Madey. 1 Aug 89, 25p DOE/ER/13663-T3
Contract AI01-87ER13663

Portions of this document are illegible in microfiche products.

Keywords: *Catalysis, *Ruthenium, *Tungsten, Ammonia, *Chemisorption, Hydrocarbons, Iron, Methanation, Molecular Structure, Phosphorus Fluorides, Platinum, Progress Report, Reaction Intermediates, Silver, Surfaces, ERDA/360102, ERDA/400201, Surface chemistry.

This report covers a broad 8-year experimental program relating to the structure and reactivity of chemisorbed species and reaction intermediates in surface reactions and catalysis by metals, semiconductors and oxides. Ultrahigh vacuum methods have been used throughout, and the program was divided loosely into two activities: (1) structure and reactivity of chemisorbed species and (2) surface reactions and catalysis over well-characterized surfaces. 81 refs., 2 figs.

000,311

DE90007426

PC A02/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Competitive ion kinetics in direct mass spectrometric organic speciation. Progress report.

1990, 10p DOE/ER/13647-T3
Contract AI01-87ER13647

Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: *Ions, Acetates, Affinity, Alkoxides, Anions, Chemical Bonds, *Chemical Reaction Kinetics, Entropy, Equilibrium, Ethanol, Ferrocene, *Mass Spectroscopy, Progress Report, Pyrolysis, Solvation, Sulfur Fluorides, Sulfur Ions, Temperature Dependence, EDB/400201, *Organic compounds, *Chemical reaction mechanisms.

Essentially all of the completed/in progress studies during the last reporting period have involved the NIST pulsed electron beam high pressure mass spectrometer. Three distinct areas of research are recognizable; (i) determinations of binding energies and entropies for association and cluster ions, which is accomplished by measuring the temperature dependence of the equilibrium A(sup +) or A(sup -) + B (leftrightharpoon) A(sup +)(center dot)B or A(sup -)(center dot)B, (ii) measurement of the temperature dependence of biomolecular rate constants and unimolecular rate constants for the thermal decomposition (pyrolysis) of protonated organic molecules, and (iii) evaluation of proton affinities and gas phase acidities via measurement of variable-temperature equilibria of the type AH(sup +) + B (leftrightharpoon) BH(sup +) + A and A(sup -) + BH (leftrightharpoon) AH + B(sup -). The various systems and classes of molecules chosen for study were those deemed most likely to provide fundamental new information on ion kinetics, ionic stabilities and ionic reaction mechanisms. The key results of some representative projects are summarized.

000,312

DE90008697

PC A03/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.

Pulse radiolytic studies of inter- and intramolecular electron transfer processes. Progress report.

P. Neta, and S. Lias. 17 Jan 89, 21p DOE/ER/13108-T5

Contract AI05-83ER13108

Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: *Colloids, *Porphyrins, *Radicals, Aqueous Solutions, Catalysts, Chemical Reaction Kinetics, *Electron Transfer, Iridium Complexes, Oxidation, Progress Report, Ruthenium Oxides, *Spectrophotometry, EDB/400201, EDB/400400.

Electron transfer processes have been studied by the pulse radiolysis technique using spectrophotometric detection. In general, these studies include examina-

tion of the mechanisms, rate constants, and equilibrium constants of electron transfer reactions in a variety of chemical systems such as organic radicals and radical ions, inorganic radicals, and metalloporphyrins, both in aqueous and in non-aqueous solutions. Highlights of our results during the past three years are summarized below under the following sections: metalloporphyrins and colloidal catalysts, peroxy radicals, inorganic radicals, and other topics.

000,313
DE90008698 PC A03/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Atomic, Molecular and Optical Physics.

Laser studies of chemical dynamics at the gas-solid interface. Progress report, January 1987-Jun 1989.

R. R. Cavanagh, and D. S. King. 1990, 14p DOE/ER/13150-T3

Contract AI05-84ER13150

Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: Gases, *Interfaces, Solids, Chemical Reactions, *Chemisorption, Laser Radiation, Platinum, Progress Report, Ruthenium, EDB/400201, *Surface reactions, Nitrogen oxide(NO), Carbon monoxide, Ammonia.

The DOE funded research program "Laser Studies of Chemical Dynamics at the Gas-Solid Interface" has taken a detailed, microscopic view of molecules desorbed from surfaces in order to gain an understanding of energy flow and interaction potentials and how these control chemical reactivity at interfaces. Successful completion of these experiments required technical expertise both in surface science and laser-based molecular dynamics, a collaborative situation that exists in the NIST center for Atomic, Molecular and Optical Physics. During the three year period covered by this progress report, our goal was to use state-resolved techniques to examine a single chemisorption system in detail, and to observe how changes in the interaction potential or method of surface excitation are manifest in the desorption dynamics. The system chosen was NO/Pt(111). Studies were undertaken in which the effects on the NO-Pt interaction potential of coadsorbates--both weakly (CO) and strongly (NH(sub 3)) interacting-- could be examined. In addition, attempts were to be made to study non-equilibrium dynamics by using pulsed laser heating. 18 refs.

000,314
DE90012888 PC A02/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Competitive ion kinetics in direct mass spectroscopic organic speciation. Final report.

Progress rept.

1990, 9p DOE/ER/13647-T4

Contract AI01-87ER13647

Sponsored by Department of Energy, Washington, DC.

Keywords: *Ions, Acetates, Affinity, Anions, Chemical bonds, Chemical reactions, Kinetics, Ethanol, Mass spectroscopy, *Chemical reaction mechanism.

Essentially all of the completed/in progress studies during the last reporting period have involved the NIST pulsed electron beam high pressure mass spectrometer. Three distinct areas of research are recognizable; (1) determinations of binding energies and entropies for associated and cluster ions, which is accomplished by measuring the temperature dependence of the equilibrium $A(\text{sup } +) + A(\text{sup } (\text{minus})) + B(\text{leftarrow})A(\text{sup } +)(\text{center dot})B$ or $A(\text{sup } (\text{minus}))(\text{center dot})B$, (2) measurement of the temperature dependence of bimolecular rate constants and unimolecular rate constants for the thermal decomposition (pyrolysis) of protonated organic molecules, and (3) evaluation of proton affinities and gas phase acidities via measurement of variable-temperature equilibria of the type $A\text{H}(\text{sup } +) + B(\text{leftarrow})\text{BH}(\text{sup } +) + A$ and $A(\text{sup } (\text{minus})) + B(\text{leftarrow})\text{AH} + B(\text{sup } (\text{minus}))$. The various systems and classes of molecules chosen for study were those deemed most likely to provide fundamental new information on ion kinetics, ionic stabilities and ionic reaction mechanisms. The key results of some representative projects are summarized.

000,315
N90-24604/2

(Order as N90-24586/1, PC A18/MF A03)
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Review of Model Sensor Studies on Pd/SnO2(110) Surfaces.

T. B. Fryberger, and S. Semancik. Jun 90, 13p
In NASA, Langley Research Center, Low-Temperature CO-Oxidation Catalysts for Long-Life CO2 Lasers p277-289.

Keywords: Gas sensor systems, *Palladium, *Tin oxides, *Adsorption, *Catalysts, Crystal surfaces, Gas analysis, Gas detectors, Additives, Reprints.

Studies performed at the National Institute of Standards and Technology on the model gas sensor system, Pd/SnO2(110), are reviewed. Adsorption and interfacial effects play a primary role in the gas sensing process, as they do in catalysis. For this reason, researchers have used a variety of surface sensitive techniques in the research, including x ray and ultraviolet photoelectron spectroscopies (XPS and UPS), low energy electron diffraction (LEED), and ion scattering spectroscopy (ISS). By combining these complementary techniques with in situ gas response (conductance) measurements, researchers were able to correlate directly sensor activity with the composition and structure of the Pd/SnO2 interface. Although the intent of this work is to develop an understanding of gas sensing mechanisms, its relevance to Pd/SnO2 catalytic systems is obvious.

000,316
PATENT-4 962 275 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.

Method and Apparatus for Supercritical Fluid Extraction Solution Separation.

Patent.

T. J. Bruno. Filed 21 Feb 90, patented 9 Oct 90, 8p
PB91-100438, PAT-APPL-7-482 589
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Patents, *Liquefied gases, *Solvent extraction, Carbon dioxide, Test equipment, Methodology, Oils, Nozzle flow, Solutions, *PAT-CL-585/834, *Separation processes, Supercritical gas extraction.

A method and apparatus for the separation of a desired product from a supercritical fluid extraction solution employ a restrictor nozzle, a coarse-pore sintered-glass enclosure member and a collecting means for collecting an oil suspension of the desired product. The supercritical fluid extraction solution is decompressed by passing through the restrictor nozzle. The resulting decompressed fluid stream is directed at the enclosure member which is saturated with an oil in which the desired product is soluble. Solutes including the desired product are dissolved in the oil, and the oil is collected. The method and apparatus are particularly suitable for use in separating beta-carotene from a carbon dioxide solvent.

000,317
PB90-136318 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Heterodyne Frequency Measurements on N(sub 2)O Near 930 cm⁻¹).

Final rept.
A. G. Maki, J. S. Wells, and M. D. Vanek. 1989, 5p
Pub. in Jnl. of Molecular Spectroscopy 138, p84-88 1989.

Keywords: *Nitrogen oxide(N2O), *Molecular spectroscopy, Calibrating, Molecular energy levels, Reprints, *Heterodyning.

Heterodyne frequency measurements have been made on the first hot band accompanying the N2O laser transitions in the region from 896 to 955/cm. These measurements tie the upper state energy level at 2798/cm to the other low-lying energy levels of N2O by measurements referred to the cesium frequency standard and thereby provide frequency calibration in the 2740 to 2840/cm region.

000,318
PB90-136425 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Microcomputer Programs for Size Exclusion Chromatography.

Final rept.
B. Dickens, and F. McCrackin. 1989, 4p
Pub. in Computer Applications in Applied Polymer Science II, Chapter 3, p25-28 1989.

Keywords: *Molecular weight, *Size screening, *Chromatographic analysis, Automation, Process control, Distribution functions, Elution, Polymers, Reprints, Computer applications.

An implementation of automatic processing in a system of computer programs to perform size exclusion chromatography on IBM-compatible microcomputers is described. The programs allow identifying vials in an auto-injector, data collection from two detectors, and manual and automatic processing to compare chromatograms and calculate molecular weight averages. Chromatograms may be compared in terms of elution volume, log hydrodynamic volume and/or log molecular weight. The programs also perform chromatographic column calibration and various house-keeping activities. The user may assign each specimen to a class and thus determine the type of chromatogram matching and automatic processing for that specimen.

000,319
PB90-149196 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Intramolecular Dynamics in Molecule-Surface Collisions: Excitation, Dissociation, and Selectivity of Reactivity.

Final rept.
J. W. Gadzuk. 1987, 28p
Pub. in Surface Science 184, n3 p483-510 1987.

Keywords: Excitation, Dissociation, Scattering, Reprints, *Molecular collisions, *Surface reactions, Molecular dynamics.

Excitation of internal vibrational modes of molecules scattered from surfaces are considered here. Emphasis is placed upon a mechanism which follows if either charge transfer between the solid and molecule occurs or alternatively, if the intra-molecular geometry varies with molecule-surface separation. The excitation is studied in terms of both analytic quantum wave-packet dynamics over simplified model potential energy surfaces and numerical classical trajectories over more realistic surfaces. Conditions under which the analytic models provide realistic descriptions of the collision dynamics are determined. Finally, the theoretical model is applied to several problems of experimental relevance. In particular translational to vibrational energy transfer is studied molecules, dissociatively scattered diatomic molecules, and selectivity in the fragmentation distributions of scattered polyatomic molecules.

000,320
PB90-149238 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Crystal Structure of Ba3V4O13.
Final rept.
B. M. Gatehouse, L. W. Guddat, and R. S. Roth. 1987, 6p
Pub. in Jnl. of Solid State Chemistry 71, n2 p390-395 1987.

Keywords: *Crystal structure, Monoclinic lattices, X ray diffraction, Reprints, *Barium vanadates.

Ba3V4O13 crystallizes in the monoclinic system with unit-cell dimensions (from single crystal data) $a = 16.100(3)$, $b = 8.947(3)$, $c = 10.173(3)$, $\beta = 114.39(2)$ deg and space group $C2/c$, $z = 4$. The structure was solved using Patterson and Fourier techniques. The structure was refined by full-matrix least-squares methods, using 1604 ($l =$ or > 3 sigma (l)) unique counter-measured reflections, to a convention R of 0.028 (R_w 0.041). The structure comprises $Ba(2+)$ and $(V4)13(6-)$ ions. The $V4O13(6-)$ polyanion consists of four corner-shared vanadium tetrahedra in a U-shaped arrangement for which the torsion angle between the vanadium atoms is 56.07(6) deg. Other known $E4O13(n-)$ anions ($E=Al, Si, P$ or Cr) comprising corner-shared tetrahedra all have torsion angles that are > 172 deg.

000,321
PB90-149345 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

NBS (National Bureau of Standards) Standard Reference Material for Depth Profile Analysis.

Final rept.

J. Fine, and B. Navinsek. 1988, 2p

Pub. in *Surface and Interface Analysis* 11, n10 p542-543 1988.

Keywords: *Materials specifications, *Surface properties, Sputtering, Erosion, Thin films, Vapor deposited coatings, Nickel, Chromium, Measurement, Reprints, *Standard Reference Materials, Depth profile analysis.

A new standard reference material (SRM) for depth profile analysis is now available from NBS. The material is intended for the calibration of sputter erosion rates and depths in surface analysis. A brief description is given of the properties of the NBS SRM 2135.

000,322

PB90-149436

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Surface Conductivity Changes in SnO(sub 2)(110): Effects of Oxygen.

Final rept.

J. W. Erickson, and S. Semancik. 1987, 11p

Pub. in *Surface Science* 187, n2-3 pL658-L668 Sep 87.

Keywords: *Tin oxides, *Surface chemistry, *Conductivity, *Oxygen, Chemical analysis, Defects, Reprints, Temperature dependence, Vacuum spectroscopy, Ultra-high vacuum.

Sheet conductivity measurements have been used to monitor the effects of temperature and exposure to oxygen on the (110) surface of tin dioxide. The electronic property is a sensitive measurement of changes in composition and structure at and just below the surface, in the space-charge layer. Three surface structures characterized by low-energy electron diffraction (LEED) and other techniques were studied using a retractable four-point conductivity probe under ultra-high vacuum (UHV) conditions and at gas pressures up to 10 Torr. The observed conductivity changes are discussed in the context of the distribution and concentration of oxygen atoms in the space-charge layer.

000,323

PB90-150038

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

pH Theory and Measurement.

Final rept.

R. A. Durst, W. F. Koch, and Y. C. Wu. 1987, 24p

Pub. in *Ion-Selective Electrode Review* 9, n2 p173-196 1987.

Keywords: *pH meters, Measurement, Buffers(Chemistry), Thermodynamics, Rain, Activity coefficients, Reprints, *Standard Reference Materials, Ion selective electrodes.

One of the most widely performed analytical measurements in chemical laboratories is that of pH using the glass electrode. In order to insure the consistency of the measurements, the National Bureau of Standards (NBS) has recommended an operational scale of pH, maintained in terms of the pH(S) of a series of standard solutions. Certified samples of buffer materials, from which the standard reference solutions of reproducible pH can be prepared, as well as solutions in the case of rainwater, are issued by the National Bureau of Standards as Standard Reference Materials. The report is concerned primarily with a discussion of the method used at NBS for the assignment of pH(S) values to these standard solutions, a description of the NBS measurement facilities for pH, and a summary of the characteristics of the buffer materials. A brief discussion of the IUPAC pH scale is included as well as a discussion of the types of electrodes used and the calibration of pH instrumentation.

000,324

PB90-150137

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Transpiration Mass Spectrometry of Liquid LiF: Vaporization Thermochemistry and Electron Impact Fragmentation.

Final rept.

D. W. Bonnell, J. W. Hastie, and K. F. Zmboj. 1988, 12p

Pub. in *High Temperatures-High Pressure* 20, n3 p251-262 1988.

Keywords: *Transpiration, *Mass spectroscopy, *Liquid phases, *Lithium fluorides, *Vaporizing, *Thermochemistry, Vapor pressure, High temperature tests, Electron beams, Ionizing radiation, Knudsen gages, Mathematical models, Thermogravimetry, Dimerization, Thermodynamics, Reprints.

A detailed study of the vapor thermochemistry of the LiF system has been carried out using a variety of techniques, including transpiration mass spectrometry (TMS), Knudsen effusion mass spectrometry (KMS) and Knudsen cell thermogravimetric analysis (TGA). Using the expansion cooled molecular beam from the TMS technique, it was possible to determine the extent of temperature dependent electron impact ionization fragmentation and to model the process. Phase analysis indicates that at high temperature (KMS conditions), the source of LiF(+) is the neutral precursor Li2F2, whereas in the cooled beam, LiF is the predominant source of LiF(+). Intercomparison of TGA-, KMS- and TMS-derived partial pressure data indicate excellent agreement with the accepted partial pressure extrapolation of the monomer over liquid LiF, and good agreement with the dimer and trimer. Ionization cross-sections for LiF monomer and dimer species were significantly lower than predicted by current empirical estimation methods.

000,325

PB90-150145

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Usefulness of Various Computer Algorithms for Locating Spots and Arrays in Electron Diffraction Patterns.

Final rept.

D. S. Bright. 1988, 8p

Pub. in *Microbeam Analysis*, p25-32 1988.

Keywords: *Electron diffraction, Pattern recognition, Algorithms, Reprints, *Image processing, Flying spot digitizers.

The search for regular arrays of spots in electron diffraction patterns is an image analysis problem with some typical stages: acquire, process and store the image; segment the image into spots; measure the spot locations; recognize the patterns and extract the data. Image processing algorithms that work at the pixel by pixel level representation of the image are used for the earlier stages of the problem, whereas algorithms using more abstract information are used for the final stages. Methods are recommended for each stage, and some alternatives are also presented. Topics covered include selection of thresholds, the top hat filter, the gradient, location diffraction spot centers, the linear Hough transform, symbolic representation of spots, and the search for and the measurement of basis vectors.

000,326

PB90-150160

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

State-Resolved Evidence for Hot Carrier Driven Surface Reactions: Laser Induced Desorption of NO from Pt(111).

Final rept.

S. A. Buntin, L. J. Richter, D. S. King, and R. R. Cavanagh. 15 Nov 89, 18p

Contract DE-AL05-84ER13150

Sponsored by Department of Energy, Washington, DC. Pub. in *Jnl. of Chemical Physics* 91, n10 p6429-6446, 15 Nov 89.

Keywords: *Nitrogen oxide(NO), *Platinum, *Desorption, Resonance, Reprints, Laser induced desorption, Surface reactions.

State-specific diagnostics are used to characterize the laser-induced desorption of NO from Pt(111). Two desorption channels are observed; one is consistent with thermal activation, while the other is driven by adsorbate interactions with hot carriers. For this latter channel, the observed dependence of the desorption yield on the wavelength of the incident laser pulse (1907, 1064, 532, and 355 nm) and the wavelength dependence of the kinetic energy distributions establish the nonthermal nature of the excitation process. The inverted spin-orbit population, the non-Boltzmann rotational state distributions, and the vibrational state population are interpreted in terms of a desorption mechanism involving a temporary ion resonance.

000,327

PB90-150251

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. ElectroSystems Div.

Collisional Electron Detachment and Decomposition Cross Sections for SF(sub 6)(1-), SF(sub 5)(1-), and F(1-) on SF(sub 6) and Rare Gas Targets.

Final rept.

Y. Wang, R. L. Champion, L. D. Doverspike, J. K. Oithoff, and R. J. Van Brunt. 1989, 7p

Sponsored by Department of Energy, Washington, DC. Pub. in *Jnl. of Chemical Physics* 91, n4 p2254-2260, 15 Aug 89.

Keywords: Sulfur hexafluoride, Rare gases, Reprints, *Sulfur fluorides, *Electron detachment, *Ion-molecule collisions, Total cross sections, Negative ions, EV range 10-100, EV range 100-1000.

Absolute total cross sections for collisional electron detachment and collision-induced dissociation (CID) have been measured for binary collisions of SF6(1-) and SF5(1-) with rare gas and SF6 targets for laboratory collision energies ranging from about 10 up to 500 eV. The cross sections for electron detachment of SF6(1-) are found to be surprisingly small, especially for the SF6 target, for relative collision energies below several tens of electron volts. Specifically, detachment onsets are found to occur at around 30 and 90 eV for the rare gas and SF6 targets, respectively. The CID channel which leads to F(1-) as a product is observed to dominate detachment for relative collision energies below 100 eV. The results for the SF5(1-) projectile are remarkably similar to those exhibited for SF6(1-). The role of long-lived excited states in the reactant SF6 ion beam is discussed.

000,328

PB90-152463

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Basic Standards.

Substrate Surface Relaxation for Cl and S on Cu(001).

Final rept.

J. R. Patel, D. W. Berreman, F. Sette, P. H. Citrin, J. E. Rowe, P. L. Cowan, T. Jach, and B. Karlin. 1989, 4p

Pub. in *Physical Review B* 40, n2 p1330-1333, 15 Jul 89.

Keywords: *Substrates, *Adsorbates, *Molecular relaxation, *Chlorine, *Sulfur, *Copper, Surface chemistry, X ray analysis, Standing waves, Reprints.

The interlayer relaxation of a metal surface in the presence of an adsorbate was determined, using a combination of x ray standing waves and surface extended x ray-absorption fine structures. The Cu(001) surface was studied with Cl c(2x2) and S p(2x2) overlayers using a back-reflection diffraction geometry from (111) planes at 2.9 keV. Outward relaxation was found to be 0.07 + or - 0.04 A while for the S-covered surface the relaxation is more difficult to determine because of possible substrate reconstruction.

000,329

PB90-152554

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Microwave Spectrum and Structure of the H2O-SO2 Complex.

Final rept.

K. Matsumura, F. J. Lovas, and R. D. Suenram. 1989, 8p

Pub. in *Jnl. of Chemical Physics* 91, n10 p5887-5894, 15 Nov 89.

Keywords: *Sulfur dioxide, *Water, *Microwave spectra, Dipole moments, Rotational spectra, Molecular structure, Deuterium compounds, Reprints, *Complexes, Van der Waals forces, Dimers.

The microwave spectrum of H2O-SO2 has been observed with a pulsed beam, Fabry-Perot cavity, Fourier-transform microwave spectrometer. In addition to the normal isotopic form, the authors have observed the spectra of H2O-(34)SO2, HDO-SO2, and D2O-SO2. The geometry obtained from fitting the derived moments of inertia has the planes of the two monomer units tilted approximately 45 degree from the parallel orientation with the oxygen atom of the water closest to the S atom of SO2, giving an S-O distance of 2.824(16) A and a center-of-mass distance R(c.m.) = 2.962(5) A. The (SO2)2 species was also produced with the same nozzle expansion conditions as used for H2O-SO2.

Physical & Theoretical Chemistry

000,330
PB90-152661 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Building Materials Div.
**Influence of Iron on the Reaction between Silicon
 and Nitrogen.**
 Final rept.
 H. M. Jennings. 1988, 4p
 Pub. in Jnl. of Materials Research 3, n5 p907-910 Sep/
 Oct 88.

Keywords: *Iron, *Chemical reactions, *Silicon, *Nitro-
 gen, Silicon nitrides, Phase diagrams, Reaction kinet-
 ics, Reprints.

The ways in which iron may affect the reaction be-
 tween silicon and nitrogen are summarized and con-
 sidered both in terms of possible mechanisms of the
 nitridation process and also in terms of the phases pro-
 duced by the reaction. Some new results are reported
 that indicate that, in addition to removing an oxide
 layer on the silicon, or forming an alloy with the silicon,
 iron somehow modifies the behavior of the nitrogen.

000,331
PB90-152695 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Precision Engineering Div.
**Raman Spectroscopy of Single Optically Levitated
 Droplets.**
 Final rept.
 T. R. Lettieri, R. E. Preston, and M. I. Bell. 1985, 3p
 Pub. in Proceedings of Chemical Research and Devel-
 opment Center's 1984 Scientific Conference on Ob-
 scuration and Aerosol Research, CRDC-SP-85007,
 p255-257 1985.

Keywords: *Raman spectroscopy, *Drops(Liquids),
 Laser beams, Argon lasers, Aerosols, Silicones,
 Phthalates, Evaporation, *Levitation, Characterization.

Spontaneous Raman scattering has been observed
 from single aerosol droplets optically levitated by an
 argon ion laser-beam. All of the Raman bands of bulk
 liquid silicone oil and dioctyl phthalate were present in
 spectra taken of droplets of the same liquids. It sug-
 gests that chemical characterization of individual drop-
 lets may be possible without the undesirable effects of
 a supporting substrate. The droplet spectra also con-
 tained unexplained, size-dependent sharp features su-
 perimposed on the Raman peaks. The new technique
 may have applications in chemical characterization
 studies of evaporating multicomponent droplets, drop-
 lets in chemically reacting flows, and other transient
 processes involving single liquid droplets.

000,332
PB90-152752 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Atomic and Plasma Radiation Div.
**Fundamental Configurations of Doubly-Ionized
 Molybdenum (Mo III).**
 Final rept.
 L. Iglesias, M. I. Cabeza, F. Rico, and V. Kaufman.
 1988, 16p
 Pub. in Physica Scripta 37, n6 p855-870 1988.

Keywords: *Energy levels, *Atomic structure, Spectro-
 graphs, Hartree-Fock approximation, Wave functions,
 Electron transitions, Reprints, *Molybdenum ions.

The spectrum of doubly ionized molybdenum (Mo III)
 was produced in a sliding-spark discharge and record-
 ed photographically in the 1100-3250 Å spectral region
 using the NBS 10.7-m normal-incidence vacuum spec-
 trograph. The level system was revised and extended
 to include 54 levels of the 4d(sup 4) and 4d(sup 3)5s
 even configurations and 66 levels of the 4d(sup 3)5p
 odd configuration. A total of 682 lines have been clas-
 sified as transitions between the levels. The observed
 level system was interpreted by means of relativistic
 Hartree-Fock calculations and least-squares paramet-
 ric fits.

000,333
PB90-152828 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Building Materials Div.
**Reply to Comment on 'Aqueous Solubility Rela-
 tionships for Two Types of Calcium Silicate Hy-
 drate.'**
 Final rept.
 H. M. Jennings. 1988, 2p
 Pub. in Jnl. of the American Ceramic Society 71, n2
 pC115-C116 1988.

Keywords: *Cements, *Calcium silicates, *Solubility,
 *Water, Chemical equilibrium, Hydration, Reprints.

Barret and Bertrandie commented recently on a paper
 entitled 'Aqueous Phase Relationships for Two Types
 of Calcium Silicate Hydrate.' The paper presents com-
 ments and analyses and concludes that the aqueous
 phase that surrounds hydrating tricalcium silicate is
 probably in near equilibrium with a surface layer of
 product.

000,334
PB90-152901 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
**Surface Forces and Viscosity of Water Measured
 between Silica Sheets.**
 Final rept.
 R. G. Horn, D. T. Smith, and W. Haller. 1989, 5p
 Sponsored by Office of Naval Research, Arlington, VA.
 Pub. in Chemical Physics Letters 162, n4-5 p404-408,
 20 Oct 89.

Keywords: *Surface energy, *Force, *Viscosity,
 *Water of hydration, *Silicon dioxide, *Sheets, Meas-
 urement, Test equipment, Aqueous electrolytes,
 Sodium chloride, Reprints, Israelachvili apparatus.

A method of preparing silica surfaces for use in the
 Israelachvili surface force apparatus is described. Two
 silica sheets were immersed in aqueous solutions of
 NaCl to study both the surface forces between them
 and the viscosity of the intervening aqueous film. The
 force shows a short-range hydration repulsion, indicat-
 ing a modified water structure at the silica interface,
 but the viscosity does not differ from the value of bulk
 water.

000,335
PB90-153404 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Chemical Kinetics Div.
**Multiphoton Ionization Spectra of Radical Pro-
 ducts in the F(sup 2)P + Ketene System: Spectral
 Assignments and Reaction Dynamics for CH(sub
 2)F, Observation of CF and CH.**
 Final rept.
 J. W. Huddgens, C. S. Dulcey, G. R. Long, and D. J.
 Bogan. 1987, 13p
 Pub. in Jnl. of Chemical Physics 87, n8 p4546-4558
 1987.

Keywords: *Ketenes, *Fluorine, *Chemical radicals,
 Deuterium compounds, Reaction kinetics, Vibrational
 spectra, Ultraviolet spectra, Near ultraviolet radiation,
 Reprints, *Multiphoton ionization, *Fluoromethyl radi-
 cals, Multi-photon processes, Rydberg states, Carbon
 atoms.

The reaction of F(doublet P) + Ketene and F(doublet
 P) + Ketene-d2 were studied in a flow reactor. Spectra
 of the radical products, CH2F, CD2F, CH, CF and
 atomic carbon were detected between 292-395 nm by
 resonance enhanced multiphoton ionization (REMPI)
 mass spectrometry. Fluoromethyl radicals were identi-
 fied as a major product of the F + ketene elementary
 reaction. The dynamics of the F + ketene reaction are
 discussed.

000,336
PB90-153412 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Thermophysics Div.
**Theoretical Study of the Three-Body Absorption
 Spectrum in Pure Rare Gas Fluids.**
 Final rept.
 B. Guillot, R. D. Mountain, and G. Birnbaum. 1988,
 11p
 Sponsored by Paris-6 Univ. (France). Lab. de Physique
 Theorique des Liquides.
 Pub. in Molecular Physics 64, n4 p747-757 Jul 88.

Keywords: *Rare gases, *Three body problem, Qua-
 drupole moment, Absorption spectra, Far infrared radia-
 tion, Liquefied gases, Helium, Krypton, Reprints,
 Atomic collisions, Molecular dynamics, Jansen model.

The three-body induced dipole resulting from ternary
 collisions among identical atoms is calculated within
 the framework of the one effective-electron model of
 Jansen. It is found that at short and intermediate
 range, the main contribution comes from dipoles in-
 duced by exchange quadrupole moments (EQID).
 Moreover, a rough estimate shows that the long-range
 dispersion contribution to the three-body dipole is ne-
 gligible for (He)3 but becomes significant for (Kr)3. In

order to investigate the nature of a spectrum due to
 triplet interactions, a molecular dynamics simulation
 taking into account only the EQID mechanism is per-
 formed to generate the translational absorption spec-
 trum in gaseous and liquid krypton. In the liquid, the
 correlation function exhibits two time scales; a fast
 decay corresponding to the mean duration of ex-
 change quadrupoles, and a slower decay, lasting sev-
 eral ps, which is associated with translational diffusion.
 A very rough estimate of the expected absorption in
 liquid krypton is also given.

000,337
PB90-153420 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Metallurgy Div.
**Hydrogen Evolution Cathodes with AB(sub 5)-
 Catalyzed Coatings.**
 Final rept.
 D. E. Hall, J. M. Sarver, and D. O. Gothard. 1988,
 15p
 Sponsored by INCO Alloys International, Inc., Hunting-
 ton, WV.
 Pub. in International Jnl. of Hydrogen Energy 13, n9
 p547-561 1988.

Keywords: Electrolysis, Intermetallics, Cathodes,
 Nickel, Hydrides, Reprints, *Hydrogen production,
 Electrocatalysts, Scanning electron microscopy.

AB5-catalyzed hydrogen evolution cathodes were
 made with coatings containing particles of AB5 and
 nickel, plus an inert binder. The effects of coating com-
 position and catalyst particle size on hydrogen evolu-
 tion were determined. Raising the binder content of
 the cathode coating increased the overpotential due to
 catalyst masking, as confirmed by scanning electron
 microscopy. Replacing half of the AB5 in the coating
 with nickel, which is much less catalytically active for
 the hydrogen evolution reaction, had a relatively small
 effect on the overall cathode efficiency. Reducing the
 AB5 particle size to increase catalyst surface area re-
 duced the overpotential slightly. The AB5-catalyzed
 cathodes showed stable overpotentials during electro-
 lyses of up to 7000 hours, and were not adversely af-
 fected by extended open circuit exposure or reverse
 polarity tests. They showed high resistance to
 common electrocatalyst poisons. Scanning electron
 microscopy and energy dispersive x-ray spectrometry
 showed that this was due to the AB5-catalyst's tend-
 ency to resist contaminant deposition from solution.

000,338
PB90-153461 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Chemical Kinetics Div.
**Redox Reactions with Colloidal Metal Oxides:
 Comparison of Radiation-Generated and Chemi-
 cally Generated Ruthenium Dioxide Dihydrate and
 Colloids.**
 Final rept.
 A. Harriman, M. C. Richoux, P. A. Christensen, S.
 Mosseri, and P. Neta. 1987, 14p
 Pub. in Jnl. of the Chemical Society, Faraday Trans-
 actions 1 83, n9 p3001-3014 1987.

Keywords: *Reduction(Chemistry), *Oxidation, *Col-
 loids, *Radiolysis, Water chemistry, Manganese
 oxides, Gamma irradiation, Catalysts, Hydrogen,
 Oxygen, Dissociation, Photochemical reactions, Com-
 parison, Reprints, *Ruthenium oxides.

Colloids of RuO2/2H2O and MnO2 have been pro-
 duced by chemical and radiolytic methods. The col-
 loids slowly aggregate upon standing in water over
 several weeks but radiolysis gives much smaller par-
 ticles. The colloids are active in catalyzing water oxida-
 tion under chemical and photochemical conditions al-
 though there is some corrosion. The chemically
 formed RuO2 colloids are quite efficient catalysts for
 water reduction to H2 but the radiolytically formed col-
 loids do not promote H2 formation. Colloidal MnO2 is a
 poor catalyst for both H2 and O2 generation and it
 tends to aggregate under operating conditions. The
 RuO2/2H2O colloids obtained by gamma radiolysis
 are selective for oxidation processes. They are stable
 and catalyze O2 formation with high efficiencies. Such
 materials appear to be the best catalysts available for
 use in model systems for the photodissociation of
 water.

000,339
PB90-161241 Not available NTIS
 American Chemical Society, Washington, DC.

Journal of Physical and Chemical Reference Data, Volume 18, Number 4, 1989.

Quarterly rept.

D. R. Lide. c1989, 322p

See also PB90-161258 through PB90-161282 and PB90-126236. Errata sheets inserted. Prepared in cooperation with American Inst. of Physics, New York. Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD.

Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamics, *Physical chemistry, Water, Melting, Equations of state, Toluene, Liquids, Free radicals, Reduction(Chemistry), Atoms, Photochemical reactions, Ultraviolet spectra, Electron scattering.

Contents: A fundamental equation for water covering the range from the melting line to 1273 K at pressures up to 25,000 MPa; Toluene thermophysical properties from 178 to 800 K at pressures to 1000 bar; Reduction potentials of one-electron couples involving free radicals in aqueous solution; Photoemission cross section for atomic transitions in the extreme ultraviolet due to electron collisions with atoms and molecules.

000,340

PB90-161258

Not available NTIS

Ruhr Univ., Bochum (Germany, F.R.). Inst. fuer Thermo- und Fluidodynamik.

Fundamental Equation for Water Covering the Range from the Melting Line to 1273 K at Pressures up to 25 000 MPa(a).

A. Saul, and W. Wagner. c7 Mar 89, 28p

Prepared in cooperation with National Inst. of Standards and Technology, Gaithersburg, MD., American Chemical Society, Washington, DC., and American Inst. of Physics, New York.

Included in Jnl. of Physical and Chemical Reference Data, v18 n4 p1537-1564 1989. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Water, *Thermodynamics, Melting, Equations of state, Enthalpy, Helmholtz function.

A new approach to describing the thermodynamic properties of water by a single fundamental equation of state is described. The 58-coefficient equation is obtained by fitting the Helmholtz function selected experimental data points. The equation covers the entire fluid region from the melting line to 1273 K at pressures up to 25 000 MPa. Comparisons are made with experimental data and other equations of state for water.

000,341

PB90-161266

Not available NTIS

National Inst. of Standards and Technology, Boulder, CO. Thermodynamics Div.

Toluene Thermophysical Properties from 178 to 800 K at Pressures to 1000 Bar.

R. D. Goodwin. c1989, 72p

Included in Jnl. of Physical and Chemical Reference Data, v18 n4 p1565-1636 1989. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Thermodynamics, *Toluene, Compressibility, Enthalpy, Equation of state, Pressure.

An equation of state for toluene has been derived by fitting all available experimental data on the thermodynamic properties. Tables of recommended values for the thermodynamic properties are presented for coexisting liquid and vapor and for the individual phases.

000,342

PB90-161274

Not available NTIS

Mount Vernon Hospital, Northwood (England). Gray Lab.

Reduction Potentials of One-Electron Couples Involving Free Radicals in Aqueous Solution.

P. Wardman. c1989, 119p

Prepared in cooperation with American Chemical Society, Washington, DC., American Inst. of Physics, New York, and National Inst. of Standards and Technology, Gaithersburg, MD.

Included in Jnl. of Physical and Chemical Reference Data, v18 n4 p1637-1756 1989. Available from American Chemical Society, 1155 16th St., NW, Washington, DC 20036.

Keywords: *Reduction potential, *Liquids, *Free radicals, *Oxidants, Oxidation reduction reactions, Electrochemistry, Radiolysis, Electron transfer.

Tables of reduction potentials are presented for about 700 one-electron couples involving free radicals in aqueous solution. These reduction potentials are of value in predicting the feasibility of free radical reactions and estimating their rate constants.

000,343

PB90-163874

PC A04

National Inst. of Standards and Technology, Gaithersburg, MD.

Journal of Research of the National Institute of Standards and Technology. November-December 1989. Volume 94, Number 6.

1989, 69p

See also PB90-163882 through PB90-163932 and Volume 94, Number 4, PB89-235634. Also available from Supt. of Docs. SN703-027-00031-8.

Keywords: *Atmospheric pressure, *Metrology, *Radioactive isotopes, *Metals, Radioactivity, Nickel isotopes, Standards, Measurement, Waveforms, Ionizing radiation, Atomic mass, Manometers, Mass spectrometers.

Contents: The reduction of uncertainties for absolute piston gage pressure measurements in the atmospheric pressure range; Absolute isotopic abundance ratios and atomic weight of a reference sample of nickel; The absolute isotopic composition and atomic weight of terrestrial nickel; Report on the 1989 meeting of the radionuclide measurements section of the consultative committee on standards for the measurement of ionizing radiations; On measuring the root-mean-square value of a finite record length periodic waveform; A search for optical molasses in a vapor cell; General analysis and experimental attempt.

000,344

PB90-163890

(Order as PB90-163874, PC A04)

National Inst. of Standards and Technology, Gaithersburg, MD.

Absolute Isotopic Abundance Ratios and Atomic Weight of a Reference Sample of Nickel.

J. W. Gramlich, L. A. Machlan, I. L. Barnes, and P. J. Paulsen. 1989, 10p

Prepared in cooperation with Curtin Univ. of Technology, Bentley (Australia).

Included in Jnl. of Research of the National Institute of Standards and Technology, v94 n6 p347-456 1989.

Keywords: *Nickel isotopes, *Atomic weight, Calibrating, Mass spectrometers, Assay.

Absolute values have been obtained for the isotopic abundance ratios of a reference sample of nickel (Standard Reference Material 986), using thermal ionization mass spectrometry. Samples of known isotopic composition, prepared from nearly isotopically pure separated nickel isotopes, were used to calibrate the mass spectrometers.

000,345

PB90-163908

(Order as PB90-163874, PC A04)

National Inst. of Standards and Technology, Gaithersburg, MD.

Absolute Isotopic Composition and Atomic Weight of Terrestrial Nickel.

J. W. Gramlich, E. S. Beary, L. A. Machlan, and I. L. Barnes. 1989, 6p

Included in Jnl. of Research of the National Institute of Standards and Technology, v94 n6 p357-362 1989.

Keywords: *Nickel isotopes, *Atomic weight, Concentration(Composition), Mass spectrometers, Standards, Accuracy.

Twenty-nine samples of high-purity nickel metals, reagent sales and minerals, collected from worldwide sources, have been examined by high-precision isotope ratio mass spectrometry for their nickel isotopic composition. These materials were compared directly with SRM 986, certified isotopic standard for nickel, using identical measurement techniques and the same instrumentation.

000,346

PB90-163916

(Order as PB90-163874, PC A04)

National Inst. of Standards and Technology, Gaithersburg, MD.

Report on the 1989 Meeting of the Radionuclide Measurements Section of the Consultative Committee on Standards for the Measurement of Ionizing Radiations: Special Report on Standards for Radioactivity.

D. D. Hoppes. 1989, 4p

Included in Jnl. of Research of the National Institute of Standards of Technology, v94 n6 p363-366 1989.

Keywords: *Radioactivity, *Radioactive isotopes, *Ionizing radiation, Standards, Measurement.

The report describes the activities discussed at the 10th meeting of Section II of the Consultative Committee on Standards for the Measurement of Ionizing Radiations held in May 1989 at Sevres (France). Topics included present and future international comparisons of activity measurements, the status and possible extension of the International reference system for activity measurements of gamma-ray emitting nuclides, reports from other working groups, accomplishments at the International Bureau of Weights and Measures.

000,347

PB90-169251

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Temperature Dependence of the Rate Constant for the Gas Phase Disproportionation Reaction of CH(sub 3)O(sub 2) Radicals.

Final rept.

M. J. Kurylo, and T. J. Wallington. 1987, 5p

Pub. in Chemical Physics Letters 138, n6 p543-547 1987.

Keywords: Disproportionation, Chemical radicals, Photolysis, Vapor phases, Reprints, *Methylperoxy radicals, Atmospheric chemistry, Temperature dependence.

Flash photolysis kinetic absorption spectroscopy was used to investigate the gas phase disproportionation reaction of CH₃O₂ radicals over the temperature range 228-380 K at pressures between 50 and 400 torr of nitrogen diluent. The measured second-order rate constants were independent of pressure and were used to derive the Arrhenius expression. The results are compared with previous literature data and the mechanistic implications are discussed.

000,348

PB90-169277

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Kinetic Measurements of the Gas Phase HO(sub 2) + CH(sub 3)O(sub 2) Cross-Disproportionation Reaction at 298K.

Final rept.

M. J. Kurylo, P. Dagaut, D. M. Neuman, and T. J. Wallington. 1987, 6p

Pub. in Chemical Physics Letters 139, n6 p513-518 1987.

Keywords: Disproportionation, Chemical radicals, Chemical reactions, Combustion, Photolysis, Vapor phases, Reaction kinetics, Reprints, *Methylperoxy radicals, Atmospheric chemistry.

Flash photolysis kinetic absorption spectroscopy was used to investigate the gas phase reaction between hydroperoxy and methylperoxy radicals at 298K, HO₂ + CH₃O₂ -> products. Due to the large difference between the self reactivities of the two radicals, first or second order kinetic conditions could not be maintained for either species. Thus, the rate constant for the cross reaction was determined from computer modeled fits of the radical absorption decay curves recorded at wavelengths between 215 and 280 nm. The procedure yielded a value for k(1) at 298K independent of total pressure (using N₂) between 25 and 600 torr, and of the partial pressure of water vapor (up to 11.6 torr). No effect of water vapor could be found on the rate constant for the self reaction of methylperoxy radicals as well.

000,349

PB90-169293

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Photon Stimulated Desorption Induced by Core Exciton States in MgO.

Final rept.
R. L. Kurtz, S. A. Flodstrom, R. Nyholm, F. Senf, and R. Stockbauer. 1987, 2p
Pub. in *Jnl. of Vacuum Science and Technology A* 5, n4 p1111-1112 1987.

Keywords: *Magnesium oxides, Excitons, Reprints, *Photon stimulated desorption, *Oxygen ions, *Hydrogen ions 1 plus.

Photon stimulated desorption of O(1+) and H(1+) from MgO(100) and MgO(111) has been observed using photon energies over the O K-edge. O(1+) and H(1+) desorption apparently arises from the decay of different O core-exciton states as well as the states produced by interband transitions. The exciton states manifest themselves as a pre-edge structure. The O excitonic levels are interpreted in terms of their related atomic origin. Electron yield data from partially oxidized Mg implies that these states are localized in the near surface region.

000,350

PB90-169319 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Comparison of Direct and through Water Binding of Platinum Amines to the Phosphate Anion.

Final rept.
M. Krauss, H. Basch, and K. J. Miller. 1988, 5p
Pub. in *Jnl. of the American Chemical Society* 110, n14 p4517-4521 1988.

Keywords: *Water, *Chemical bonds, *Platinum, *Amino compounds, *Anions, *Energy levels, Comparison, Mathematical models, Molecular orbitals, Hydrogen bonds, Heat of hydration, Electrostatics, Mechanisms, Reprints, *Self consistent fields, *Phosphates.

The recently determined crystal structure for cis-Pt(NH₃)₂ bound to d(pGpG) has directed attention to the importance of Pt ammine binding to the phosphate moiety. Molecular mechanics (MM) modeling with kinked oligomer duplex models demonstrates that both 'direct' and 'through-water' binding conformations to phosphate are possible. The intrinsic energetics of the binding is modeled for the Pt(NH₃)₂(2+) - H₂O - H₂PO₄(-) complex with valence self-consistent-field molecular orbital calculations. The model geometries were guided by MM calculations to allow the anionic oxygen of the phosphate group to approach the ammonia ligand through a hydrogen bond or by axial approach towards the Pt atom. The 'through-water' complex is constructed to allow for an intervening water molecule that is hydrogen bonded both to the cation and anion. The energetics of 'direct' and 'through-water' conformations are found to be competitive. Two strong ionic hydrogen bonds to water from the cationic ammine and the phosphate anion in the 'through-water' complex are sufficient to offset the reduction in the ionic binding caused by the larger separation in the charged species. The binding of water to Pt(NH₃)₂(2+) and H₂PO₄(-) is also reported for a variety of conformations.

000,351

PB90-169343 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Structures and Heats of Formation of C(sub 4)H(sub 7)(1+) Ions in the Gas Phase.

Final rept.
S. G. Lias, and P. Ausloos. 1987, 17p
Pub. in *International Jnl. of Mass Spectrometry and Ion Processes* 81, p165-181 1987.

Keywords: *Molecular structure, *Heat of formation, *Ions, *Butadienes, *Gases, *Alkyne hydrocarbons, *Thermodynamic equilibrium, Acetonitrile, Chemical reactions, Protons, Isomerization, Reprints, Affinity, Butyne.

The proton affinities of 1,3-butadiene and 2-butyne have been derived from equilibrium constant determinations to 190 + or - 1 kcal/mol, and 188 + or - kcal/mol, respectively. Based on the results, the heats of formation of the 1-methylallyl ion (CH₃CHCH=CH₂(+)), and the 2-butenyl ion (CH₃CCHCH₃(+)) are 202 and 213 kcal/mol, respectively. The proton affinity of 1,2-butadiene has been determined to be 189 kcal/mol, leading to a (stationary electron convention) value for the heat of formation of the corresponding C₄H₇(+) ion of approximately 215 kcal/mol, indicating that the ion has the same struc-

ture as protonated 2-butyne. The 2-butenyl ion reacts with CH₃CN by proton transfer with a rate constant of 5-7 x 10¹⁰(sup -10) cu cm/molecules. A competing reaction is a collision-induced rearrangement to the lower-energy 1-methylallyl structure. The latter ion reacts with CH₃CN with a rate constant of 0.5 x 10¹⁰(sup -10) cu cm/molecules. Based on the difference in reactivity, it is possible to ascertain that under the conditions of the ICR experiment (40 eV ionizing electrons, 10 (sup -6) torr), about 85-90% of the fragment C₄H₇(+) ions formed in cyclopentane initially have the 1-methylallyl structure, while the fragment ions in the linear and branched pentenes and in the butenes originate predominantly with a higher energy structure which may be either CH₃CCHCH₃(+) or CH₂C(CH₃)=CH₂.

000,352

PB90-169434 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Growth of a Coherent Precipitate from Supersaturated Solution.

Final rept.
V. J. Laria, W. C. Johnson, and P. W. Voorhees. 1988, 10p
Pub. in *Jnl. of Materials Research* 3, n2 p257-266 1988.

Keywords: *Supersaturation, *Precipitation(Chemistry), *Coherence, *Solutions, *Grain growth, Diffusion, Elastic properties, Interfaces, Reprints, *Coherent production.

A treatment of diffusion limited growth of a coherent precipitate into supersaturated solution is presented. The precipitate has a spherical morphology and may have different elastic constants than the matrix phase. It is found that the growth kinetics are strongly affected by dilatational coherency strains and by compositionally induced strains in the matrix phase. Analytic and numerical solutions to the time dependent problem are obtained and are compared to the quasi-stationary solution. The transformation strain, the partial molar volumes of the components, the elastic constants in each phase, the interfacial compositions and the far-field composition must all be specified to determine the parabolic growth coefficient. In contrast, the growth coefficient is determined solely by a reduced supersaturation parameter in the absence of stress. The elastic effects tend to perturb the interfacial concentration of the matrix in the direction of the far-field concentration and reduce the effective driving force for growth. At the same time, compositionally induced strains increase the diffusive flux and tend to increase the growth rate.

000,353

PB90-169616 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Thermodynamic Perturbation Theory for Multi-component and Polydisperse Mixtures.

Final rept.
J. M. Kincaid, R. A. MacDonald, and G. Morrison. 1987, 12p
Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in *Jnl. of Chemical Physics* 87, n9 p5425-5436 1987.

Keywords: *Thermodynamics, Perturbation theory, Critical point, Mixtures, Fluids, Reprints.

A general perturbation method is described that can be used to solve the equilibrium and critical-point conditions for model systems described by an analytic Helmholtz free energy. The general technique is developed within the framework of continuous or polydisperse systems; it may be applied to systems with discrete components, as well as to systems described by a continuous distribution of components. The expansion is based on the assumption that the microscopic parameters characterizing the system may be expressed as those of a reference system plus a series of small corrections. Explicit formulae for the first- and second-order solutions to the equilibrium and critical-point conditions are given.

000,354

PB90-169624 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Cd I Isoelectronic Sequence: Wavelengths and Energy Levels for Xe VII through Eu XVI.

Final rept.
V. Kaufman, and J. Sugar. 1987, 5p
Pub. in *Jnl. of the Optical Society of America B: Optical Physics* 4, n12 p1919-1923 1987.

Keywords: *Energy levels, *Wavelengths, *Xenon, *Europium, Atomic structure, Frequencies, Spectrographs, Spectroscopy, Spectral emittance, Reprints, *Isoelectronic atoms, Electronic structures.

Low-inductance triggered spark spectra of Xe through Eu were observed with the NBS 10.7 m normal and grazing-incidence vacuum spectrographs. Transition arrays of the Cd I isoelectronic sequence were identified, as well as those of the Rh I, Pd I and Ag I sequences previously reported. Energy levels and fitted radial integrals were derived. Perturbations due to configuration crossings arising from the contraction of the 4f shell were revealed in these analyses.

000,355

PB90-169681 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Stopped-Flow Studies of the Mechanisms of Ozone-Alkene Reactions in the Gas Phase: Trans-2-butene.

Final rept.
R. I. Martinez, and J. T. Herron. 1988, 5p
Pub. in *Jnl. of Physical Chemistry* 92, n16 p4644-4648 1988.

Keywords: *Ozone, *Chemical reactions, *Butenes, Reaction kinetics, Mass spectroscopy, Reprints.

The reaction of ozone with trans-2-butene has been studied in the gas phase at 294 K and 530 Pa (4 torr) using a stopped-flow reactor coupled to a photoionization mass spectrometer. The concentrations of reactants and products were determined as a function of reaction time. A mechanism is proposed to account for the observed products: CH₃CHO, H₂CO, CO₂, CH₄, CH₃C(O)-C(H)(OH)CH₃, H₂C=C=O, H₂O, 2-butanone and 2,3-epoxybutane, CH₃C(O)-C(O)CH₃, and HC(O)-C(O)H. This work again indicates that the simple 'hot' ester hypothesis needs to be critically reconsidered for gas-phase ozonolysis.

000,356

PB90-169707 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Temperature and Pressure Div.

Determination of the Indium Freezing-Point and Triple-Point Temperatures.

Final rept.
B. W. Mangum. 1989, 7p
Pub. in *Metrologia* 26, p211-217 1989.

Keywords: *Indium, *Melting points, Temperature, Resistance bridges, Reprints, *Triple point.

The freezing-point temperatures of two samples of 99.9999% pure indium in cells constructed such that the indium was in contact only with Teflon were measured with four standard platinum resistance thermometers and two resistance bridges, one bridge operating at 400 Hz and the other with square-wave dc. Although nominally of the same purity, one sample was purer than the other, with a difference in freezing-point temperature of 0.2 to 0.4 mK, the value depending on the bridge used for the measurements. The temperature, t(sub 68), of the purer sample as determined from dc measurements is (156.6342 plus or minus 0.0004) C and as determined from ac measurements is (156.6345 plus or minus 0.0004) C. The pressure dependence was determined to be (4.92 plus or minus 0.05)mK/(std. atm). Consequently, the triple-point temperatures are (4.92 plus or minus 0.05)mK lower than the freezing-point values. The indium freezing-point temperature would be a suitable defining fixed point for a temperature scale.

000,357

PB90-169871 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Physical & Theoretical Chemistry

High-Resolution Measurement of Water-Vapor Overtone Absorption in the Visible by Frequency-Modulation Spectroscopy.

Final rept.

N. C. Wong, and J. L. Hall. 1989, 9p

Grant NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of the Optical Society of America B 6, n12 p2300-2308 Dec 89.

Keywords: *Water vapor, Absorption spectra, Visible spectrum, Reprints, Frequency modulation spectroscopy, High resolution.

The authors demonstrate the use of near-shot-noise-limited frequency-modulation spectroscopy in the study of a weakly absorbing transition of water vapor at 16940.27/cm. The high sensitivity of the technique allows a detailed study of the line shape to yield accurate air-induced pressure-broadening and line-center shift coefficients and the self-induced pressure-broadening coefficient of the transition.

000,368

PB90-169889

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Symmetry Breaking in HCl and DCI Dimers: A Direct Near-Infrared Measurement of Interconversion Tunneling Rates.

Final rept.

M. D. Schuder, C. M. Lovejoy, D. D. Nelson, and D. J. Nesbitt. 1989, 2p

Grants NSF-CHE86-05970, NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Jnl. of Chemical Physics 91, n7 p4418-4419, 1 Oct 89.

Keywords: Deuterium compounds, Infrared spectroscopy, Near infrared radiation, Hydrogen bonds, Reprints, *Hydrogen chloride dimers, Symmetry breaking, High resolution, Chlorine 35, Chlorine 37, Supersonic jet flow.

The authors determined the interconversion splittings for (HCl)₂ and (DCI)₂ to spectroscopic precision for the mixed (35)Cl-(37)Cl dimers. A phenomenological model of the interconversion process explains several experimental observations and provides good estimates of the splittings expected for the (35)Cl-(35)Cl and (37)Cl-(37)Cl homodimers.

000,359

PB90-170010

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

New Electronic Spectrum of the SiH(sub 3) Radical Observed Using Multiphoton Ionization Spectroscopy.

Final rept.

R. D. Johnson, and J. W. Hudgens. 1987, 3p

Pub. in Chemical Physics Letters 141, n3 p163-165 1987.

Keywords: Chemical radicals, Near ultraviolet radiation, Ultraviolet spectroscopy, Reprints, *Silyl radicals, *Multi-photon processes, *Multiphoton ionization, Visible radiation, Rydberg states.

The silyl radical SiH₃ was observed between 365-410 nm using resonance enhanced multiphoton ionization spectroscopy. The spectrum arises from two photon resonances states which lie between 49,229-54,014/cm. A vibrational progression interval of -800/cm was assigned to the resonant intermediate state symmetric deformation mode, nu sub 2.

000,360

PB90-170028

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Resonance Enhanced Multiphoton Ionization Spectra of the SiCl Radical between 430 and 520 nm.

Final rept.

R. D. Johnson, E. Fang, and J. W. Hudgens. 1988, 4p

Pub. in Jnl. of Physical Chemistry 92, n13 p3880-3883 1988.

Keywords: *Silicon chlorides, *Chemical radicals, Visible spectrum, Vibrational spectra, Reprints, *Multiphoton ionization, *Multi-photon processes, Rydberg states.

The resonance enhanced multiphoton ionization spectra of the SiCl radical observed between 430 to 520 nm is reported. Bands involving transitions to the C doublet Pi(r) and D doublet Sigma(+) states are analyzed. The C doublet Pi(r) state exhibits vibrational levels to v' = 6, higher than previously observed, as well as hot bands to v'' = 6. The (S⁷)Cl isotope shift has been measured for these levels, confirming the vibrational assignments. Two vibrations of the E-state are also observed.

000,361

PB90-170085

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Infrared and Microwave Study of Angular-Radial Coupling Effects in Ar-HCN.

Final rept.

G. T. Fraser, and A. S. Pine. 1989, 8p

Pub. in Jnl. of Chemical Physics 91, n6 p3319-3326, 15 Sep 89.

Keywords: *Infrared spectroscopy, *Microwave spectroscopy, *Argon, *Hydrogen cyanide, *Complex compounds, *Angular momentum, Intermolecular forces, Quadrupole moment, Vibrational spectra, Hydrogen bonds, Distortion, Asymmetry, Stretching, Reprints, *Coupling constants, *Radial distribution.

Microwave and infrared spectra of Ar-HCN have been obtained using an electric-resonance optothermal spectrometer. The microwave measurements extend to higher J the previous results of Leopold et al. and Klots et al., allowing the determination of higher-order centrifugal distortion constants for the quasilinear, highly nonrigid complex. A Pade approximate fit to the microwave data indicates a significant rotation-induced asymptotic increase in the zero-point center-of-mass separation between the Ar and the HCN, above that expected from pure radial distortion. It results from the large coupling between the angular and radial degrees in the intermolecular potential forcing the centrifugal alignment of the HCN. Infrared spectra are reported for the C-H stretching fundamental v₁ and the combination band v₁ + v₅(sup 1)5, where v₅ is the van der Waals bending vibration. The band-origin difference between the two bands gives v₅ = 7.8 reciprocal cm, in rough agreement with the 10 reciprocal cm harmonic value predicted from the microwave-determined nuclear quadrupole coupling constant. The complexation-induced red shift of the C-H stretching vibration is 2.69 reciprocal cm and the vibrational predissociation linewidths are < 10 MHz(FWHM). The vibrationally excited complex predissociates before striking the bolometer detector, implying that the predissociation lifetime is less than 1 ms.

000,362

PB90-170150

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Analysis of the Microwave and Far Infrared Spectrum of the Water Dimer.

Final rept.

L. H. Coudert, and J. T. Hougen. 1990, 19p

Pub. in Jnl. of Molecular Spectroscopy 139, p259-277 1990.

Keywords: *Microwave spectra, *Infrared spectra, Far infrared radiation, Hydrogen bonds, Reprints, *Water dimer.

The radiofrequency, microwave, and far infrared spectrum of the water dimer has been analyzed using an IAM-like treatment developed in two previous papers and slightly extended. It was assumed for the analysis that four large amplitude motions are feasible in the water dimer, two of them being interconversion motions during which the hydrogen-bond acceptor monomer becomes the donor monomer and vice versa. The present global analysis of 173 transitions made possible the determination of 22 parameters in the theoretical formalism corresponding to the various tunneling motions, including the angles describing the J and K dependence of the tunneling splittings. In addition, the seven asymmetric rotor parameters A, B, C, D(1), D(k), d(1), and d(2) were determined, corresponding to constants with contributions from the various tunneling motions removed.

000,363

PB90-170176

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Vibrational Predissociation Dynamics of the Nitric Oxide Dimer.

Final rept.

M. P. Casassa, J. C. Stephenson, and D. S. King.

1988, 4p

Pub. in At. Mol. Processes Short Intense Laser Pulses 171, p367-370 1988.

Keywords: Reprints, *Nitric oxide, *Predissociation, Van der Waals forces, Laser induced fluorescence, Picosecond pulses, Lifetime, Time dependence, Dimers.

Details of experimental measurements of the total energy distribution and time dependence of the vibrational predissociation of the nitric oxide dimer are presented. Energy disposal measurements indicated the fragments to exhibit low average rotational energy, full equilibration of the lambda doublet species, approximately equal populations in both spin-orbit states, no significant degree of alignment, and isotropic flux distribution, and kinetic energies of 400/cm per fragment. Although approximately 75% of the available energy goes into fragment translation, picosecond laser pump-probe experiments showed that nu(1) decayed exponentially with a 880 ps lifetime. Excitation of nu(4) at 1789/cm gave a 39 ps predissociative lifetime.

000,364

PB90-170226

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Fire Measurement and Research Div.

Solid-State (13)C NMR Investigation of Methyltin(IV) Compounds. Correlation of NMR Parameters with Molecular Structure.

Final rept.

T. P. Lockhart, and W. F. Manders. 1987, 6p

Pub. in Jnl. of the American Chemical Society 109, n23 p7015-7020 1987.

Keywords: *Nuclear magnetic resonance, *Molecular structure, Linear regression, Reprints, *Organotin compounds.

Solid-state (13)C NMR data are reported for 52 methyltin(IV) compounds. The dependence of NMR parameters(chemical shift and tin-carbon J coupling, (I)J((119)Sn,(13)C)) on molecular structure has been investigated with reference to the x-ray structures known for many of the compounds. (13)C chemical shifts of the tin-methyls generally increase (are more deshielded) in the series: tetra- penta- hexa- hepta-coordinated methyltin(IV) and tri- di- mono-methyltin(IV) compounds, although there is considerable overlap between several of these groups. (I)J((119)Sn,(13)C) values were determined for 30 compounds whose x-ray structures are known; a linear regression of the data for 28 compounds yields the equation: (I)J((119)Sn,(13)C) = 10.7 (Me-Sn-Me angle) - 778 (r - 0.975). A Fermi contact term-tin hybridization model is used to rationalize the general behavior; changes in the effective nuclear charge of tin may be responsible for the several poorly behaved compounds that have been identified. Cases have been found in which more than one (I)J((119)Sn,(13)C) value exists for the methyls in di- and trimethyltin(IV) compounds. This appears to arise in cases where the tin atom bonds to different methyls with substantially different hybrid orbitals.

000,365

PB90-170259

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Polarization Effects in Molecular X-Ray Fluorescence.

Final rept.

D. W. Lindle, P. L. Cowan, R. E. LaVilla, T. Jach, R. D. Deslattes, R. C. C. Perera, and B. Karlin. 1987, 3p

Pub. in Jnl. de Physique 48, nC-9 p761-763 1987.

Keywords: *X ray fluorescence, Synchrotron radiation, Reprints, *Linear polarization, K shell, Chloromethane, Chlorotrifluoromethane, Dichlorodifluoromethane.

Highly polarized x-ray fluorescence has been observed following K-shell excitation of several Cl-containing molecules. Monochromatic synchrotron radiation with a high degree of linear polarization was used to resonantly excite Cl 1s electrons in CH₃Cl, and the Freons, CF₃Cl, CF₂Cl₂. The subsequent Cl K(beta) fluorescence was found to be strongly linearly polarized. The direction of polarization of the K(beta) fluorescence is determined in part by the symmetry of the valence-orbital electron involved in the fluorescence decay which fills the Cl 1s hole. The results illustrate that the core-level resonance lifetimes are short

enough to preclude substantial disorientation of the molecule prior to fluorescence decay. Measurements of this type may prove to be a sensitive probe of orbital symmetry in more complicated molecular systems, condensed matter, and adsorbates.

000,366
PB90-170325 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Reaction-Induced Mass Discrimination in XQQ In-Struments: Absolute Cross Sections for N₂(1+) (SF₆,N₂)SF_x(1+) (x=1-5).
Final rept.
R. I. Martinez, and B. Ganguli. 1988, 6p
Pub. in Rapid Commun. Mass Spectrom. 2, n2 p41-46 1988.

Keywords: *Sulfur hexafluoride, Cross sections, Mass spectroscopy, Reprints, *Ion-molecule collisions, *Charge transfer, *Nitrogen ions, Energy dependence, EV range 01-10, EV range 10-100, Branching ratio.

Dynamically-correct branching ratios can be measured in a XQQ tandem mass spectrometer (MS/MS) under single-collision conditions when the key MS/MS parameters are properly selected to correct for reaction-induced mass discrimination within the rf-only quadrupole mass filter (Q2). The energy dependence of the cross section, $\sigma(E)$, for the reaction $N_2(1+) + SF_6 \rightarrow N_2 + SF(x)(1+)$ ($x=1-5$) was measured in the NBS triple quadrupole (QQQ) tandem mass spectrometer. For P approx = 0.02-0.13 mtorr and E approx = 5-60 eV (LAB) (the range of collision energies used for collisionally-activated dissociation (CAD)), the authors measured identical $\sigma(E)$ from both the rate of reactant ion decay and the rate of product ion formation.

000,367
PB90-170333 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Absolute Cross-Section Measurements in XQQ In-Struments: Ar(1+)(N(sub 2),Ar)N(sub 2)(1+).
Final rept.
R. I. Martinez, and S. Dheandhanoo. 1988, 16p
Pub. in International Jnl. of Mass Spectrometry and Ion Processes 84, n1-2, p1-16, 6 Jun 88.

Keywords: *Nitrogen, Mass spectrometers, Cross sections, Dissociation, Reprints, *Ion-molecule collisions, *Charge transfer, *Argon ions, Energy dependence, EV range 01-10, EV range 10-100.

The energy dependence of the cross section, $\sigma(E)$, for the asymmetric near-resonant charge transfer reaction $Ar(1+)(N_2,Ar)N_2(1+)$ was measured in the authors' triple quadrupole (QQQ) tandem mass spectrometer. For P approx = 0.04-0.35 mtorr and E approx = 5-60 eV (LAB) (the range of collision energies used for collisionally activated dissociation (CAD)), the authors measured identical $\sigma(E)$ from both the rate of reactant ion decay and the rate of product ion formation; i.e., the authors' instrument is kinetically well behaved. Moreover, the authors' $\sigma(E)$ complements that of other workers over the energy range of 0.04 to 100 eV. Hence, the authors' instrument can be used to measure absolute cross sections for the CAD of ions. This is essential if generic, instrument-independent CAD spectral databases are to be developed.

000,368
PB90-170416 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Quasielastic Neutron Scattering Study of Rotations and Diffusion in KC(sub 24)(NH(sub 3))(sub 4,3).
Final rept.
D. A. Neumann, H. Zabel, J. J. Rush, Y. B. Fan, and S. A. Solin. 1987, 4p
Pub. in Jnl. of Physics C: Solid State Physics 20, n29 pL761-L764, 20 Oct 87.

Keywords: *Ammonia, Potassium inorganic compounds, Neutron scattering, Elastic scattering, Graphite, Rotation, Diffusion, Reprints, *Intercalation.

Quasielastic neutron scattering results are reported which examine the rotations, reorientations, and diffusion of the ammonia molecules in the stage 1 graphite intercalation compound $KC_{24}(NH_3)_{4.3}$. Two different rotational modes are observed. The first is apparent at low temperatures and broadens into a flat background

as the temperature is increased while the second is seen at 200 K. At room temperature, translational motion of the NH_3 molecules is also present.

000,369
PB90-170465 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Glycine Permeation through Na(1+), Ag(1+) and Cs(1+) - Forms of Perfluorosulfonated Ion Exchange Membranes.
Final rept.
M. Jin, S. K. Sikdar, and S. D. Bischke. 1988, 16p
Pub. in Separation Science and Technology 23, n14-15 p1293-1308 1988.

Keywords: *Glycine, *Permeability, *Ion exchange resins, *Sulfonates, Liquid saturation, Flux(Rate), Reprints, *Membrane transport, *Sodium ions, *Silver ions, *Cesium ions, Fick laws, Sulfonic acid esters.

Counterions in perfluorosulfonated ion exchange membranes controlled permeation behavior of glycine. The $Na(+)$ -form of the membrane exhibited saturation kinetics of the Michaelis-Menten type, i.e., the flux rapidly increased with concentration, and reached a limiting flux at a concentration of about 2 mol/L. The $Cs(+)$ -form exhibited markedly lower fluxes which were nearly Fickian. For the $Ag(+)$ -form, however, the fluxes increased rapidly and nonlinearly at low concentrations, but attained Fickian linearity at high concentrations. Ionization of the metal substituents, believed to lead to an interaction of the transport species with the membrane, appeared to cause departure from the Fickian behavior.

000,370
PB90-170481 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Progress in Resonance Enhanced Multiphoton Ionization Spectroscopy of Transient Free Radicals.
Final rept.
J. W. Hudgens. 1988, 126p
Pub. in Advances in Multi-Photon Processes and Spectroscopy, v4 p171-296 1988.

Keywords: *Free radicals, Mass spectroscopy, Detection, Reviews, Reprints, *Multiphoton ionization, Multiphoton processes, Selection rules, Rydberg states, Transients.

A comprehensive review of resonance enhanced multiphoton ionization (REMPI) spectroscopy of transient molecular free radicals is presented. Topics covered include a history of REMPI free radical detection, multiphoton selection rules, the experimental apparatus used in REMPI studies, the applications of mass spectrometry, methods of determining the photon order of resonant states, and the characteristics of Rydberg states. REMPI spectroscopic results for twenty-six free radicals are summarized through the use of 42 figures and 27 tables.

000,371
PB90-170754 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Improved Calculation of the Quadratic Stark Effect in the 6P (sub 3/2) State of Cs.
Final rept.
H. L. Zhou, and D. W. Norcross. 1989, 4p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review A 40, n9 p5048-5051 Nov 89.

Keywords: *Cesium, *Stark effect, Electron transitions, Polarization, Scalars, Tensors, Reprints.

Calculations of the Stark scalar and tensor polarizabilities $\alpha(0)$ and $\alpha(2)$ for the $6P(3/2)$ state in cesium are reported, along with values of $\alpha(0)$ for the $6S(1/2)$, $7S(1/2)$ and $6P(1/2)$ states. The results are in very good agreement with the latest measurements. The authors also used their method to calculate the Stark-amplitude coefficients for the $6S(1/2) - 7S(1/2)$ transition; the results are compared with those of previous theoretical and experimental work.

000,372
PB90-170820 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.

Search for Tricriticality in Binary Mixtures of Near-Critical Propane and Normal Paraffins.

Final rept.
C. J. Peters, H. J. van der Kooij, J. L. de Roo, J. de Swaan Arons, J. S. Gallagher, and J. M. H. Levelt Sengers. 1989, 13p
Pub. in Fluid Phase Equilibria 51, p339-351 1989.

Keywords: *Critical point, *Propane, *Mixtures, *Chemical equilibrium, *Alkanes, Liquid phase, Vapor phase, Solubility, Reprints.

The paper reports on three-phase equilibria liquid + liquid + vapor of binary mixtures of near-critical propane and higher normal paraffins. Special attention has been given to locate the (pseudo-)binary first showing partial miscibility in the liquid phase. For that purpose the three-phase equilibria liquid + liquid + vapor, including critical endpoints, have been determined experimentally in the binaries $C_3 + C_{32}$, $C_3 + C_{34}$, $C_3 + C_{36}$, $C_3 + C_{38}$, $C_3 + C_{40}$, $C_3 + C_{44}$, $C_3 + C_{46}$ and $C_3 + C_{50}$. Extrapolation of the results obtained shows that for a carbon number between 29 and 30 tricriticality has to be expected. In order to model the measured three-phase equilibrium data, an algorithm has been developed on the basis of the simplified perturbed hard chain theory. The calculations are still in progress.

000,373
PB90-170937 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Coupled Channel Quantum Scattering Study of Alignment Effects in Na(doublet P(3/2)) + He -> Na(doublet P(1/2)) + He Collisions.
Final rept.
G. C. Schatz, L. J. Kovalenko, and S. R. Leone. 1989, 12p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 91, n1 p6961-6972, 1 Dec 89.

Keywords: *Sodium, *Helium, Quantum theory, Cross sections, Alignment, Scattering, Reprints, *Atom-atom collisions.

The authors present results of coupled channel quantum scattering calculations of the alignment selected $j = 3/2 \rightarrow j = 1/2$ fine structure changing integral cross section for $Na(\text{doublet } P) + He$. This cross section has in the past been written in terms of a coherent sum of partial wave amplitudes, but the authors have found that it can be expressed in terms of an incoherent sum of partial cross sections, each labeled by the total angular momentum J and by parity.

000,374
PB90-170945 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Damped Dispersion Interaction Energies for He-H(sub 2), Ne-H(sub 2), and Ar-H(sub 2).
Final rept.
M. E. Rosenkrantz, and M. Krauss. 1985, 10p
Pub. in Physical Review A-General Physics 32, n3 p1402-1411 1985.

Keywords: Intermolecular forces, Hydrogen, Helium, Neon, Argon, Damping, Reprints, *Van der Waals forces.

The van der Waals interactions energy between two closed-shell systems can be approximated as the sum of the Hartree-Fock (HF) and dispersion interaction energies. The dispersion energy is given as a power series in $R \supset (-n)$ when the interaction potential is expanded in the multipole operators of the asymptotic systems. The series is convergent only if the overlap of the systems is explicitly considered. The present paper will describe the calculation of the induced-dipole-induced-dipole dispersion interaction including the anisotropic damping due to change overlap. The He-H₂, Ne-H₂ and Ar-H₂ systems were considered and the van der Waals potential were constructed with use of available HF interaction potentials.

000,375
PB90-170952 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Analysis of CH(sub 2) a tilde (sup 1)A(sub 1) (1,0,0) and (0,0,1) Coriolis-Coupled States, a tilde (sup 1)A(sub 1) - X tilde (sup 3)B(sub 1) Spin-Orbit Coupling, and the Equilibrium Structure of CH(sub 2) a tilde (sup 1)A(sub 1) State.

Final rept.

H. Petek, D. J. Nesbitt, D. C. Darwin, P. R. Ogilby, C. B. Moore, and D. A. Ramsay. 1989, 13p
Grant NSF-CHE83-04893

Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 91, n11 p6566-6578, 1 Dec 89.

Keywords: Spin orbit interactions, Infrared spectroscopy, Magnetic fields, Chemical radicals, Reprints, *Methylene radicals, High resolution, Tunable lasers.

The symmetric and antisymmetric stretch spectra (a tilde) singlet A(1) CH₂ are measured with Doppler-limited resolution by infrared flash-kinetic spectroscopy between 2600 and 3050/cm. The spectra are significantly perturbed by spin-orbit interactions between near-resonant levels of (X tilde) triplet B(1) in both lower and upper levels of the transitions, and by Coriolis interaction between symmetric and antisymmetric stretch states. The triplet character of the perturbed levels is detected by observing broadening of M(J) structure in a magnetic field about 1 kG. The levels that are likely to be perturbed by triplet methylene are identified using the experimentally observed and theoretically calculated triplet B(1) energy level structure. The term values of the remaining symmetric and antisymmetric stretch levels are simultaneously fit to Watson's Hamiltonian including Coriolis coupling. The analysis provides the remaining information needed to determine the equilibrium rotational constants and, therefore, the equilibrium structure of this fundamentally important carbene.

000,376

PB90-171026

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

NBS (National Bureau of Standards) Triple Quadrupole Tandem Mass Spectrometer.

Final rept.

R. I. Martinez. 1987, 4p

Pub. in Review of Scientific Instruments 58, n9 p1702-1705 1987.

Keywords: *Mass spectrometers, Cross sections, Dissociation, Reprints, *Tandem mass spectrometers, Molecular collisions.

A detailed description is provided of a triple quadrupole (QQQ) tandem mass spectrometer (MS/MS) which is kinetically well behaved and can be configured to use either a molecular beam target (Type A) or collision chamber (Type B) configuration. Its unique capabilities are being used to explore design criteria essential for absolute cross-section measurements, and for the development of standardized operating conditions for generic, instrument-independent spectral databases for collisionally-activated dissociation (CAD).

000,377

PB90-171042

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Reactions of H(sub 2) with He(1+) at Temperatures Below 40 K.

Final rept.

M. M. Schauer, S. R. Jefferts, S. E. Barlow, and G. H. Dunn. 1989, 4p

Grant NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 91, n8 p4593-4596, 15 Oct 89.

Keywords: *Chemical reaction, *Reaction kinetics, *Cryogenics, *Hydrogen, *Helium, *Ions, Dissociation, Reprints, Temperature dependence, Radiative transfer, Charge transfer.

The rate coefficients for radiative (RCT) and dissociative (DCT) charge transfer from He⁺ to H₂ at temperatures equal to or between 15 and 40 K were measured. The radiative charge transfer reaction was found to be essentially independent of temperature, while the rate coefficient for the dissociative reaction increases with increasing temperature in the temperature range. The results were compared with others and sources of uncertainty unique to the experiment were considered.

000,378

PB90-171067

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Alignment Effects Involving Multiple Pathways: Electronic Energy Transfer of Sr 5s6p (1)P(sub 1) with Rare Gases.

Final rept.

L. J. Kovalenko, R. L. Robinson, and S. R. Leone. 1989, 15p

Grants NSF-PHY86-04504, NSF-CHE83-08403

Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of the Chemical Society, Faraday Transactions 2 85, n8 p939-953 1989.

Keywords: *Strontium, Atomic energy levels, Electron transitions, Alignment, Helium, Xenon, Reprints, *Atom-atom collisions.

Orbital alignment effects and branching fractions have been measured for collisionally induced electronic energy transfer from the Sr5s6p singlet P(1) state to seven near-resonant states: 5s6p triplet P(2,1,0), 4d5p singlet D(2) and 4d5p triplet F(4,3,2). The measurements were carried out in a crossed-beam experiment using a pulsed, linearly polarized laser which propagates perpendicular to the initial average relative velocity vector of the collision partners. The results show remarkably high specificity in both the formation of product states and the alignment effects into each state.

000,379

PB90-171075

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Mechanism of Collisionally Induced Transitions among Fine-Structure Levels: Semiclassical Calculations of Alignment Effects in the Na-He System.

Final rept.

L. J. Kovalenko, S. R. Leone, and J. B. Delos. 1989, 13p

Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA.

Pub. in Jnl. of Chemical Physics 91, n11 p6948-6960, 1 Dec 89.

Keywords: *Sodium, Cesium, Helium, Atomic energy levels, Electron transitions, Alignment, Cross sections, Reprints, *Atom-atom collisions.

To gain insight into the mechanism of Na(3p) doublet P(3/2) --> doublet P(1/2) fine-structure transitions induced by collision with He, the authors monitor the expectation values of the orbital- and spin-angular momentum vectors, l and s, as a function of time along the trajectory, using a semiclassical formalism. In a typical collision, (s) remains nearly space-fixed while (l) precesses about the rotating internuclear axis. Thus, in the interaction region, the projection of (l) onto the internuclear axis, (lambda), remains nearly constant, and the molecular alignment of the orbital is preserved. It is shown how equations of motion for the classical analogues of these expectation values agree qualitatively with the quantum equations of motion. A qualitative comparison is also made with the Cs-He system for which the spin-orbit coupling is much stronger.

000,380

PB90-171117

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Translational and Internal State Distributions of NO Produced in the 193 nm Explosive Vaporization of Cryogenic NO Films: Rotationally Cold, Translationally Fast NO Molecules.

Final rept.

L. M. Cousins, R. J. Levis, and S. R. Leone. 1989, 12p

Sponsored by Army Research Office, Hanscom AFB, MA.
Pub. in Jnl. of Chemical Physics 91, n9 p5731-5742, 1 Nov 89.

Keywords: *Nitrogen oxide(NO), Solidified gases, Cryogenics, Films, Reprints, *Rotational states, Vibrational states, Multiphoton ionization, Multilayers, Time-of-flight method, Multi-photon processes.

The authors report the translational, rotational, and spin-orbit state distributions of fast NO molecules which are generated by the 193 nm laser vaporization of 30 K multilayer NO films. Rotational distributions in

nu = 0 are obtained by laser multiphoton ionization for five different velocities ranging from 900 to 2200 m/s, corresponding to translational energies (E(t) = 0.14 to 0.71 eV. In every case, the average molecular rotational energy is more than 10 times smaller than the component of translational energy normal to the surface.

000,381

PB90-183351

PC A07/MF A01

National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.

Thermophysical Properties of Helium-4 from 0.8 to 1500 K with Pressures to 2000 MPa.

Technical note.

V. D. Arp, and R. D. McCarty. Nov 89, 143p NIST-TN/1334

Also available from Supt. of Docs. as SN003-003-02991-2. Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center, Department of Defense, Washington, DC., and Department of the Air Force, Washington, DC.

Keywords: *Helium, *Thermophysical properties, *Thermodynamic properties, Tables(Data), Temperature, Density, Viscosity, Conductivity, Entropy, Enthalpy, Acoustic velocity, Energy levels.

Tabular summary data of the thermophysical properties of fluid helium are given for temperatures from 0.8 to 1500 K, with pressures to 2000 MPa between 75 and 300 K, or to 100 MPa outside of this temperature band. Properties include density, specific heats, enthalpy, entropy, internal energy, sound velocity, expansivity, compressibility, thermal conductivity, and viscosity. The data are calculated from a computer program which is available from the National Institute of Standards and Technology. The computer program is based on carefully fitted state equations for both normal and superfluid helium.

000,382

PB90-185109

PC A05/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Technical Activities 1989, Standard Reference Data Program.

M. W. Chase. Feb 90, 87p NISTIR-89/4216

See also PB90-161985.

Keywords: Physical properties, Chemical properties, Thermodynamics, Materials, *Chemical information systems, *Standard reference data, National Institute of Standards and Technology, Data bases, NSRDS system.

Standard Reference Data is a program office in the Technology Services, National Institute of Standards and Technology. Standard Reference Data develops and disseminates publications and databases of critically evaluated physical, chemical, and materials properties of substances. These publications and databases are available through NIST and private publications, on magnetic tape, PC diskettes, and from on-line retrieval systems. Standard Reference Data is responsible for management and coordination of the program. Work is carried out through a decentralized network of data centers and projects referred to as the National Standard Reference Data System (NSRDS). This volume summarizes the activities of the program for the year 1989.

000,383

PB90-187519

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Hg(1+) Single Ion Spectroscopy.

Final rept.

J. C. Bergquist, F. Diedrich, W. M. Itano, and D. J. Wineland. 1989, 5p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.

Pub. in Proceedings of Symposium on Frequency Standards and Metrology (4th), Ancona, Italy, September 5-9, 1988, p287-291 1989.

Keywords: *Mercury, *Spectroscopy, *Ions, Doppler effect, Quantum theory, Reprints.

A single Hg⁺ ion that is confined in an rf (Paul) trap can be laser cooled so that the amplitude of its motion is much less than a wavelength (the Dicke limit) for optical transitions. Recently, the technique of optical sideband cooling was used to reach the zero point of

motion. This realizes for the first time the fundamental limit of laser cooling for a bound atom and the ideal of an isolated atomic particle at rest in space to within the quantum mechanical limits imposed by the surrounding apparatus. In both limits, Doppler effects become negligible to all orders, the interrogation time is long and the fundamental shot noise detection limit of a single atom is readily attained.

000,384
PB90-187592 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Chemical Engineering Science Div.
**Experimental Measurement and Prediction of
Thermophysical Property Data of Carbon Dioxide
Rich Mixtures.**

Final rept.
J. F. Ely, and J. W. Magee. 1989, 11p
Pub. in Proceedings of Annual Convention of the Gas
Processors Association (68th), San Antonio, TX.,
March 13, 1989, p89-99.

Keywords: *Thermophysical properties, *Carbon dioxide, *Mixtures, *Gases, Transport properties, Measurement, Density(Mass/Volume), Specific heat, Equation of state, Mathematical models, Reprints, Temperature dependence, Pressure dependence, Comparative evaluation, Isochoric processes.

Comprehensive isochoric (p,Vm,T) measurements have been performed for six carbon dioxide-rich mixtures and pure carbon dioxide (CO₂). The nominal range of state points studied include those with densities from 1 to 24 mol/cu dm, temperatures from 220-400 K, and pressures to 35 MPa. In addition, direct measurements of the saturated liquid density and isochoric heat capacity of pure CO₂ have been performed. The measurements, combined with the studies of other investigators, have allowed the development of an accurate predictive equation of state model (DDMIX) for CO₂-rich mixtures. In the report the mixture measurements and present comparisons of the measurements with DDMIX are summarized. In addition, a new TRAPP-like model for the prediction of transport properties which is used in DDMIX is described.

000,385
PB90-187840 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Molecular Spectroscopy Div.
**Torsional-Rotational Spectrum and Structure of
the Formaldehyde Dimer.**

Final rept.
F. J. Lovas, R. D. Suenram, L. H. Coudert, T. A.
Blake, K. J. Grant, and S. E. Novick. 1990, 8p
Pub. in Jnl. of Chemical Physics 92, n2 p891-898, 15
Jan 90.

Keywords: *Rotational spectra, *Molecular structure, *Formaldehyde, Torsion, Deuterium, Hydrogen, Isotopic labeling, Microwave spectra, Fourier transformation, Dipole moments, Stark effect, Stereochemistry, Reprints, Dimers.

The microwave spectra of (H₂CO)₂ and (D₂CO)₂ have been observed with a pulsed beam, Fabry-Perot cavity, Fourier transform microwave spectrometer. Both species exhibit a-type spectra which are split by internal rotation of each monomer unit and an interchange of donor-acceptor bonding roles analogous to the water dimer. The geometry obtained from fitting the derived moments of inertia has the planes of the two monomer units perpendicular in a nearly antiparallel orientation of the CO groups with a center-of-mass distance of 3.046(17) Å. The shortest carbon to oxygen distance (2.98 Å) and hydrogen to oxygen distance (2.18 Å) between the monomer units are indicative of a dual bond interaction to form a ring structure.

000,386
PB90-187899 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Reactor Radiation Div.
**NBS (National Bureau of Standards) Crystal Data:
Database Description and Applications.**

Final rept.
A. D. Mighell, J. K. Stalick, and V. L. Himes. 1987,
10p
Pub. in Crystallographic Databases, p134-143 1987.

Keywords: *Crystallography, Chemical properties, Physical properties, Utilization, Data retrieval, Reprints, *Data base management, Evaluated data.

The NBS Crystal Data Center builds, evaluates and disseminates a large scientific database of evaluated

crystallographic, chemical and physical data. NBS CRYSTAL DATA, with information on all classes of crystalline materials, currently contains more than 115,000 entries and is expanding at the rate of approximately 7,000 entries per year. The data items in each entry have been critically evaluated, represented according to rigorous rules and transformed to standard forms. Additional data items have been derived from the literature data and strict adherence to specified formats has been ensured by extensive computer evaluation of the Database. As a result, all of the information in the Database can be accessed and used. Searches and statistical analyses can be carried out using a database management system and independent computer programs, and printed products can be prepared using typesetting software. NBS CRYSTAL DATA has been used extensively in industrial and academic laboratories. For example, the Database has played a vital role in the design of technologically important materials such as superconductors and lasers.

000,387

PB90-188202 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Thermophysics Div.

Relationship between the Carbon-Number of N-Paraffins and Their Solubility in Supercritical Solvents.

Final rept.
C. J. Peters, J. de Swaan Arons, A. H. Harvey, and
J. M. H. Levelt Sengers. 1989, 8p
Pub. in Fluid Phase Equilibria 52, p389-396 1989.

Keywords: *Supercritical flow, *Alkanes, *Solubility, *Solvents, *Carbon, Methane, Carbon dioxide, Natural gas liquids, Condensing, Molecular structure, Dew, Reprints, Carbon number.

A relationship is postulated between the solubility of liquid n-paraffins in supercritical solvents, such as methane and carbon dioxide, and the carbon number of the solute. The predictions of the simplified perturbed-hard-chain equation of state suggest that, at fixed temperature and pressure, the logarithm of the mole fraction of the solute varies linearly with the carbon number. A relation of this type is very useful for predicting supercritical solubility of long n-alkanes and retrograde condensation of natural gas. The thermodynamic considerations that lend support to the hypothesis are presented and agreement with available experimental data is shown.

000,388

PB90-188210 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Radiation Physics Div.

Magnetic Microstructure of Thin Films and Surfaces: Exploiting Spin-Polarized Electrons in the SEM and STM.

Final rept.
D. T. Pierce, M. R. Scheinfein, J. Unguris, and R. J.
Celotta. 1989, 10p
Pub. in Materials Research Society Symposia Proceedings 151, p49-58 1989.

Keywords: *Thin films, *Microstructure, *Magnetic storage, *Magnetic domains, *Surface properties, Electrons, *Magnetic materials, Reprints, *Polarization(Spin alignment), *Scanning electron microscopy, *Transmission electron microscopy.

Magnetic microstructure, that is the configuration of domains and domain walls in a magnetic material, is of both fundamental interest and of crucial importance for device applications. For example, the ultimate density of magnetic information storage is limited by the sharpness of a domain boundary. The magnetic microstructure of a thin film or surface depends sensitively on its physical structure which is strongly affected by sample preparation or growth. High resolution magnetization imaging is necessary to determine the domain configuration that occurs for a particular sample preparation and the changes that take place under external perturbations such as applied magnetic field, stress or temperature.

000,389

PB90-188228 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.

Progress and Pitfalls in Quantitative Surface Analysis by Auger-Electron Spectroscopy and X-ray Photoelectron Spectroscopy.

Final rept.
C. J. Powell. 1989, 11p
Pub. in New Developments and Trends in Surface Science, p1-11 1989.

Keywords: *Quantitative analysis, *Surface chemistry, *X ray analysis, Error analysis, Accuracy, Reprints, Auger electron spectroscopy, Photoelectron spectroscopy.

Auger-electron spectroscopy (AES) and x-ray photoelectron spectroscopy (XPS) are in widespread use for solving many types of scientific and technological problems. Most surface analyses made to date have been qualitative, but there is a growing demand for quantitative analyses, particularly with the availability now of data systems for commercial instruments. Although adequate repeatability is often achieved in analyses of AES and XPS, there are unfortunately many sources of systematic error that make credible accuracy statements very difficult. The principal systematic errors are associated with the complex morphology of typical specimens, with parameters of instrument performance, and with limitations of current methodology and data. The paper contains an overview of the pitfalls that exist in making quantitative surface analyses by AES and XPS and the progress that has been made in overcoming them.

000,390

PB90-188251 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Temperature and Pressure Div.

Broadening and Shifting of the Raman Q-Branch of HD.

Final rept.
G. J. Rosasco, A. D. May, W. S. Hurst, L. B. Petway,
and K. C. Smyth. 1989, 10p
Pub. in Jnl. of Chemical Physics 90, n4 p2115-2124
1989.

Keywords: *Hydrogen, *Raman spectra, Deuterium compounds, Energy transfer, Reprints, Line broadening, Vibrational states, Rotational states.

The line broadening and shifting of the vibrational Q-branch in pure HD has been measured for transitions J=0 to 3 at room temperature over the density range 0.8 to 10.6 amagat. The shifting and broadening coefficients have been determined with an uncertainty of plus or minus 0.002/cm/amagat, which now provides a discriminating test for various semiclassical and quantal theoretical calculations. The line broadening coefficients are compared with linewidth data from other spectroscopic branches and with measurements of the rates of state-to-state rotational energy transfer. Use of an exponential gap law for the rates of rotational energy transfer allows estimates to be made of the contributions to the line widths from rotationally inelastic, elastic vibrational dephasing, and elastic reorientation processes. This analysis suggests that rotational energy transfer occurs approximately 30% faster in v=1 than in v=0.

000,391

PB90-188285 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Metallurgy Div.

Gibbs-Thomson Equation for a Spherical Coherent Precipitate with Applications to Nucleation.

Final rept.
C. Rottman, P. W. Voorhees, and W. C. Johnson.
1988, 6p
Pub. in Scripta Metallurgica 22, n2 p293-298 Feb 88.

Keywords: *Precipitates, *Spheres, *Nucleation, Metals, Thermodynamic equilibrium, Interfaces, Surface chemistry, Shape, Coherence, Reprints, *Gibbs-Thomson equation, Radii.

The conditions necessary for thermodynamic equilibrium at the precipitate-matrix interface of a coherent spherical precipitate are derived and are corrected to the equilibrium conditions of Johnson and Alexander for a spherical precipitate in an isotropic matrix. These conditions were used to derive the dependence of the interfacial precipitate and matrix concentrations on precipitate radius (Gibbs-Thomson equation) for such a precipitate. In addition, the relationships are used to calculate the critical radius for the nucleation of a coherent misfitting precipitate.

000,392

PB90-188293

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.

Study of Vibronic Coupling in the tild C State of CO(+)(sub 2).

Final rept.

P. Roy, T. A. Ferrett, V. Schmidt, A. C. Parr, S. H. Southworth, J. E. Hardis, R. Bartlett, W. Trela, and J. L. Dehmer. 1987, 4p
Pub. in Jnl. de Physique 48, nC-9 p765-768 1987.

Keywords: *Carbon dioxide, Synchrotron radiation, Molecular energy levels, Reprints, Photoelectron spectroscopy, Forbidden transitions.

The authors have studied the issue of vibronic coupling in the vibrationally-resolved photoionization to the (C tilde) doublet Sigma (g)(+) state of CO2(1+) in the photon-energy range h(nu)=20-28.5 eV. The measurements use the SURF-II synchrotron radiation source at the National Bureau of Standards and high-resolution hemispherical electron analyzers equipped with area detectors. The angular distribution asymmetry-parameters (beta) for the allowed (C tilde)(0,0,0) and forbidden (c tilde)(1,0,1) (19,747 eV: binding energy) peaks are found to be quite different. However, similarities between the (C tilde)(1,0,1) curve and that for the (B tilde) state suggest that vibronic coupling to the (B tilde)(doublet Sigma(u)(+)) state of CO2(1+) is the explanation for the intensity of the (C tilde) state forbidden band.

000,393

PB90-188319

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Diode Laser Measurement of the (nu sub 3) Band of (14)CO(sub 2).

Final rept.

R. L. Sams, and J. R. DeVoe. 1988, 3p
Pub. in Jnl. of Molecular Spectroscopy 128, n1 p296-298 1988.

Keywords: *Diodes, *Carbon dioxide, *Lasers, *Infrared spectroscopy, Carbon 14, Reprints.

Diode laser infrared absorption measurements were made on the (14)CO2 v(sub 3) band. The results are v(sub 0) = 2225.80250(35)/cm and B(sub 00.0) = 0.3902528(8)/cm.

000,394

PB90-188335

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Spin Splittings in the (nu sub 3) Band of NO(sub 2).

Final rept.

R. L. Sams, and A. Fried. 1987, 11p
Pub. in Jnl. of Molecular Spectroscopy 126, n1 p129-139 1987.

Keywords: *Nitrogen dioxide, Atmospheric radiation, Band spectra, Line spectra, Infrared radiation, Reprints, Spin states, High resolution.

Spin splittings for several important atmospheric lines in the nu(3) band of NO2 have been measured by diode laser. An improved spin splitting program has been developed which takes into account the asymmetry effects in the lower K(a) splittings. The measured spin splittings and the derived spin-rotational constants are reported in the study to a much higher accuracy than previously achieved.

000,395

PB90-188343

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Determination of Column Selectivity Toward Polycyclic Aromatic Hydrocarbons.

Final rept.

L. C. Sander, and S. A. Wise. 1988, 5p
Pub. in Jnl. of High Resolution Chromatography and Chromatography Communications 11, n5 p383-387 1988.

Keywords: *Column packings, *Aromatic polycyclic hydrocarbons, Absorption, Water pollution, Polymers, Liquid phases, Thickness, Separation, Chemical analysis, Reprints, *Reversed flow, *Liquid chromatography.

An empirical test is described for the evaluation of column selectivity in reversed-phase liquid chromatog-

raphy. Using a test mixture of three polycyclic aromatic hydrocarbons (PAH), overall column selectivity toward PAH was assessed for various commercial C18 columns. Retention behavior was correlated to phase type (i.e., monomeric and polymeric surface modification chemistry) for custom synthesized phases. A classification scheme is proposed in which commercial columns are grouped into three classes based on retention behavior: monomeric-like, polymeric-like and intermediate phase selectivity toward PAH. Correlation of retention behavior (using the test mixture) with more general column properties (e.g., phase thickness) is discussed.

000,396

PB90-188376

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

High Resolution Infrared Spectrum of (28)SiH(sub 3)D from 1450 to 1710 cm(-1).

Final rept.

R. D. Schaeffer, R. W. Lovejoy, W. B. Olson, and G. Tarrago. 1988, 16p
Pub. in Jnl. of Molecular Spectroscopy 128, n1 p135-150 1988.

Keywords: *Infrared spectra, *Silane, Deuterium compounds, Fourier transformation, Rotational spectra, Labeled substances, Isotopic labeling, Reprints, Silicon 28.

The v2 and 2v6 infrared bands of (28)SiH3D have been recorded between 1450 and 1710/cm with 0.005/cm apodized spectral resolution using a Fourier transform spectrometer. Line assignments were made from J = 0 to 25 and K = 0 to 15 for the v2 band, from J = 0 to 20 and K = 0 to 13 for the 2v6(sup 0) band, and from J = 0 to 20 and K = 0 to 8 for the 2v7(sup 2) band. Very strong perturbations were observed in all three components of the triad system, including l-type interactions between 2v6(sup 0) and 2v6(sup 2) and Fermi interactions between v2 and 2v6. Observed transitions were fit using ground state constants, obtained from ground state combination differences, and upper state energy levels, obtained by diagonalizing an energy matrix including Fermi resonance terms between v2=1 and v6=2. Molecular coefficients and the method of determination are reported.

000,397

PB90-188392

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Systematics of Wetting at the Vapor-Liquid Interface.

Final rept.

J. W. Schmidt. 1988, 8p
Pub. in Jnl. of Colloid and Interface Science 122, n2 p575-582 1988.

Keywords: *Wetting, Surface chemistry, Air, Fluorohydrocarbons, Alcohols, Interfacial tension, Measurement, Mixtures, Carbinols, Transition temperature, Reprints, *Liquid-vapor interfaces.

The transition temperatures, Tw, from incomplete wetting to complete wetting at the air-liquid interface above five binary mixtures of a normal chain alcohol with the fluorocarbon perfluoromethylcyclohexane (C7F14) have been measured. Consolute temperatures Tc, contact angles and surface tensions were measured for each mixture. Tw decreases monotonically as the alcohol chain length increases from 1 (methanol) to 6 (n-hexanol). The mixture water (chain length-O) + C7F14 is anomalous with the lowest Tw (only an upper bound was obtained). From the measurements and a regular solution free energy, the lengths of the prewetting lines and the discontinuity in the derivative of the vapor-liquid surface tension at T - Tw were calculated and ranged from 38K (for ethanol + C7F14) to 99K (for n-hexanol + C7F14). The calculated discontinuities in the derivative ranged from 0.008 dy/cm K (for ethanol + C7F14) to 0.039 dy/cm K (for n-hexanol + C7F14) and are roughly correlated with the lengths of the prewetting lines.

000,398

PB90-188400

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.

Universal Adsorption at the Vapor-Liquid Interface Near the Consolute Point.

Final rept.

J. W. Schmidt. 1990, 6p
Pub. in Physical Review A 41, n2 p885-890, 15 Jan 90.

Keywords: Polarimetry, Adsorption, Reprints, *Methylcyclohexane, *Perfluoromethylcyclohexane, Liquid-vapor interfaces, Ellipsometry.

The ellipticity of the vapor-liquid interface above mixtures of methylcyclohexane (C7H14) plus perfluoromethylcyclohexane (C7F14) has been measured near the consolute point T(c)=318.6K. The data are consistent with a model of the interface that combines a short-ranged density-versus-height profile in the vapor phase with a much longer-ranged composition-versus-height profile in the liquid. The one parameter model profile fits the data well for reduced temperatures t=(T-T(c))/T(c) > 0.0007. The model predicts a maximum ellipticity at t=0.0007, which occurs at t=0.0002 in the experiment. The value of the free parameter produced by fitting the model to the data is consistent with results from two other simple mixtures and a mixture of a polymer and solvent. The experiment combines precision ellipsometry of the vapor-liquid interface with in situ measurements of refractive indices of the liquid phases, and it precisely locates the consolute point.

000,399

PB90-188434

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.

Separation of Hydrophilic Thiols Using Reversed-Phase Chromatography with Trihaloacetate Buffers.

Final rept.

D. Shea, and W. A. MacCrehan. 1988, 15p
Pub. in Jnl. of Chromatography 457, p111-125 Dec 88.

Keywords: *Separation, *Chromatography, *Halogen organic compounds, *Thiols, *Buffers(Chemistry), *Acetates, Column packings, Absorption, pH, Ionic mobility, Cysteine, Liquid phases, Vapor phases, Reprints, Reversed flow, Hydrophilicity, Retention, Ionic strength, Ion pairs, Gas chromatography, Liquid chromatography.

The reverse-phase retention behavior of several neutral and cationic hydrophilic thiols using trihaloacetic acid pairing agents is studied. Retention for cationic compounds increases with the size of the halogen substituent of the trihaloacetic acid. The effect of pH, ionic strength, pairing ion and counter ion concentration on retention of cysteine and other thiols is measured. The formation of mobile-phase ion-pairs is proposed as the mechanism of retention enhancement.

000,400

PB90-192279

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Two Photon Resonance Enhanced Multiphoton Ionization Spectroscopy of Gas Phase O(sub 2) a(sub 1)Delta(sub g) between 305-350 nm.

Final rept.

R. D. Johnson, G. R. Long, and J. W. Hudgens. 1988, 1p
Pub. in Jnl. of Chemical Physics 89, n6 p1079 1988.

Keywords: *Oxygen, *Electronic spectra, *Spectrum analysis, Mass spectroscopy, Ionization, Molecular energy levels, Reprints, *Multi-photon processes, Rydberg states.

The resonance enhanced multiphoton ionization (REMPI) spectrum of O2 a(sub 1)delta(sub g) between 295 micrometers and 350 micrometers is reported. The spectrum is compared to the REMPI spectrum of ground state molecular oxygen in the same electronic energy region and a number of differences in the respective spectra are observed. Detection limits for O2 a(sub 1)delta(sub g) by REMPI is calculated to be 5x10 to the 9th power/molecules/cubic cm in the ion source of the mass spectrometer.

000,401

PB90-192287

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Two Photon Resonance Enhanced Multiphoton Ionization Spectroscopy of the 3p(pi) D (2)II(sub r) (v' = 0, 1, 2)-X (2)II(sub r) (v' = 0) Bands of the Fluoromethylidene Radical between 355 and 385 nm.

Final rept.

R. D. Johnson, and J. W. Hudgens. 1987, 3p
Pub. in Jnl. of Physical Chemistry 91, n24 p6189-6191 1987.

Keywords: *Free radicals, *Spectrum analysis, *Electronic spectra, Ionization, Molecular vibration, Band

spectra, Reprints, *Carbon fluorides, *Multi-photon processes, Rydberg states.

The two-photon resonance enhanced multiphoton ionization spectrum between 355-385 micrometers of the $3p(\pi) D(\text{sup } 2)I(\text{sub } r)$ ($v=0,1,2$) - $X(\text{sup } 2)I(\text{sub } r)$ ($v=0$) band system of CF radical is reported. Three vibrational bands are rotationally analyzed and spectroscopic constants for the $D(\text{sup } 2)I(\text{sub } r)$ states are derived.

000,402
PB90-192295 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.
Rare Gas Interaction Energy Curves.
 Final rept.
 M. Krauss, R. M. Regan, and D. D. Konowalow.
 1988, 5p
 Pub. in Jnl. of Physical Chemistry 92, n15 p4329-4333 1988.

Keywords: *Rare gases, *Atomic energy levels, Hartree-Fock approximation, Van der Waals equation, Dispersion relations, Perturbation theory, Reprints, *Atomic models, *Dimers, *Atomic interactions, Self-consistent field, Interatomic forces.

Interaction energy curves for all the heteronuclear rare gas dimers including He to Xe are calculated as the sum of the exchange repulsion and the attractive interatomic correlation energy between the atoms. The self-consistent-field (SCF) method represents the repulsion and a perturbation method is used to calculate a dispersion energy which takes account of the overlap of the atoms. The effect of overlap is to reduce or damp the dispersion energy. The hybrid model yields binding energies that are in the range of 75% to 90% of experimental values. The differences are due to slow convergence of the damped dispersion energy and to the difficulty in obtaining Hartree-Fock limit energy curves within 1/cm accuracy. The comparable accuracy for the binding energies over a range of atoms for He to Xe suggests that the model correctly represents the dominant energy terms. The model is generally applicable since it depends on the polarization behavior of the fragments for the dispersion calculation and SCF energies which can be more accurately calculated in routine calculation.

000,403
PB90-192428 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Chemiluminescence Instrumentation for Fuel and Lubricant Oxidation Studies.
 Final rept.
 P. Pei, S. M. Hsu, S. Weeks, and R. Lawson. 1989, 7p
 Pub. in Lubrication Engineering 45, n1 p9-15 1989.

Keywords: *Oxidation, *Fuels, *Lubricants, *Chemiluminescence, *Lubricating oils, Laboratory equipment, Design criteria, Performance evaluation, Continuous sampling, Chemical properties, Fuel storage, Lubrication systems, Reprints, *Stability tests, Fuel tests, Lubricating properties, Lubricant tests.

Chemiluminescence is a rapid, versatile and nonintrusive technique for continuous monitoring rates of oxidation. It is ideal to observe the oxidation properties of a lubricating base oil and additive package combination under storage and service conditions directly or by simulating engine conditions. In the paper, a chemiluminescence apparatus is designed with the sole purpose to study the oxidation stability of lubricants or fuel. The effects of the general parameters to optimize the apparatus have been examined. These parameters include temperature, film thickness, atmosphere control, sample introduction, spectral bandpass, the use of energy transfer agent, and the surface catalytic effect. Preliminary experimental results are very promising and show that the apparatus and CL method are versatile and suitable for oxidation studies.

000,404
PB90-192519 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Measurement of Diffusion Coefficients by DC and EHD Electrochemical Methods.
 Final rept.
 B. Robertson, B. Tribollet, and C. Deslouis. 1988, 6p
 Pub. in Jnl. of the Electrochemical Society 135, n9 p2279-2284 Sep 88.

Keywords: *Electrohydrodynamics, *Diffusion coefficients, *Electrochemistry, Schmidt number, Comparison, Iron cyanides, Mass transfer, Electrodes, Reprints, *DC systems, Rotating disks.

The electrohydrodynamic (EHD) method of measuring the Schmidt number is compared carefully with the DC method using a rotating disk electrode. Ferricyanide and ferrocyanide ions in 1 M potassium chloride are used for the comparison. The best agreement between the two methods occurs when the EHD measurement is done at a low disk velocity.

000,405
PB90-192600 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Biological Thermodynamic Data for the Calibration of Differential Scanning Calorimeters: Heat Capacity Data on the Unfolding Transition of Ribonuclease A in Solution.
 Final rept.
 F. P. Schwarz, and W. H. Kirchoff. 1988, 29p
 Pub. in Thermochemica Acta 128, p267-295 1988.

Keywords: *Thermodynamics, *Specific heat, *Differential scanning calorimetry, Enthalpy, Pancreas, Reprints, *Pancreatic ribonuclease.

Extensive measurements of the heat-capacity changes accompanying the unfolding transition of bovine pancreatic ribonuclease A in buffered aqueous solutions have been performed in a differential scanning calorimeter over a range of experimental conditions. The concentration of ribonuclease A varied from about 1 mass % to 2 mass %. The pH varied from 1.8 to 5.0 at two glycine-HCl buffer concentrations: 0.1 M and 0.2 M. Measurements were made on ribonuclease A obtained from various commercial sources. The heat capacity data were corrected for the thermal lag of the instrument and fit by least squares to a two-state model to determine the transition enthalpy and temperature, the baseline heat-capacity change, and the cooperativity of the transition. The transition temperature T_m and enthalpy ΔH_m determined from the fit of a two-state model to the transition profile increased linearly with pH from $311.9 + 0.5K$ and $308.2 + 6.4 \text{ kJ/mol}$ at $pH=2$ to $335.4 + .6 K$ and $408.9 + 6.6 \text{ kJ/mol}$ at $pH=4$, where the uncertainties represent two standard deviations based on a linear least squares fit of ΔH_m and T_m to pH. Values of T_m and ΔH_m were independent of the commercial source of ribonuclease A. T_m was independent of the buffer concentration but showed a slight dependence on the concentration of ribonuclease A.

000,406
PB90-192618 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Mechanisms of Condensation of Biaryl Hydrocarbons.
 Final rept.
 V. P. Senthinathan, and S. E. Stein. 1988, 8p
 Pub. in Jnl. of Organic Chemistry 53, n13 p3000-3007 1988.

Keywords: *Reaction kinetics, *Pyrolysis, *Condensation reactions, *Aromatic hydrocarbons, Free radicals, Naphthalene, Anthracene, Isomerization, Dissociation, Reprints, *Chemical reaction mechanisms.

Results of kinetic studies of the condensed phase thermal reactions of the following biaryl hydrocarbons are reported; 1,1'-binaphthyl, 1,2'-binaphthyl, 1-phenylanthracene and 9-phenylanthracene. Condensation generally occurred in parallel with both isomerization and dissociation and rates depended on concentrations of hydrogen donors. In order to simplify mechanisms, detailed studies used donors capable of providing just one H-atom. These donors were xanthene, fluorene and diphenylmethane. A mechanism is proposed in which the key intermediates of all reactions are radicals created H-atom transfer to the biaryls. In the condensation of naphthyl-containing biaryls, it is suggested that reactions are initiated by H-transfer to a remote position. According to this model, the resulting radical then cyclizes by simple intramolecular radical attack.

000,407
PB90-192634 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Characterization of Ultrathin Pt Overlayers Deposited on a W(110) Surface.

Final rept.
 S. M. Shivaprasad, R. A. Demmin, and T. E. Madey. 1988, 5p
 Pub. in Thin Solid Films 163, p393-397 Sep 88.

Keywords: *Platinum, *Tungsten, Thin films, Electron diffraction, Desorption, Surface chemistry, Crystal growth, Carbon monoxide, Annealing, Catalysts, Metal films, Reprints, Characterization, Auger electron spectroscopy, Temperature programmed desorption, Low energy electron diffraction.

The growth of Pt overlayers (sub-monolayer to multiple layer coverages) on a clean W(110) surface are studied by Auger Electron Spectroscopy (AES) and Temperature Programmed Desorption (TPD). Based on Auger peak amplitudes, thermally evaporated Pt appears to grow in the Frank-van der Merwe mode on W(110), at least for the first few layers. Annealing of Pt deposited at 90K shows distinct changes in Auger ratios and adsorption states of molecular CO, providing evidence for changes in the electronic and structural properties of the overlayers. TPD of CO combined with the AES measurement suggest that annealing induces either agglomeration of the Pt atoms into large islands with a small cluster density, or the formation of a surface Pt/W alloy. Annealing above 1500K produces a stable monolayer of Pt on the W surface for all initial Pt coverages 1 monolayer. Preliminary low Energy Electron Diffraction (LEED) studies are consistent with the observed trends in the structure of the Pt-overlayers on W(110).

000,408
PB90-192709 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.
Resonance Structure in the Vibrationally Resolved Photoelectron Branching Ratios and Angular Distributions of the $2\pi(-1)$ Channel of NO.
 Final rept.
 S. H. Southworth, J. L. Dehmer, J. E. Hardis, and A. C. Parr. 1987, 6p
 Pub. in Jnl. of Chemical Physics 87, n9 p5125-5130 1987.

Keywords: *Nitrogen oxide(NO), Synchrotron radiation, Angular distribution, Reprints, Photoelectron spectroscopy, Branching ratio, Vibrational states, Autoionization, Rydberg states.

The authors report on vibrationally resolved measurements of photoelectron angular distribution and branching ratios for $\text{No}(1+)$ using synchrotron radiation over $h(\nu) = 11.5-26 \text{ eV}$. Normally weak vibrational levels are strongly enhanced below 18 eV, and the photoelectron asymmetry parameters and branching ratios display a vibrationally dependent, broad spectral structure over $h(\nu)$ approximately = 11-18 eV. These observations may reflect the presence of the expected shape resonance; however, various interchannel coupling mechanisms may also be involved. Resonance structure in the photoelectron asymmetry parameters is also observed in the $h(\nu)$ approximately = 19-22 eV region. The structure is likely associated with Rydberg excitations.

000,409
PB90-192733 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Calculation of the Anisotropy of Equilibrium Surface Composition in Metallic Solid Solutions Using the Embedded Atom Method.
 Final rept.
 D. A. Steigerwald, and P. Wynblatt. 1988, 17p
 Pub. in Surface Science 193, n1-2 p287-303 1988.

Keywords: *Solid solutions, Chemical equilibrium, Chemical composition, Metals, Mathematical models, Embedding, Separation, Enthalpy, Crystal structure, Anisotropy, Reprints, *Surface composition, Embedded atom method.

A new model is developed to account for the anisotropy of the equilibrium surface composition of dilute alloys. The anisotropy is assumed to result from the existence of a distribution of different surface sites, each of which may possess a unique enthalpy of segregation. The model relies on the hypothesis that any given surface, with an orientation parallel to a plane having Miller indices (kkl), may be synthesized from atoms distributed among terrace, step, and kink sites.

The types and surface densities of surface sites in a given (kk1) surface are evaluated by means of an existing microfacet notation. An enthalpy of segregation for a surface composed of specified fractions of terrace, step, and kink sites. The model is compared and contrasted with other approaches which have been used to evaluate the anisotropy of surface composition.

000,410

PB90-193501 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Total Molecular Surface Area as a Predictor for Reversed-Phase High Performance Liquid Chromatography in Various Organotin Systems.

Final rept.
E. J. Tierney, J. M. Bellama, G. Eng, F. E. Brinckman, and R. B. Johannesen. 1988, 9p
Pub. in *Jnl. of Chromatography* 441, n2 p229-237 1988.

Keywords: *Tin organic compounds, Separation, Logarithm functions, Numerical analysis, Linear systems, Experimental design, Reprints, *High performance liquid chromatography, *Surface area, *Molecular liquids.

Various organotin compounds were separated using a reverse bonded C-18 column with a 93% methanol - 7% water mobile phase. Both holistic total surface area (TSA) calculations and assembly of molecular TSA's from addition of 'mean functional groups and atom' TSA values were employed in the study. A significant linear correlation was obtained between the natural logarithms of the capacity factor and the TSA values for both fluxional and rigid organotin systems. Although the two systems could not be intercorrelated, tie-lines could be drawn between them. The use of these tie-lines enable the predictions of unreported compounds.

000,411

PB90-193327 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Laser-Enhanced Ionization Spectroscopy in Flames and Plasmas.

Final rept.
G. C. Turk. 1987, 5p
Pub. in *Jnl. of Analytical Atomic Spectroscopy* 2, n6 p573-577 1987.

Keywords: *Spectroscopy, *Lasers, *Ionization, *Plasmas(Physics), Fluorescence, Crude oil, Reprints.

Recent progress in the area of laser-enhanced ionization (LEI) is reviewed. Among the topics discussed are: the use of LEI for petroleum analysis, three-dimensional double resonance LEI spectra, and the optical detection of LEI by means of laser-induced ionic fluorescence.

000,412

PB90-193442 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Comparison of the Optoacoustic and Hg Tracer Methods for the Study of Energy Transfer Processes in Gas Mixtures.

Final rept.
T. J. Wallington, W. Braun, K. M. Beck, and R. J. Gordon. 1988, 4p
Pub. in *Jnl. of Physical Chemistry* 92, n13 p3839-3842 1988.

Keywords: *Energy transfer, Sulfur hexafluoride, Argon, Comparison, Reprints, *Gas mixtures, Acousto-optics, Pentafluorobenzene, Mercury tracer technique.

Rates of energy transfer from vibrationally excited SF₆ and pentafluorobenzene to argon in the gas phase have been studied using the Hg tracer technique and time-resolved optoacoustics. These two techniques which rely on fundamentally different physical principles were found to give equivalent results. The implications for the study of energy transfer processes in gas mixtures are discussed.

000,413

PB90-193459 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Correlation between Gas Phase and Solution Phase Reactivities of Hydroxyl Radicals Towards Saturated Organic Compounds.

Final rept.
T. J. Wallington, P. Dagaut, and M. J. Kurylo. 1988, 5p
Pub. in *Jnl. of Physical Chemistry* 92, n17 p5024-5028 1988.

Keywords: *Organic compounds, *Vapor phases, *Liquid phases, *Reaction kinetics, Comparison, Linear systems, Liquid saturation, Photolysis, Reprints, *Hydroxyl radicals, *Chemical reaction mechanisms, Resonance fluorescence.

The gas phase and aqueous solution phase reactivities of hydroxyl radicals (OH) with a wide variety of organic compounds are compared. When kinetic data are available for the same reaction occurring in both phases, this comparison provides useful information about the reaction mechanism. Through this comparison the authors can demonstrate a linear correlation between the gas/solution phase OH reactivities for numerous saturated organic compounds. The empirical relationship can be used together with mechanistic information to estimate the OH reactivity in one phase from the measured rate constant in the other. In order to develop and extend the correlation, they have used the flash photolysis resonance fluorescence technique to measure rate constants for the gas phase reactions of OH radicals with methanol-d₄; ethanol-d₆; 2-chloroethanol; 2,2,2-trichloroethanol; 2,2,2-trifluoroethanol; acetone-d₆; 1,1,1-trifluoroacetone; and 1,2-butylene oxide at 298 K. The results are reported herein.

000,414

PB90-193467 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Gas-Phase Reactions of Hydroxyl Radicals with the Fuel Additives Methyl Tert-Butyl Ether and Tert-Butyl Alcohol Over the Temperature Range 240-440 K.

Final rept.
T. J. Wallington, P. Dagaut, R. Liu, and M. J. Kurylo. 1988, 3p
Pub. in *Environmental Science and Technology* 22, n7 p842-844 1988.

Keywords: *Reaction kinetics, *Butanols, Fuel additives, Exhaust emissions, Photolysis, Air pollution, Reprints, *Hydroxyl radicals, *Atmospheric chemistry, *Ether/methy-butyl, Resonance fluorescence.

Methyl-tert-butylether (MTBE) and tert-butylalcohol (TBA) are widely used as motor fuel additives to increase the octane number and to reduce CO emissions. Since their reaction with hydroxyl radicals (OH) is a major loss process for these oxygenated species in the atmosphere, the authors have conducted a flash photolysis resonance fluorescence study of the kinetics of the reactions of OH radicals with MTBE and TBA and report the results of these measurements here. Experiments were performed over the temperature range 240-440K at total pressures (using Ar diluent gas) between 25-50 torr. The implications of these results for the atmospheric chemistry of MTBE and TBA are discussed.

000,415

PB90-205790 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

FTS Infrared Measurements of Alkali Halides in the Gas Phase: Rubidium Fluoride and Cesium Fluoride.

Final rept.
A. G. Maki, and W. B. Olson. 1990, 5p
Pub. in *Jnl. of Molecular Spectroscopy* 140, p185-189 1990.

Keywords: *Infrared spectroscopy, Vapor phases, Molecular vibration, Vibrational spectra, Molecular rotation, Reprints, *Fourier transform spectrometers, *Cesium fluorides, *Rubidium fluorides, Alkali halides.

High-resolution Fourier transform spectroscopy measurements have been made on rubidium fluoride and cesium fluoride vapor in the region of the fundamental vibrational bands between 290 and 360 cm⁻¹. The measurements were made at temperatures between 1020 and 1180 K. Vibrational transitions covering the range from $\nu = 1-0$ to $\nu = 9-8$ were observed. Dunham potential and rovibrational constants were determined for CsF and for (85) RbF and (87) RbF.

000,416

PB90-205824 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Sputtering-Induced Surface Roughness of Metallic Thin Films.

Final rept.
D. Marton, and J. Fine. 1990, 12p
Pub. in *Thin Solid Films* 185, p79-90 1990.

Keywords: *Metal films, Thin films, Surface roughness, Sputtering, Interfaces, Nickel, Chromium, Silver, Light scattering, Reprints, Depth profile, Auger electron spectroscopy.

Changes in surface microtopography which often occur during sputter depth profile analysis can significantly affect the measured depth resolution of interfaces. To understand better the importance of the roughening effect on interface analysis, correlated measurements of surface roughness obtained while Auger sputter depth profiling thin metallic multilayered systems (Ni/Cr, Ag/Ni and chromium oxide/Cr) with the observed Auger interface widths. The r.m.s. roughness of the surfaces was measured, in situ, using optical total integrated scattering (TIS) techniques. The surface roughness increases with sputtered depth as well as with the energy of the impacting ions. The TIS measurements of r.m.s. roughness are in good agreement with the interface widths obtained from the Auger depth profiles and with the predictions of a statistical sputtering model. At elevated temperatures, 373 and 473 K, a slight decrease is observed in the surface roughness of Ag/Ni thin films, probably as a result of surface diffusion: such materials sputtered at yet higher temperatures (576 and 673 K) become rougher, probably because of recrystallization processes.

000,417

PB90-205840 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Precision, Accuracy, and Uncertainty in Quantitative Surface Analyses by Auger-Electron Spectroscopy and X-ray Photoelectron Spectroscopy.

Final rept.
C. J. Powell, and M. P. Seah. 1990, 29p
Pub. in *Jnl. of Vacuum Science and Technology A* 8, n2 p735-763 Mar/Apr 90.

Keywords: *Surface chemistry, *Quantitative analysis, *X ray spectroscopy, Performance evaluation, Error analysis, Reprints, *Auger electron spectroscopy, *Photoelectron spectroscopy.

A quantitative surface analysis by Auger-electron spectroscopy (AES) or x-ray photoelectron spectroscopy (XPS) requires a series of operations that typically includes instrument setup, specimen positioning, data acquisition, data manipulation, and data analysis. These operations involve a sequence of measurements which are combined and/or compared with other data to yield an analysis. The final result has an estimated uncertainty that reflects the sum of the separate random and systematic errors in the various measurements and sources of data. The authors identify the major steps in typical analyses and comment on the major sources of error leading to estimates of uncertainty. Systematic errors generally exceed those of a random nature and are associated with the complex morphology of typical specimens, with parameters of instrument performance, and with limitations of current methodology and data. They review general measurement principles for surface analysis, the development of a suitable analytical strategy, and identify and discuss many of the sources of error. The discussion is specific to AES and XPS but many of the issues are relevant to other techniques of surface analysis. Finally, two examples are presented to illustrate the sources and magnitudes of some of the errors and the final uncertainties in some common examples of surface analyses.

000,418

PB90-205915 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.

Crossover from Singular Critical to Regular Classical Thermodynamic Behavior of Fluids.

Final rept.
Z. Y. Chen, P. C. Albright, and J. V. Sengers. 1990, 17p

Contract DE-FG05-88ER13902
Sponsored by Department of Energy, Washington, DC.

Pub. in Physical Review A 41, n6 p3161-3177, 15 Mar 90.

Keywords: *Thermodynamics, Free energy, Critical point, Carbon dioxide, Steam, Ethylene, Fluids, Reprints.

A procedure is presented for constructing a thermodynamic free energy for fluids in the critical region that incorporates the crossover from Ising-like singular behavior near the critical point to regular classical behavior far away from the critical point. The procedure is based on an approximation of the solution of the renormalization-group theory of critical phenomena, modified to include effects from a cutoff wave number for the crossover to the classical limit. As an illustration, the authors show how the procedure can be applied to a truncated classical Landau expansion. The results are compared with experimental thermodynamic-property data for carbon dioxide, steam, and ethylene in the critical region.

000,419

PB90-206004 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD, Molecular Spectroscopy Div.

Microwave Spectrum and Electric Dipole Moment of Ne-HF.
Final rept.

G. T. Fraser, and R. D. Suenram. 1990, 6p
Pub. in Jnl. of Molecular Spectroscopy 140, p141-146 1990.

Keywords: *Hydrogen fluoride, *Neon, *Microwave spectroscopy, *Dipole moments, Electric moments, Complex compounds, Hydrogen bonds, Rotational spectra, Reprints, *Fourier transform spectrometers, Van der Waals forces.

Rotational spectra of (20)Ne-HF and (22)Ne-HF have been measured using a pulsed-nozzle Fourier-transform microwave spectrometer. The $J = 2-1$ and $1-0$ transitions were observed, yielding $B(\text{sub } 0) = 4514.0949(15)$ MHz, $D(\text{sub } J) = 0.59889(19)$ MHz, and $\mu = 0.3882(21)$ D for (20)Ne-HF and $B(\text{sub } 0) = 4318.53739(93)$ MHz, $D(\text{sub } J) = 0.54021(12)$ MHz, and $\mu = 0.3917(13)$ D for (22)Ne-HF. The measured dipole moments provide an estimate of $\langle (P(\text{sub } 1)\cos\Theta) \rangle = 0.21$ which can be related to the anisotropy of the Ne-HF intermolecular potential.

000,420

PB90-206129 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD, Reactor Radiation Div.

Neutron Scattering Studies of Potassium-Ammonia Layers in Graphite.
Final rept.

H. Zabel, and D. A. Neumann. 1988, 6p
Pub. in Canadian Jnl. of Chemistry 66, n4 p666-671 1988.

Keywords: *Graphite, *Neutron scattering, *Ammonia, *Molecular structure, *Potassium, Dynamic properties, Mathematical models, Diffusion, Molecular rotation, Ions, Reprints, *Clathrates.

Neutron scattering investigations of the structural and dynamical properties of ammonia molecules in the stage 1 compound $\text{KC}_{24}(\text{NH}_3)_{4.3}$ are discussed. The K-NH₃ intercalate layers represent the two-dimensional analogue of the well known metal-ammonia solutions. At room temperature the intercalate liquid structure factor can be described by a model in which the K-ions are surrounded on the average by four NH₃ molecules, and the remaining molecules are essentially free. Quasi-elastic neutron scattering revealed two independent rotational motions of the NH₃ molecule, one associated with the rotation about the C₃ symmetry axis and the other one about the K-ions. Above 200K also translational diffusion becomes noticeable. The phonon dispersion of the (OOq) longitudinal modes show clear signs of a phonon-libron coupling which causes the acoustic branch to split.

000,421

PB90-206145 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD, Ceramics Div.

X-ray Line Broadening Study on Shock-Modified Hematite.
Final rept.

Y. Zhang, J. M. Stewart, B. Morosin, R. A. Graham, and C. R. Hubbard. 1988, 8p
Pub. in Advances in X-ray Analysis 31, p287-294 1988.

Keywords: *Hematite, *X ray diffraction, *Line width, Strain measurement, Size determination, Shock tests, Revisions, Crystal structure, Crystal lattices, Reprints.

Hematite ($\alpha\text{-Fe}_2\text{O}_3$) powder compacts have been subjected to controlled, quantitative high pressure shock loading at peak pressures from 8-27 GPa and preserved for post shock analysis. The broadened x-ray diffraction peak profiles have been analyzed to determine the residual lattice strain and the coherent crystallite sizes. Maximum modification effects are observed near 17 GPa with strain values near .003 and size values near 200 Å suggesting annealing at higher shock pressure, resulting from the higher shock temperature.

000,422

PB90-206673 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD, Ceramics Div.

Computerization of the ICDD Powder Diffraction Database Critical Review of Sets 1 to 32(1).
Final rept.

W. Wong-Ng, C. R. Hubbard, J. K. Stalick, and E. H. Evans. 1988, 7p
Pub. in Powder Diffr. 3, n1 p12-18 1988.

Keywords: *Crystallography, *Information systems, Automation, Reprints, Data bases.

The Powder Diffraction File of crystallographic data has been converted from printed data cards to a computer database. Extensive testing, review, and editing of the database was completed, the history and first stages of which are presented. Computer programs used to create and analyze the database are described.

000,423

PB90-206806 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Time and Frequency Div.

Heterodyne Frequency Measurements on OCS Near 61.76 THz (2060 cm⁻¹).
Final rept.

J. S. Wells, M. Schneider, and A. G. Maki. 1990, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC, Office of Atmospheric Research.
Pub. in Jnl. of Molecular Spectroscopy 140, p170-176 1990.

Keywords: *Infrared spectroscopy, *Demodulation, Calibrating, Frequencies, Spectrum analysis, Reprints, *Carbon oxysulfide, *Fourier transform spectrometers, *Heterodyning.

Heterodyne measurements have been made on the $10(\text{sup } 0)0-00(\text{sup } 0)0$ and $11(\text{sup } 1)0-01(\text{sup } 1)0$ bands of $(16)\text{O}(12)\text{C}(32)\text{S}$ and $(16)\text{O}(13)\text{C}(32)\text{S}$ and the $10(\text{sup } 0)0-00(\text{sup } 0)0$ band of $(16)\text{O}(12)\text{C}(34)\text{S}$. These measurements were combined with earlier frequency measurements and Fourier transform measurements to obtain accurate calibration frequencies for the regions 1985 to 2085 and 2550 to 2600/cm.

000,424

PB90-206830 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Unstable Periodic Orbits, Recurrences, and Diffuse Vibrational Structures in the Photodissociation of Water Near 128 nm.
Final rept.

K. Weide, K. Kuhl, and R. Schinke. 1989, 10p
Pub. in Jnl. of Chemical Physics 91, n7 p3999-4008, 1 Oct 89.

Keywords: *Water, Absorption spectra, Reprints, *Photodissociation, Vibrational states, Periodic orbits.

The photodissociation of H₂O in the second absorption band (Chi tilde->Beta tilde) is investigated in a completely time-dependent approach. The Schrodinger equation is solved by a time-dependent close-coupling method expanding the two-dimensional wave packet in terms of free rotor states. The vibrational degree of freedom of the OH fragment is fixed and only motion on the Beta tilde-state potential-energy surface is considered. The existence of unstable periodic orbits leading to a recurrence of the autocorrelation function gives, for the first time, a consistent explanation of the diffuse structure in the absorption spectrum of H₂O in the second band.

000,425

PB90-206897 Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO, Time and Frequency Div.

Heterodyne Frequency Measurements of (12)C(16)O Laser Transitions Near 2050 cm⁻¹.
Final rept.

M. Schneider, J. S. Wells, and A. G. Maki. 1990, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Molecular Spectroscopy 139, p432-438 1990.

Keywords: *Carbon monoxide, *Infrared spectroscopy, *Demodulation, Calibrating, Frequencies, Spectrum analysis, Tables(Data), Doppler effect, Molecular vibration, Molecular rotation, Reprints, *Laser spectroscopy, *Fourier transform spectrometers, *Heterodyning.

New heterodyne frequency measurements of $(12)\text{C}(16)\text{O}$ laser transitions were made in the 1995 to 2082/cm (59.81 to 62.39 THz) region. Frequencies of 23 transitions (with lower vibrational quantum numbers, ν double prime, ranging from 1 to 4) were measured. New constants for these low-lying vibrational levels were determined by fitting these data (along with sub-Doppler measurements by Pollock et al., rotational transition measurements, and FTS measurements from Guelachvili et al. to the Dunham expression. Frequency calibration tables calculated from these new constants are reported. These tables provide accurate transition frequencies for the CO laser stabilized to the Doppler-broadened gain profile.

000,426

PB90-206905 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Rotational Distributions in the Photodetachment of IHI(1-) and in the I + HI Reaction: The Influence of IHI Transition State Resonances.
Final rept.

G. C. Schatz. 1989, 7p
Grant NSF-CHE87-15581
Sponsored by National Science Foundation, Washington, DC.
Pub. in Israel Jnl. of Chemistry 29, p361-367 1989.

Keywords: *Molecular rotation, *Molecular energy levels, *Hydrogen iodide, Ionization, Chemical reactions, Spectrum analysis, Reprints, *Photodetachment, *Franck-Condon principle, Rotational states, Coupled channel theory, Resonance scattering.

Franck-Condon factors which determine IHI-photodetachment spectra have been calculated using a three-dimensional coupled-channel reactive scattering program. These Franck-Condon factors show peaks as a function of energy that are in reasonable agreement with measured spectra due to Neumark and co-workers. Some of these peaks are due to IHI transition state resonances and others are due to direct scattering reactive threshold effects. An analysis of the rotational distributions associated with the Franck-Condon factors indicates that when direct scattering is dominant, the distributions peak at the rotational state which is nearest to its effective reaction threshold. At energies where IHI transition state resonances are important, the rotational distribution changes, thus providing a characteristic signature of resonance formation. The I + HI bimolecular rotational distributions are also considered, and they also show important differences between direct and resonant energies.

000,427

PB90-206939 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Quantum Physics Div.

Observation of the NF(2+) Dication in the Electron Impact Ionization Mass Spectrum of NF(sub 3).
Final rept.

S. A. Rogers, P. J. Miller, S. R. Leone, and B. Brehm. 1990, 4p
Grant AFOSR84-0272
Sponsored by Air Force Weapons Lab., Kirtland AFB, NM.
Pub. in Chemical Physics Letters 166, n2 p137-140, 16 Feb 90.

Keywords: *Nitrogen fluorides, Mass spectroscopy, Ionization, Chemical radicals, Reprints, Electron impact, Dication.

The NF(2+) dication has been experimentally observed for the first time by electron impact ionization of NF₃ followed by mass analysis of the ionization prod-

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Physical & Theoretical Chemistry

ucts. The direct detection of $NF(2+)$ by mass spectrometry indicates that the dication species is kinetically stable, in agreement with recent ab initio molecular orbital calculations. A lower limit for the $NF(2+)$ lifetime is obtained (\approx or $>$ 10 microseconds) along with its appearance energy (43.8 + or - 1.0eV) in the electron impact ionization of NF_3 .

000,428

PB90-206988 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div. **Spectrum and Energy Levels of Six-Times-Ionized Molybdenum (Mo VII)**.

Final rept.
J. Reader, and U. Feldman. 1990, 13p
Sponsored by Department of Energy, Washington, DC., and Naval Research Lab., Washington, DC.
Pub. in Jnl. of the Optical Society of America B 7, n3 p253-265 Mar 90.

Keywords: Ultraviolet spectroscopy, Hartree-Fock approximation, Quantum numbers, Energy levels, Ionization, Reprints, *Molybdenum ions.

The spectrum of the krypton-like ion Mo VII was observed from 140 to 2274 Å with sliding-spark discharges on 10.7-m normal- and grazing-incidence spectrographs. Experimental energies were determined for all levels of the $4s(2)sp(6)$, $4s(2)4p(5)4d$, $4f$, $5s$, $5p$, $5d$, $5f$, $5g$, and $4s(4)p(6)4d$ configurations. A few levels of the $4s(2)4p(4)d(3)$ configuration were also found. A total of 399 lines were classified as transitions between 86 observed levels. The observed configurations were theoretically interpreted. The energy parameters determined by least-squares fits to the observed levels are compared with Hartree-Fock calculations. A revised value of the ionization energy was obtained by using the energy of the $4p(5)5g$ configuration together with an isoelectronically extrapolated value of the effective quantum number $n^*(5g)$. The adopted limit is $1\ 013\ 340 \pm$ or $-200/cm$ (125.64 + or - 0.02 eV).

000,429

PB90-206996 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Modified Leung-Griffiths Model for Vapor-Liquid Equilibria: Application to Polar Fluid Mixtures.

Final rept.
J. C. Rainwater, and J. J. Lynch. 1989, 11p
Sponsored by Department of Energy, Washington, DC.
Pub. in Fluid Phase Equilibria 52, p91-101 1989.

Keywords: *Mathematical models, *Critical point, Revisions, Polarization (Charge separation), Methyl alcohol, Butanols, Ethyl ether, Reprints, *Liquid-vapor equilibrium, *Binary-fluid systems, *Binary mixtures, *Leung-Griffiths model, Freons.

The Leung-Griffiths model as modified by Moldover and Rainwater has proven successful for correlation of critical-region vapor-liquid equilibria (VLE) surfaces of many binary nonpolar fluid mixtures. In this work the model is applied to four binary mixtures of polar fluids: diethyl ether + n-butanol and methanol + n-butanol as measured by Kay and Donham and the refrigerant mixtures R13B1 + R114 and R22 + R114 as measured by Uematsu, Watanabe and co-workers. The model provides accurate correlations of the polar mixtures, although the number of required adjustable parameters is in some cases larger than that needed for a nonpolar mixture with an equivalent critical locus.

000,430

PB90-207028 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Vibrational Mode Mixing in Terminal Acetylenes: High-Resolution Infrared Laser Study of Isolated J States.

Final rept.
A. McIlroy, and D. J. Nesbitt. 1990, 15p
Grants NSF-CHE86-05970, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 92, n4 p2229-2243, 15 Feb 90.

Keywords: Infrared spectroscopy, Reprints, *Alkynes, Laser spectroscopy, High resolution, Supersonic expansion, Vibrational states, J states.

Mode-mode vibrational coupling in the acetylenic CH stretch at 3330/cm of 1-butyne and 1-pentyne is stud-

ied via high-resolution, direct absorption infrared spectroscopy. As in the authors' previous study of propyne, mixing of the CH stretch vibration carrying oscillator strength (the bright state) with the bath of multiquantum combination states (the dark, or background, states) manifests itself in the spectrum via fragmentation of the isolated bright state transitions into clusters of closely spaced spectral lines in an approximate 0.01/cm window about the zeroth order acetylenic CH stretch position.

000,431

PB90-217787 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

System of PC Computer Programs for Size Exclusion Chromatography.

Final rept.
B. Dickens, and F. L. McCrackin. 1988, 4p
Pub. in Proceedings of ACS Division of Polymeric Materials Science and Engineering, Toronto, Canada, June 6-10, 1988, v58 p465-468.

Keywords: *Chromatography, Data acquisition, Polymers, Reprints, *Computer applications, Data analysis, Personal computers.

A system of computer programs for size exclusion chromatography is described. The programs are written for PC microcomputers, run under DOS2.xx and higher, collect data, and analyze data both interactively and automatically.

000,432

PB90-217811 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Stimulated Desorption from CO Chemisorbed on Cr(110): Sensitivity to Bonding Changes.

Final rept.
N. D. Shinn, and T. E. Madey. 1988, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p216-219 1988.

Keywords: *Carbon monoxide, *Desorption, Chemical bonds, Chemisorption, Chromium, Surfaces, Sensitivity, Reprints, *Electron stimulated desorption.

Electron stimulated desorption (ESD) experiments using a time-of-flight pulse counting method have revealed a correlation between the binding states of carbon monoxide on the Cr(110) surface at 90K and the positive ion yield. Consistent with previous qualitative observations using the electron stimulated desorption ion angular distribution method, negligible $CO(1+)$ and $O(1+)$ desorption signals were measured from the alpha (1) CO molecular binding state which saturates at 1/4 monolayer. For $\theta(CO) > 0.25$, terminally-bonded molecular CO (the alpha (2) CO binding state) co-exists with the alpha (1) CO state and both $CO(1+)$ and $O(1+)$ ions are observed. In addition, a decrease in the $O(1+)$ yield near saturation coverages ($\theta(CO)$ approx = 0.35) of the mixed alpha (1) CO + alpha (2) CO adlayer is attributed to intermolecular interactions which reduce the ion desorption probability for the ESD-active alpha (2) CO species.

000,433

PB90-217860 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Single Pulse Shock Tube Studies on the Stability of 1-Phenylbutene-2.

Final rept.
J. P. Cui, Y. Z. He, and W. Tsang. 1987, 8p
Pub. in Preprints of Papers - American Chemical Society, Division of Fuel Chemistry 32, n3 p448-455 1987.

Keywords: *Shock tubes, Decomposition, Reaction kinetics, Heat of formation, Vinyl compounds, Free radicals, Heat of dissociation, Reprints, *Phenylbutene.

1-Phenylbutene-2(1-PHB-2) has been decomposed in single pulse shock tube experiments. Acetylene formation is used as a measure of the rate of cleavage of the benzyl-vinyl C-C bond. The rate expression for the reaction has been found to be $k(1-PHB-2 - benzyl + propenyl) = 2.4 \times 10^{sup 16} \text{Exp}(-43780/T) /s$. The A-factor for the process is unexpectedly large. It may be indicative of a larger than usual combination rate constant for vinyl radicals. Possible sources of experimental errors are considered. The results are consistent with a bond dissociation energy for the primary vinyl C-H bond in propylene of 475 + or - 10 kJ/mol.

000,434

PB90-217894 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Reference Materials, Reference Data, and Reference Procedures for Surface Analysis: National and International Standards Activities.

Final rept.
C. J. Powell. 1987, 12p
Pub. in Proceedings of International SAMPE (Society for the Advancement of Material and Process Engineers) Electronics Conference on Electronic Materials and Processes (1st), Santa Clara, CA., June 23-25, 1987, p252-263.

Keywords: *Surface chemistry, Standards, Chemical analysis, Reprints, *Standard reference materials.

As the use of surface analysis increases, the need for reference materials, reference data, and reference procedures becomes more urgent. A brief description is given of the needs for surface-analysis standards and of recent efforts to develop such standards. Emphasis is given to the work of two national laboratories, the US National Bureau of Standards and the UK National Physical Laboratory, and of three standards organizations. The three standards organizations are the ASTM Committee E-42 on Surface Analysis, the Surface Chemical Analysis Working Party established by the Versailles Project on Advanced Materials and Standards (a cooperation of seven nations and the Commission of the European Communities), and the Surface Analysis Working Group of the International Union of Pure and Applied Chemistry.

000,435

PB90-218132 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Influence of Surface Structure on Mechanisms of Stimulated Desorption.

Final rept.
R. L. Kurtz, R. L. Stockbauer, and T. E. Madey. 1988, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p109-114 1988.

Keywords: *Titanium dioxide, *Rutile, *Desorption, Surfaces, Reprints, *Photon stimulated desorption, Electron stimulated desorption.

There have been many studies of the mechanisms and of the structural influences in stimulated desorption, however few investigations have considered their simultaneous interplay. The authors' recent studies of stimulated desorption from TiO_2 surfaces have shown that there is a significant interaction between both of these aspects. In the context of desorption from this maximal-valent oxide, for which the Knotek-Feibelman mechanism has been proposed, it will be shown that the geometric structure can determine the probability that an electronic excitation will result in ion desorption.

000,436

PB90-218157 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Ion Desorption Induced by Core Exciton States in MgO.

Final rept.
R. L. Kurtz, R. L. Stockbauer, F. Senf, R. Nyholm, and S. A. Flodstrom. 1988, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p258-261 1988.

Keywords: *Magnesium oxides, *Desorption, Excitons, Reprints, *Photon stimulated desorption.

Investigations into the mechanisms of stimulated desorption via the excitation of deep core levels are producing improved understanding of the fundamental processes that result in ion formation and desorption. The authors report a study of photon-stimulated desorption from $MgO(100)$ with photon energies spanning the O 1s and Mg 1s levels.

- 000,437
PB90-218264 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Entropy-Driven Ion-Molecule Reactions.
 Final rept.
 M. Mautner. 1987, 4p
 Pub. in Proceedings of NATO (North Atlantic Treaty Organization) Advanced Study Institute on Structure/Reactivity and Thermochemistry of Ions, Les Arcs, France, June 30-July 11, 1986, p383-386 1987.
- Keywords: Thermochemistry, Meetings, Reprints, *Ion molecule interactions, Rate constants.
- The paper presents a summary of the panel discussion on 'Entropy-Driven Ion-Molecule Reactions' by M. Henchman.
- 000,438
PB90-218272 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Ellipsoidal Mirror Analyzer for the Study of Photon Stimulated Desorption.
 Final rept.
 R. Stockbauer, R. L. Kurtz, and T. E. Madey. 1988, 4p
 Sponsored by Office of Naval Research, Arlington, VA. Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p126-129 1988.
- Keywords: *Electrostatic analyzers, Synchrotron radiation, Surfaces, Titanium, Reprints, *Photon stimulated desorption, *Ellipsoidal mirror analyzers.
- The authors' studies over the past few years have concentrated on elucidating the mechanisms of ion desorption from surfaces using synchrotron radiation. While the cylindrical mirror analyzer has served them well over the years, it is limited in its ability to measure the angular distribution and mass of ions desorbed from a surface following photon impact. For this reason, they embarked on a project several years ago to design and construct a new charged particle analyzer without these limitations. The analyzer selected for this purpose was the ellipsoidal mirror analyzer design developed by Eastman, et al. The analyzer has the ability to measure simultaneously, the kinetic energy, emission angle, and mass of the desorbing ions. A description of the analyzer, several unique features, and its intended uses are given in detail.
- 000,439
PB90-218280 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Electrophoretic Response of Submicron Particles to Alternating Electric Fields.
 Final rept.
 A. K. Gaigalas, S. Woo, and J. B. Hubbard. 1990, 11p
 Pub. in Jnl. of Colloid and Interface Science 136, n1 p213-223 Apr 90.
- Keywords: Alternating current, Electric fields, Light scattering, Polystyrene, Latex, Spheres, Reprints, *Electrophoretic mobility, Aqueous solutions.
- Electrophoretic light-scattering (ELS) experiments were carried out to study the translational motion of submicron polystyrene latex spheres (0.198 micrometer radius) under the influence of alternating electric fields in aqueous solution. The motion was measured by observing the autocorrelation of photons scattered by the moving particles. In all cases, the homodyne detection mode was used. For electric field frequencies from 50 Hz to 1 KHz (the highest frequency for which a Doppler shift could be seen), the magnitude of the particle's electrophoretic response decreased with increasing frequency. The observed low-frequency dispersion in the apparent electrophoretic mobility is anomalously large and cannot be explained by conventional electrohydrodynamic theories. For frequencies below 50 Hz, the response was highly nonlinear and large second harmonic components were observed in the motion of the particles. Electroosmotic perturbations due to the coupling of the electric field to the space charge near the surfaces of the ELS cell are estimated.
- 000,440
PB90-218306 Not available NTIS
- National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
ESDIAD (Electron Stimulated Desorption Ion Angular Distributions) of Small Molecules on Surfaces: A Few Caveats.
 Final rept.
 T. E. Madey, M. Polak, A. L. Johnson, and M. M. Walczak. 1988, 6p
 Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p120-125 1988.
- Keywords: *Surface chemistry, Molecular structures, Chemical bonds, Irradiation, Reprints, *Electron stimulated desorption ion angular distributions(ESDIAD), Ion beams.
- ESDIAD (Electron Stimulated Desorption Ion Angular Distributions) has proven to be an extremely useful method for characterizing the local bonding structure of molecules at surfaces and a number of examples are indicated below. In order to optimize ESDIAD measurements, however, care must be taken to avoid such pitfalls as beam damage, 'defective' regions of the sample surface, and impurity adsorbates. Several recent illustrations of these problems are discussed.
- 000,441
PB90-218330 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Dynamics of O(1+) Desorption from TiO(sub 2).
 Final rept.
 R. E. Walkup, and R. L. Kurtz. 1988, 7p
 Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p160-166 1988.
- Keywords: *Titanium dioxide, *Rutile, *Desorption, Particle trajectories, Surfaces, Reprints, *Photon stimulated desorption, *Electron stimulated desorption, *Oxygen ions.
- Electron and photons can stimulate positive ion desorption from surfaces provided that: the positive ion is formed by electronic transitions initiated by the incident electron or photon, repulsive forces act to expel the particle, and the positive ion escapes without neutralization or re-capture by the solid. A microscopic mechanism has been proposed by Knotek and Feibelman to explain positive ion desorption from ionic insulators. The prototypical system for this mechanism is O(1+) desorption from TiO₂. Since the Ti cation is maximal valent, i.e., a filled 3p shell and no 3d electrons, a Ti core hole that is produced by electron or photon impact can only be filled by an inter-atomic Auger decay process that involves O valence electrons. There is a finite branching ratio for two Auger electrons to be ejected from a single oxygen center, resulting in the formation of O(1+). This O(1+) ion can be expelled from the surface by repulsive Coulomb forces. Since the repulsive forces are relatively well known, the nuclear motion can be predicted. In the article, the authors discuss classical trajectory calculations of O(1+) desorption from TiO₂.
- 000,442
PB90-218348 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Determination of Molecular Structure at Surfaces Using Electron Stimulated Desorption.
 Final rept.
 T. E. Madey, and A. L. Johnson. 1988, 9p
 Pub. in Proceedings of Sino-U.S. Joint Seminar on Vacuum and Surface Analysis, Beijing, China, September 8-10, 1987, p68-76 1988.
- Keywords: *Surface chemistry, Molecular structure, Reprints, Electron stimulated desorption ion angular distributions.
- ESDIAD (electron stimulated desorption ion angular distributions) has proven to be a very useful method for characterizing the local bonding structure of molecules at surfaces. The physical basis of ESDIAD and new instrumentation are discussed, along with recent applications to the structure of small molecules on semiconductors.
- 000,443
PB90-218496 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Magnitude of Secondary Electron Contributions in Photon Stimulated Desorption.

Final rept.
 D. E. Ramaker, T. E. Madey, R. L. Kurtz, and H. Sambe. 1988, 4p
 Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p182-184 1988.

Keywords: *Desorption, Surfaces, Reprints, *Photon stimulated desorption, *Secondary electrons, Electron stimulated desorption.

Recent reports on the extent of secondary electron contributions in electron/photon stimulated desorption (ESD/PSD) appear to be contradictory. JAEGER et al. suggested that secondary electrons provide the dominant contribution to the H(1+) yield from NH₃/Ni and called the process x-ray induced ESD(XESD). Others have concluded that the XESD process is the dominant mechanism in the PSD of N(1+) and O(1+) ions from mixed condensed gases such as N₂ and O₂ and in the PSD of H(1+) ions from OH/YbO-Sm. On the other hand, considerable evidence exists in the literature for the dominance of the direct photon excitation mechanisms. The evidence usually comes from observed differences between the ion yield and the secondary electron yield or from the absence of any clear structure or 'turn on' at certain core levels. The paper presents a re-examination of the three systems mentioned above where a dominant XESD effect has been postulated to determine the validity of the conclusions previously reached.

000,444
PB90-235243 PC A06
 National Inst. of Standards and Technology, Gaithersburg, MD.

Journal of Research of the National Institute of Standards and Technology. January-February 1990. Volume 95, Number 1.

Bi-monthly rept.
 1990, 118p
 See also PB90-235250 through PB90-235326 and Volume 94, Number 6, PB90-163874. Also available from Supt. of Docs. as SN703-027-00032-6.

Keywords: *Standards, Research projects, Polymers, Primary standards, Gold, Pressure sensors, Spectroscopy, Mass, Temperature measurement, Gas flow, US NBS, US NIST, Calibration standards, Quantum Hall effect.

Contents: New Program and Directions at the National Institute of Standards and Technology; Apparatus for Simultaneous Small Angle Neutron Scattering and Steady Shear Viscosity Studies of Polymer Melts and Solutions; Dynamics of the Bell Prover, II; A Proposed Dynamic Pressure and Temperature Primary Standard; Spectroradiometric Determination of the Freezing Temperature of Gold; Special Report on the International Temperature Scale of 1990--Report on the 17th Session of the Consultative Committee on Thermometry; New Assignment of Mass Values and Uncertainties to NIST Working Standards; Observation and an Explanation of Breakdown of the Quantum Hall Effect.

000,445
PB90-235284 (Order as PB90-235243, PC A06)
 National Inst. of Standards and Technology, Gaithersburg, MD.

Proposed Dynamic Pressure and Temperature Primary Standard.

Bi-monthly rept.
 G. J. Rosasco, V. E. Bean, and W. S. Hurst. 13 Oct 89, 15p
 Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n1 p33-47 Jan-Feb 90.

Keywords: *Primary standards, *Pressure sensors, *Temperature measuring instruments, Measurement, Dynamic tests, Thermodynamic equilibrium, vibrational spectra, Rotational spectra, Lasers, Trnsducers, Raman Spectra, Frequencies, Molecular relaxation.

Diatomic gas molecules have a fundamental vibrational motion whose frequency is affected by pressure in a simple way. In addition, the molecules have well defined rotational energy levels whose populations provide a reliable measure of the thermodynamic temperature. Since information concerning the frequency of vibration and the relative populations can be deter-

mined by laser spectroscopy, the gas molecules themselves can serve as sensors of pressure and temperature. Through measurements under static conditions, the pressure and temperature dependence of the spectra of selected molecules is now understood. As the time required for the spectroscopic measurement can be reduced to nanoseconds, the diatomic gas molecule is an excellent candidate for a dynamic pressure/temperature primary standard. The temporal response in this case will be limited by the equilibration time for the molecules to respond to changes in local thermodynamic variables. Preliminary feasibility studies suggest that by using coherent anti-Stokes Raman spectroscopy it is possible to measure dynamic pressure up to $10(\text{sup } 8) \text{ Pa}$ and dynamic temperature up to 1500 K with an uncertainty of 5%.

000,446

PB90-235292

(Order as PB90-235243, PC A06)

National Inst. of Standards and Technology, Gaithersburg, MD.

Spectroradiometric Determination of the Freezing Temperature of Gold.

Bi-monthly rept.

K. D. Mielenz, R. D. Saunders, and J. B. Shumaker.

28 Nov 89, 19p

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n1 p49-67 Jan-Feb 90.

Keywords: *Gold, *Temperature measurement, Spectroradiometers, Freezing, Melting points, Thermodynamic properties, Irradiation, Blackbody radiation, Infrared detectors, Standards, Silicon, *Calibration standards, Laser heating, Planck radiation formula.

A direct spectroradiometric determination of the temperature of freezing gold was performed by measuring the spectral radiances of a gold blackbody relative to those of a laser-irradiated integrating sphere which was calibrated with absolute silicon detectors and an electrically calibrated radiometer. The measurements were performed at three laser wavelengths near 600 nm , and the temperature of the blackbody was calculated by substituting the measured spectral radiances into Planck's radiation formula. The result obtained $T_{\text{Au}} = (1337.33 \pm 0.34) \text{ K}$, is 0.25 K below the gold-point assignment in the International Practical Temperature Scale of 1968 (IPTS-68) and has been adopted in September 1990 as the new gold-point value in the International Temperature Scale of 1990 (ITS-90). The effect of the change in the gold-point assignment on pyrometric, radiometric, and photometric measurement services provided by the National Institute of Standards and Technology is assessed.

000,447

PB90-235300

(Order as PB90-235243, PC A06)

National Inst. of Standards and Technology, Gaithersburg, MD.

Report on the Session of the Consultative Committee on Thermometry (17th).

Bi-monthly rept.

B. W. Mangum. 4 Nov 89, 9p

Held in Sevres, France on September 12-14, 1989.

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n1 p69-77 Jan-Feb 90.

Keywords: *Temperature measurement, Standards, Thermodynamic properties, Platinum, Resistance thermometers, Radiometry, Reproducibility, *Temperature scales, International organizations.

The article summarizes the results of the 17th Session of the Consultative Committee on Thermometry of the International Committee of Weights and Measures (Comite Consultatif de Thermometrie of the Comite International des Poids et Mesures) that met in Sevres, France, September 12-14, 1989. That session was devoted exclusively to the completion of the International Temperature Scale of 1990, described herein, and to the implications of its adoption.

000,448

PB90-235318

(Order as PB90-235243, PC A06)

National Inst. of Standards and Technology, Gaithersburg, MD.

New Assignment of Mass Values and Uncertainties to NIST Working Standards.

Bi-monthly rept.

R. S. Davis. 6 Jan 90, 14p

Included in Jnl. of Research of the National Institute of Standards and Technology v95 n1 p79-92 Jan-Feb 90.

Keywords: *Mass, *Primary standards, Probability theory, Statistical analysis, Platinum, Iridium, Comparison, Calibration standards, US NBS, US NIST.

For some time it had been suspected that values assigned to NIST working standards of mass were some 0.17 mg/kg larger than mass values based on artifacts representing mass in the International System of Units (SI). The relatively small offset, now confirmed, has had minimal scientific or technological significance. The discrepancy was removed on January 1, 1990. The report documents the history of the discrepancy, the studies which allow its removal, and the methods in place to limit its effect and prevent its recurrence. For routine calibrations, it is believed that the working standards now have a long-term stability of 0.033 mg/kg (3 sigma) with respect to the national prototype kilograms of the United States. It is provisionally admitted an additional uncertainty of 0.09 mg/kg (3 sigma), systematic to all NIST mass measurements, which represents the possible offset of our primary standards from standards maintained by the Bureau International des Poids et Mesures (BIPM). The systematic uncertainty may be significantly reduced after analysis of results from the 3rd verification of national prototype kilograms, which is now underway.

000,449

PB90-241282

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Kinetics Div.

Hydrogen Transfer from 9,10-Dihydrophenanthrene to Anthracene.

Final rept.

R. Billmers, R. L. Brown, and S. E. Stein. 1989, 12p. Pub. in International Jnl. of Chemical Kinetics 21, n6 p375-386 1989.

Keywords: *Anthracene, *Phenanthrene compounds, Free radicals, Reaction kinetics, Chemical reactions, Photochemical reactions, Thermodynamic properties, Catalysts, Synthesis (Chemistry), Reprints, *Hydrogen transfer.

Kinetic studies of the transfer of hydrogen from 9,10-dihydrophenanthrene to anthracene were done at 350 C in the liquid phase. Principal products were phenanthrene and 9,10-dihydroanthracene. At low extents of reaction, the 9,10-dihydroanthracene product catalyzed the reaction by acting as a radical initiator. At high extents of reaction the product inhibited reactions by diverting intermediate radicals back to reactants. A quantitative kinetic model based on literature rate and thermodynamic data fits the observations well. A key reaction in the mechanism involves the transfer of an H-atom from a radical (9-hydrophenanthryl) to a molecule (anthracene). The derived rate constant for the exothermic process ($7.5 \times 10^5 \text{ M}^{-1} \text{ s}^{-1}$) is considerably faster than that for the related, but thermoneutral H-transfer between anthracene units ($120 \text{ M}^{-1} \text{ s}^{-1}$). The values are consistent with a three step process involving addition, intramolecular H-transfer and dissociation.

000,450

PB90-241340

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

Effects of Particle Size Distribution on the Kinetics of Hydration of Tricalcium Silicate.

Final rept.

P. W. Brown. 1989, 4p

Pub. in Jnl. of the American Ceramic Society 72, n10 p1829-1832 1989.

Keywords: *Calcium silicates, *Cements, Reaction kinetics, Particle size distribution, Hydration, Fineness, Heat measurement, Heat of hydration, Calorimeters, Reprints.

The hydration rates of two finenesses of tricalcium silicate, each with known particle size distributions, were measured by isothermal calorimetry for a period of 28 days. The data were integrated, normalized, and represented as a-time curves as a basis for comparison with kinetic models of hydration. Agreement with kinetic models was found to be strongly influenced by the effect of particle size distribution. However, the rate limiting mechanisms appear to be independent of par-

ticule size distribution. No single kinetic model was adequate to describe C3S hydration over the first 28 days. A kinetic model that assumes initial surface area control with diffusion control dominating subsequently provided an excellent fit to the experimental data.

000,451

PB90-241373

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.

Density Dependence of the 5 micrometers Infrared Spectrum of NH₃.

Final rept.

C. Chapados, G. L. Bjoraker, and G. Birnbaum. 1990, 8p

Pub. in Jnl. of Quantitative Spectroscopy and Radiative Transfer 43, n4 p319-326 1990.

Keywords: *Ammonia, *Infrared spectra, Hydrogen, Mixtures, Reprints, Infrared absorption, Density dependence.

Measurements of dilute mixtures of NH_3 in H_2 were made in the window region $1900\text{-}2100 \text{ cm}^{-1}$ of the NH_3 spectrum to determine its behavior with increasing pressure of H_2 . The spectra of pure H_2 , pure NH_3 , and mixtures of the two, in the total pressure range from 2.38 to 8.17 atm at 309 K , were obtained with a 975 cm^{-1} White cell. Synthetic spectra were calculated using precise line strengths, line positions, and a Lorentz profile. The experimental and calculated spectra are in reasonably good agreement, except that the former is superimposed on a rather flat background not given by the calculation. A possible mechanism for this background is suggested.

000,452

PB90-241530

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Surface Forces and Their Action in Ceramic Materials.

Final rept.

R. G. Horn. 1990, 19p

Grant N0014-88-F-0034

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of the American Ceramic Society 73, n5 p1117-1135 1990.

Keywords: *Ceramics, Reprints, Solid-Solid interfaces, Surface forces.

A descriptive account is given of the surface forces acting between two solids. Different contributions to the force are outlined, with particular attention paid to the underlying mechanisms, and how they are affected by the nature of the medium between the surfaces. This is followed by a discussion of the areas of ceramic science and engineering in which surface forces play a role.

000,453

PB90-241548

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Measuring Surface Forces to Explore Surface Chemistry: Mica, Sapphire and Silica.

Final rept.

R. G. Horn, and D. T. Smith. 1990, 10p

Grant N0014-88-F-0034

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of Non-Crystalline Solids 120, p72-81 1990.

Keywords: *Surface chemistry, *Ceramics, *Silicate minerals, Silicon dioxide, Mica, Sapphire, Measurement, Surface energy, Interfacial tension, Reprints, Liquid-solid interfaces, Solid-solid interfaces, Fluid films, Squeeze films, Surface reactions, Solid-solid interfaces.

Measurements of the forces acting between two solid surfaces separated by a thin liquid film are discussed. By investigating the forces in a range of different liquids and solutions, it is possible to acquire an understanding of the surface properties of the solid material. The surface of mica has been studied extensively in this way, and the results obtained are reviewed to illustrate how the surface force measurements can give surface chemical information. Recent measurements on two other materials, sapphire and silica, which are of greater practical interest are also discussed.

000,454
PB90-241613 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Thermophysics Div.
**Dynamical Aspects of Anisotropic Correlations in
 Supercooled Liquids.**
 Final rept.
 R. D. Mountain, and D. Thirumalai. 1990, 8p
 Grant NSF-CHE86-57396
 Sponsored by National Science Foundation, Washing-
 ton, DC.
 Pub. in Jnl. of Chemical Physics 92, n10 p6116-6123,
 15 May 90.

Keywords: *Supercooling, Liquids, Mixtures, Spheres,
 Anisotropy, Reprints, Molecular dynamics, Correlation
 functions, Binary alloys, Relaxation.

The dynamics of anisotropic correlation functions for
 the supercooled liquid states of soft-sphere mixtures is
 examined using molecular dynamics. Two measures of
 the local anisotropy are considered. These dynamic
 functions, which are representations of local coopera-
 tive motions, exhibit considerable slowing down long
 before the glass transition temperature is reached. It is
 clear that the decay of these functions over the time
 interval considered here cannot be fit by a single expo-
 nential function. By analogy with the behavior ob-
 served in supercooled molecular liquids, it is suggest-
 ed that these correlation functions provide a measure
 of alpha relaxation processes in these binary alloys.

000,455
PB90-241639 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Boulder, CO. Quantum Physics Div.
**Spin-Orbit State Specific Laser Probing of the De-
 sorption Kinetics and Island Behavior of In on Si(100).**
 Final rept.
 D. J. Oostra, R. V. Smilgys, and S. R. Leone. 1990,
 11p
 Grant AFOSR-84-02
 Sponsored by Air Force Office of Scientific Research,
 Bolling AFB, DC.
 Pub. in Surface Science 226, p226-236 1990.

Keywords: *Indium, *Desorption, Adsorption, Silicon,
 Spin orbit interactions, Reprints, *Surface reactions,
 Laser induced fluorescence, Heteroepitaxy, Binding
 energy, Sticking coefficients.

The adsorption and desorption characteristics of In on
 Si(100) are investigated. Laser-induced fluorescence
 is used to probe specific spin-orbit states of the de-
 sorbing or scattered in atoms. The sticking coefficients
 of both In(doublet P(1/2)) and In(doublet P(3/2)) are
 determined to be unity (> 0.9). State specific desorp-
 tion measurements show that the two spin-orbit states
 have the same desorption parameters. This indicates
 that both spin-orbit states originate from the same
 'bath' of In atoms on the surface. Isothermal desorp-
 tion measurements, also using Auger spectroscopy,
 find that at surface temperatures below 820 K, and for
 coverages theta < 0.5 ML, In desorbs by a half order
 mechanism. This is in contrast to the results of Knall et
 al. (Surf. Sci. 209 (1989) 314) who observe a first order
 behavior. The 1/2 order desorption indicates two-di-
 mensional In islands on the surface.

000,456
PB90-241670 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Boulder, CO. Quantum Physics Div.
**Individual Cross Sections for (1)D2 Sublevels ((M
 sub L)=0, + or - 1, + or - 2) in the Alignment-De-
 pendent Process: Ca(4p(2) (1)D2) + Rg -> Ca
 (3d4p (1)F3) + Rg as a Function of Rare Gas.**
 Final rept.
 R. L. Robinson, L. J. Kovalenko, C. J. Smith, and S.
 R. Leone. 1990, 10p
 Grants NSF-CHE84-08403, NSF-PHY86-04504
 Sponsored by National Science Foundation, Washing-
 ton, DC.
 Pub. in Jnl. of Chemical Physics 92, n9 p5260-5269, 1
 May 90.

Keywords: *Calcium, Cross sections, Atomic energy
 levels, Energy transfer, Rare gases, Wave functions,
 Excitation, Reprints, Atomic collision, Polarized light,
 Laser radiation.

The Ca(4p(2) singlet D(2)) state is prepared in a two-
 step excitation with linearly polarized lasers. Two dif-
 ferent angular wave functions are selected by using

parallel or perpendicular laser polarizations, respec-
 tively. Subsequent collision with a rare gas atom (He,
 Ne, Ar, Kr, or Xe) populates the near-resonant Ca(3d
 4p singlet F(3)) state. The dependence of the colli-
 sional energy transfer process is measured as a func-
 tion of the alignment of the initial singlet D(2) state
 wave function with respect to the average relative ve-
 locity vector.

000,457
PB90-241688 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Organic Analytical Research Div.
**Evaluation of Shape Selectivity in Liquid Chroma-
 tography.**
 Final rept.
 L. C. Sander, and S. A. Wise. 1990, 10p
 Pub. in LC GC: The Magazine of Separation Science 8,
 n5 10p May 90.

Keywords: *Aromatic polycyclic hydrocarbons,
 Column packings, Separation, Tests, Methodology,
 Chemical analysis, Selectivity, Shape, Solutes, Re-
 prints, *Liquid column chromatography, Calibration
 standards, Reversed flow, Isomers, Liquid-solid inter-
 faces.

A simple empirical test is described for the evaluation
 of column selectivity in reversed-phase liquid chroma-
 tography. The test is based on the relative retention of
 three carefully selected polycyclic aromatic hydrocar-
 bon (PAH) probes. Trends in the retention behavior of
 the solutes are discussed for a variety of chromatogra-
 phy parameters, including column phase type, sub-
 strate pore size, bonded phase length and ligand cov-
 erage, and column temperature. Models for solute re-
 tention are presented based on the separation of iso-
 mers and other structurally similar PAHs. Routine uses
 of the Column Selectivity Test Mixture in manufactur-
 ing and laboratory applications are described.

000,458
PB90-241696 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Boulder, CO. Quantum Physics Div.
**Rotational State Distributions Following the Pho-
 todissociation of Cl-CN: Comparison of Classical
 and Quantum Mechanical Calculations.**
 Final rept.
 R. Schinke. 1990, 4p
 Pub. in Jnl. of Chemical Physics 92, n4 p2397-2400, 15
 Feb 90.

Keywords: Reprints, *Photodissociation, *Rotational
 states, *Cyanogen chloride, Quantum mechanics.

Exact quantum mechanical close-coupling calcula-
 tions are reported for the photodissociation of Cl-CN
 using the ab initio potential of Waite and Dunlap. It was
 found that the simple classical calculations of Barts
 and Halpern based on the rotational reflection princi-
 ple agree very nicely with the exact rotational state
 distributions. Furthermore, it is shown that the impulsive
 model fails severely to account for the high degree of
 rotational excitation in the photodissociation of Cl-CN.

000,459
PB90-242249 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Boulder, CO. Quantum Physics Div.
**Photodissociation of Vibrationally Excited Water
 in the First Absorption Band.**
 Final rept.
 K. Weide, S. Hennig, and R. Schinke. 1989, 8p
 Pub. in Jnl. of Chemical Physics 91, n12 p7630-7637,
 15 Dec 89.

Keywords: *Water, Adsorption spectra, Reprints,
 *Photodissociation, Excited states, Vibrational states.

The authors investigate the photodissociation of highly
 excited vibrational states of water in the first absorp-
 tion band. The calculation includes an ab initio poten-
 tial energy surface for the A tilde-state and an ab initio
 X tilde -> A tilde transition dipole function. The bend-
 ing angle is fixed at the equilibrium value within the
 ground electronic state. Most interesting is the high
 sensitivity of the final vibrational distribution of OH on
 the initially prepared vibrational state of H2O. At wave-
 lengths near the onset of the absorption spectrum the
 vibrational state distribution can be qualitatively un-
 derstood as a Franck-Condon mapping of the initial H2O
 wave function. At smaller wavelengths final state inter-
 action in the excited state becomes stronger and the
 distributions become successively broader. The calcula-
 tions are in satisfactory accord with recent measure-
 ments of Vander Wal and Crim.

000,460
PB90-254400 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Thermophysics Div.
**Hydrogen-Component Fugacity Coefficients in
 Binary Mixtures with Isobutane: Temperature De-
 pendence.**
 Final rept.
 T. J. Bruno, and S. L. Outcalt. 1990, 9p
 Pub. in International Jnl. of Thermophysics 11, n1
 p109-117 1990.

Keywords: *Hydrogen, *Fugacity, Comparison, Test
 chambers, Membranes, Butanes, Reprints, *Binary
 mixtures, *Temperature dependence, Semipermeabi-
 lity, Gas pressure.

The fugacity coefficients of hydrogen in binary mix-
 tures with isobutane were measured using a physical
 equilibrium technique. This technique involves the use
 of an experimental chamber which is divided into two
 regions by a semipermeable membrane through which
 hydrogen, but not isobutane, can penetrate. Measure-
 ment of the gas pressures inside and outside of the
 membrane allows a direct measurement of the hydro-
 gen component fugacity at a given temperature, binary
 mixture mole fraction, and mixture pressure. Results
 are reported at 120, 140, 160, and 180 C. In each
 case, the total pressure of the mixture was maintained
 at an average value of 3.40 MPa. The general qualita-
 tive features of the data are discussed, and compari-
 sons are made with predictions obtained from the Red-
 lich-Kwong and the Peng-Robinson equations of state.

000,461
PB90-254418 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Boulder, CO. Thermophysics Div.
**Hydrogen Component Fugacity in Binary Mixtures
 with Carbon Monoxide: Temperature Dependence.**
 Final rept.
 T. J. Bruno, and J. A. Schroeder. 1988, 10p
 Sponsored by Gas Research Inst., Chicago, IL.
 Pub. in International Jnl. of Thermophysics 9, n4 p525-
 534 1988.

Keywords: *Fugacity, *Hydrogen, Comparison, Test
 chambers, Membranes, Carbon monoxide, Reprints,
 *Binary mixtures, *Temperature dependence, Semi-
 permeability, Gas pressure.

The fugacity coefficients of hydrogen in binary mix-
 tures with carbon monoxide were measured using a
 physical equilibrium technique. This technique involves
 the use of an experimental chamber which is divided
 into two regions by a semipermeable membrane
 through which hydrogen, but not carbon monoxide,
 can penetrate. Measurement of the gas pressures
 inside and outside of the membrane allows a direct
 measurement of the hydrogen component fugacity at a
 given temperature and binary mixture mole fraction.
 Results are reported at 130, 160, and 190 C. In each
 case, the total pressure of the mixture was maintained
 at a nominal value of 3.39 MPa. The general qualita-
 tive features of the data are discussed, and compari-
 sons are made with predictions obtained from the Red-
 lich-Kwong, Peng-Robinson-Soave, and extended corre-
 sponding-state models.

000,462
PB90-254491 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Surface Science Div.
**Structural Characterization of Thin Metal Over-
 layers by X-ray Photoelectron and Auger-Electron
 Forward Scattering.**
 Final rept.
 W. F. Egelhoff. 1987, 9p
 Pub. in Proceedings of Symposium on Physical and
 Chemical Properties of Thin Metal Overlayers and
 Alloy Surfaces, Boston, MA., December 3-5, 1986,
 p189-197 1987.

Keywords: *Surface chemistry, *Metal films, X ray
 spectroscopy, Epitaxy, Meetings, Thin films, Molecular
 structure, Segregation process, Crystallography, For-
 ward scattering, Copper, Nickel, Gold, Substrates, Dif-
 fusion, Reprints, Photoelectron spectroscopy, Auger
 electron spectroscopy, Electronic structure, Solid-solid
 interfaces.

Forward scattering of XPS and Auger electrons by
 atoms in a crystalline lattice produce beams of en-
 hanced intensity radiating out from the surface at

angles corresponding to the internuclear axes present in the top few atomic layers. The effect has been applied to analyze the mechanism of surface segregation in ultrathin metal films, to analyze the interdiffusion at the interfaces of ultrathin films, and to assess the effects of substrate contamination on the growth of epitaxial films. The systems studied are Cu, Ni, and Co on Ni(100).

000,463

PB90-254509

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Predictive, Exact Shape Factor Extended Corresponding States Model for Mixtures.

Final rept.

J. F. Ely, 1990, 10p

Sponsored by Department of Energy, Washington, DC. Pub. in *Advances in Cryogenic Engineering* 35, p1511-1520 1990.

Keywords: *Cryogenics, *Equations of state, Thermodynamics, Air, Mathematical models, Mixtures, Intermolecular forces, Diffusion, Molecular structure, Shape, Reprints, Potentials, Predictive equations, Correlation functions.

In the early 1970s, Leland and co-workers developed the principle of extended corresponding states that allow more accurate predictions of single phase fluid properties of structured molecules by making the effective intermolecular potentials functions of the thermodynamic state. This is accomplished through molecular shape factors. Early applications of the method were limited by the lack of accurate, wide-range equations of state which could be used to determine state dependence of the effective intermolecular potentials. Recent work has, however, provided a broad base of experimental data and correlations which enable accurate determination of the shape factors. In the paper, extended corresponding states using exact shape factors are discussed and applications of the method to cryogenic systems are presented. The later predictions are obtained using the computer program DDMIX which is available through the NIST Office of Standard Reference Data.

000,464

PB90-254517

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Energy Transfers in the Quasielastic Scattering of 70-1250-eV Electrons by Surfaces.

Final rept.

N. E. Erickson, and C. J. Powell. 1989, 4p

Pub. in *Physical Review B* 40, n10 p7284-7287, 1 Oct 89.

Keywords: *Vapor deposited coatings, *Metals, Polycrystalline, Accuracy, Elastic scattering, Quantum interactions, Sputtering, Electron scattering, Surface energy, Copper, Gold, Silver, Phonons, Reprints, Energy transfer, Electron spectrometers, Quasi-elastic scattering, Calibration.

Energy transfers of up to about 200 meV have been observed in the quasielastic scattering of 70-1250-eV electrons by sputtered surfaces of polycrystalline copper, silver, and gold. The experiment consisted of measuring shifts in positions of elastic peaks with a double-pass cylindrical mirror analyzer for different voltages applied to the cathode of the electron gun. The shifts are believed due to changing cross sections for phonon excitations with electron energy. The results are significant in the use of the elastic peak technique for high-accuracy calibrations of the energy scales of electron spectrometers.

000,465

PB90-254566

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Field-Space Conformal Solution Method.

Final rept.

J. R. Fox, and T. S. Storvick. 1990, 12p

Sponsored by Department of Energy, Washington, DC. Div. of Chemical Sciences.

Pub. in *International Jnl. of Thermophysics* 11, n1 p49-59 Jan 90.

Keywords: *Equations of state, Binary systems(Materials), Thermophysical properties, Critical point, Boiling points, Conformal mapping, Vapor pressure, Thermodynamic equilibrium, Reprints, Thermodynamic activity, Liquid-vapor equilibrium, Mathematical manifolds.

A radical extension of the principle of corresponding states to mixtures is proposed. All previous methods are based upon the application of 'mixing rules' which are explicit in the compositions of the resultant, or target, mixture. In the present development the relations are functions of field variables alone, specifically the activities of the reference system. It has a profound effect upon the basic machinery of the transformations. For example, when the new method is used to map the properties of a binary fluid mixture onto those of a pure fluid (and in contrast to the description of a mixture by one-fluid theory with van der Waals mixing rules), the dew-bubble-point surface of the mixture is mapped onto the vapor pressure curve of the pure fluid, and the critical line of the mixture is mapped onto the critical point of the pure fluid. Thus, there is no separate 'pseudocritical' locus. The principal technical advantage of such a development is numerical; calculation of the location of vapor-liquid coexistence and critical manifolds is enormously simplified.

000,466

PB90-254731

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Critical Behavior of a Conducting Ionic Solution Near Its Consolute Point.

Final rept.

M. L. Japas, and J. M. H. Levelt Sengers. 1990, 9p

Pub. in *Jnl. of Physical Chemistry* 94, n13 p5361-5368 1990.

Keywords: *Electrical resistance, *Critical point, Temperature, Ions, Dissociation, Reprints, *Ammonium bromide/tetrapentyl, *Consolute point, *Ion recombination, Consolidation, Aqueous solutions.

Measurements are reported of the coexistence curve and electrical conductivity of the partially miscible aqueous solution of tetra-n-pentylammonium bromide near its consolute point, which was located at $T(\text{sub } c) = 404.90 \pm 0.01 \text{ K}$ and approximately 0.03 in mole fraction. The compositions of coexisting phases were measured over three decades of temperature, from 21 to 0.01 K from the consolute point. The conductivity was measured in the supercritical regime, from high dilution to compositions exceeding the critical. The degree of dissociation was estimated to be higher than 20% at the critical composition. In the data analysis, attention was given to the assessment of experimental error and proper weight assignment, and also to asymptotic range and choice of order parameter. No evidence of classical behavior was found. This finding is in contrast to several recent reports of effectively classical critical behavior in ionic solutions similar to the authors; but it is in accordance with earlier measurements in very weak electrolytes. They present reasons why their conclusion differs from these recent results; an explanation is given why nonclassical behavior might be expected in systems of this type.

000,467

PB90-254764

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Chemical Engineering Science Div.

Onset of Nucleate and Film Boiling Resulting from Transient Heat Transfer to Liquid Hydrogen.

Final rept.

B. Louie, and W. G. Steward. 1990, 10p

Sponsored by Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.

Pub. in *Advances in Cryogenic Engineering* 35, p403-412 1990.

Keywords: *Cryogenics, *Liquid hydrogen, Film boiling, Nucleate boiling, Heat transfer, Thin films, Carbon, Platinum, Metals, Phase diagrams, Reprints.

The Chemical Engineering Science Division (Boulder, Colorado) of the National Institute of Standards and Technology has investigated transient heat transfer to liquid hydrogen. Thin carbon films and Pt foils submerged in liquid hydrogen received stepped power inputs of 1 to 42 W/sq cm, and the onset of nucleate or film boiling was obtained for each power level. The critical heat flux was found to be approximately 8 W/sq cm, with the transition to film boiling occurring in times less than 1/1000 s. Premature film boiling can be related to the positive temperature coefficient of resistance and the narrowness of the Pt heaters.

000,468

PB90-254830

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Rotational Spectrum of the CH Radical in Its $\sigma(0)$ State, Studied by Far-Infrared Laser Magnetic Resonance.

Final rept.

T. Nelis, J. Brown, and K. M. Evenson. 1990, 10p

Contract NASA-W-15047

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in *Jnl. of Chemical Physics* 92, n7 p4067-4076, 1 Apr 90.

Keywords: Rotational spectra, Free radicals, Metastable state, Far infrared radiation, Reprints, *Methylidyne radicals, Laser magnetic resonance.

The CH radical has been detected in its alpha quartet $\sigma(0)$ state by the technique of laser magnetic resonance at far-infrared wavelengths. Spectra relating to different spin components of the first three rotational transitions have been recorded. The molecule was generated either by the reaction of F atoms with CH₄, with a trace of added oxygen or by the reaction of O atoms with C₂H₂. The observed resonances have been analyzed and fitted to determine the parameters of an effective Hamiltonian for a molecule in a quartet $\sigma(0)$ state. The principal quantities determined are the rotational constant $B_{\text{sub } 0} = 451\,138.434(94) \text{ MHz}$ and the spin-spin parameter $\lambda_{\text{sub } 0} = 2785.83(18) \text{ MHz}$. Proton hyperfine parameters have also been determined.

000,469

PB90-254848

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Vapor + Liquid Equilibria and Coexisting Densities of (Carbon Dioxide + n-butane) at 311 to 395 K.

Final rept.

V. G. Niesen. 1989, 9p

Pub. in *Jnl. of Chemical Thermodynamics* 21, p915-923 1989.

Keywords: *Carbon dioxide, *Butanes, Gases, Thermodynamic equilibrium, Phase diagrams, Density(Mass/volume), Vapor phases, Liquid phases, Measurement, Test equipment, Densitometers, Vibration, Reprints.

An experimental phase-equilibrium apparatus has been modified with the addition of vibrating-tube densitometers to allow the simultaneous measurement of (vapor + liquid) equilibrium and saturated phase densities. The equipment operates from 300 to 400 K and at pressures to 14 MPa. Both the vapor and liquid phases are recirculated. Measurements have been obtained on (carbon dioxide + n-butane) at 311.09, 344.43, and 394.6 K at pressures up to the critical. The measured phase compositions and densities agree within experimental uncertainty with previously reported results.

000,470

PB90-254939

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Radical Concentration Measurements in Hydrocarbon Diffusion Flames.

Final rept.

K. C. Smyth, and P. J. H. Tjossem. 1990, 13p

Pub. in *Applied Physics B* 50, p499-511 1990.

Keywords: *Diffusion flames, Concentration(Composition), Absorption, Reprints, *Hydroxyl radicals, *Hydrogen atoms, *Oxygen atoms, Laser induced fluorescence, Multiphoton ionization.

Absolute OH radical concentrations and relative H-atom and O-atom profiles have been measured in a laminar, co-flowing methane/air diffusion flame burning at atmospheric pressure. Laser absorption and laser-induced fluorescence methods were used to probe the A(doublet $\Sigma(0^+)$) \leftarrow X(doublet $\Pi(\text{sub } i)$) transition in OH radical. Establishing absolute H-atom and O-atom concentrations is discussed in terms of partial equilibrium considerations and detailed flame structure calculations.

000,471

PB90-261009

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Nonintersecting Random Walk in the Presence of Nonspherical Obstacles.

Final rept.
E. A. Di Marzio. 1990, 5p
Pub. in Physical Review Letters 64, n23 p2791-2794, 4 Jun 90.

Keywords: *Random walk, Molecules, Reprints, Excluded volume problems, Scaling laws.

The statistics of a self-avoiding walk of N steps on a lattice in a field of asymmetric obstacles is developed. The obstacles are modeled by rigid rods of asymmetry ratio r oriented preferentially and/or by stretched flexible molecules. Each obstacle consists of N segments, each one of which occupies one lattice site. The size, shape, and entropy of the molecule represented by the self-avoiding walk are obtained. The scaling law deviates from the conventional no-obstacles limit ($\nu=0.6$) only for large concentrations of obstacles. However, the molecule is elongated even for a small concentration of obstacles. Because the formulas are so easily obtained and extended, the method promises to be widely applicable.

000,472
PB90-261348 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.

Rotational and Tunneling Spectrum of the H₂S.CO₂ van der Waals Complex.

Final rept.
J. K. Rice, L. H. Coudert, K. Matsumura, R. D. Suenram, and F. J. Lovas. 1990, 13p
Pub. in Jnl. of Chemical Physics 92, n11 p6408-6419, 1 Jun 90.

Keywords: *Hydrogen sulfide, *Carbon dioxide, Microwave spectra, Rotational spectra, Dipole moments, Molecular structure, Reprints, *Complexes, Dimers.

The rotational spectra of (H₂S)(CO₂) complex and two deuterated forms have been observed using a pulsed-beam Fourier-transform microwave spectrometer. For each of the three complexes the authors assign a-type and c-type transitions which are split into a 'weak' and a 'strong' intensity component. The analysis based on that previously used for the (H₂O)₂ complex and modified for application to (H₂S)(CO₂) complex allowed assignment of internal rotation, inversion tunneling states of the H₂S and CO₂ units in the complex. Rotational constants were determined for the ground tunneling state of each species.

000,473
PB90-261371 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electrosystems Div.

Processes Leading to SF₆ Decomposition in Glow-Type Corona Discharges.

Final rept.
R. J. Van Brunt. 1989, 13p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Physics of Ionized Gases, p161-172 1989.

Keywords: *Reaction kinetics, *Sulfur hexafluoride, *Oxidation, Electric discharges, Ionized gases, Decomposition reactions, Free radicals, Reprints, *Corona discharges, Molecular interactions.

Recent progress which has been made in understanding the fundamental gas-phase oxidation processes involving SF₆ in corona discharges is discussed within the framework of a three-zone chemical kinetics model. Gaps in our knowledge about fundamental molecular interactions that are keys to a better understanding of SF₆ oxidation are discussed.

000,474
PB90-261405 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Molecular Dynamics Investigation of Deeply Quenched Liquids.

Final rept.
J. X. Yang, H. Gould, W. Klein, and R. D. Mountain. 1990, 14p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of Chemical Physics 93, n1 p711-723, 1 Jul 90.

Keywords: *Crystal growth, *Nucleation, Drops(Liquids), Supercooling, Simulation, Reprints, Molecular dynamics, Lennard-Jones potential.

Molecular dynamics simulations of homogeneous crystalline nucleation in systems of 1300 particles

have been performed as a function of quench depth for the Lennard-Jones, $r_{sup}(-12)$, and $r_{sup}(-6)$ potentials. The authors observe that the nucleating droplet is spatially asymmetric, has a layered structure, and is ramified for deep quenches. The initial growth of the droplet occurs by the addition of layers until the droplet becomes sufficiently large to be characterized by a crystalline close-packed structure. The authors also observe that the time lag between the time of formation of the nucleating droplet and the time of release of latent heat is a nonmonotonic function of quench depth. The results for deep quenches are interpreted as evidence for the influence of a pseudospinodal.

000,475
PB90-261421 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.

Water Hydrogen Bonding: The Structure of the Water-Carbon Monoxide Complex.

Final rept.
D. Yaron, K. I. Peterson, D. Zolanz, W. Klemperer, and F. J. Lovas. 1990, 15p
Sponsored by National Science Foundation, Washington, DC.
Pub. in Jnl. of Chemical Physics 92, n12 p7095-7109, 15 Jun 90.

Keywords: *Molecular spectra, *Molecular structure, *Carbon monoxide, *Hydrogen bonds, *Water, Molecular rotation, Dipole moments, Isotope effect, Molecular spectra, Deuterium compounds, Reprints, *Complexes, Carbon 13, Oxygen 17.

Rotational transitions within the K=O manifold with changes in J of 3 or less have been observed for H₂O-CO, HDO-CO, D₂O-CO, H₂O-(13)CO, HDO-(13)CO, and H₂(17)O-CO using molecular beam electric resonance and Fourier transform microwave absorption techniques. Changes in M of + or -1 within the J=1 level have also been measured. The equilibrium structure of each complex has the heavy atoms approximately collinear. The water is hydrogen bonded to the CO carbon. The hydrogen bond length is approximately 2.41 angstroms.

000,476
PB90-264086 PC A03/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.

Technical Activities 1989, Molecular Physics Division.

A. Weber. Aug 90, 43p NISTIR-4390
See also PB90-207267.

Keywords: Molecular spectroscopy, Quantum chemistry, Frequency standards, Atmospheric composition, *Molecular physics, Molecular dynamics, Van der Waals forces, Complexes, Electronic structure, Photodissociation, Predissociation.

The report summarizes the technical activities of the NIST Molecular Physics Division during the Fiscal Year 1989. The activities span experimental and theoretical research in high resolution molecular spectroscopy, quantum chemistry and molecular dynamics, and include the development of frequency standards, critically evaluated spectral data, applications of spectroscopy to important scientific and technological problems, and the advancement of spectroscopic measurement methods and techniques. A listing is given of publications and talks by the Division staff.

000,477
PB90-271115 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Critical Exponent for the Viscosity of Carbon Dioxide and Xenon.

Final rept.
R. F. Berg, and M. R. Moldover. 1990, 13p
Contract NASA-C-86129D
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Chemical Physics 93, n3 p1926-1938, 1 Aug 90.

Keywords: *Viscosity, *Carbon dioxide, *Xenon, Critical temperature, Fluid flow, Reduced gravity, Viscometers, Reprints, *Critical exponent, Temperature dependence.

The viscosities (η) of carbon dioxide and xenon have been measured near their critical points and the critical exponent γ characterizing the asymptotic divergence, η approximately equal to $(T-T(\text{sub } c))(\text{sup } -\gamma)$, has

been determined. This agreement between experiments is the first evidence that pure fluids and binary liquids are in the same dynamic universality class. The torsion oscillator viscometer operated at low frequency and low shear rate to avoid systematic errors caused by critical slowing down. Far from $T(\text{sub } c)$ the analysis accounted for the crossover from critical to noncritical temperature dependence, where the latter was obtained from previously published correlations. Corrections for gravitational stratification were included close to $T(\text{sub } c)$.

000,478
PB90-271149 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Pressure Synthesis of p-Nitroaniline Condensation Products.

Final rept.
S. Block, and G. J. Piermarini. 1988, 5p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Multifunct. Mater., v878 p21-25 1988.

Keywords: *Condensation reactions, *Phase diagrams, *Synthesis(Chemistry), Nitroaryl compounds, Dimerization, X ray diffraction, Infrared spectroscopy, Mass spectroscopy, High pressure tests, Reprints, *Aniline/nitro, Fourier transform spectrometers, Hyperbaric conditions, Optical microscopy, Semiconductors, Chemical reaction mechanisms, Hyperbaric chambers.

Theoretical calculations by R. Bardo predict that under high pressure, p-Nitroaniline (PNA) forms semiconducting condensation products which possibly may be retained at ambient conditions. A combination phase-reaction P,T diagram has been determined in order to evaluate the correctness of the prediction and to indicate synthesis routes. The data were obtained by a combination of optical microscopy, x-ray diffraction, and Fourier transform infrared (FTIR) spectroscopy coupled with a diamond anvils high pressure cell. The results show, (1) a reversible crystallographic transition occurs at about 4.0 GPa; (2) a reversible transition at about 1.0 GPa and 140 C which effects the optical properties of the material also occurs; (3) the melting point increases to 245 C at 1.0 GPa and (4) irreversible chemical reactions begin to be significant above 280 C and 1.0 GPa. The reaction products were investigated by mass spectrometry. A series of dimers with N or N-N linkages are formed under pressure at moderate temperatures. If temperatures at pressure are excessive, i.e., above 360 C, then the PNA reacts to form an amorphous material stable when heated to over 350 C.

000,479
PB90-271313 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Isochoric (p,Vm,T) Measurements on CO₂ and on (0.982 CO₂ + 0.018 N₂) from 250 to 330 K at Pressures to 35 MPa.

Final rept.
J. F. Ely, W. M. Haynes, and B. C. Bain. 1989, 17p
Pub. in Jnl. of Chemical Thermodynamics 21, p879-894 1989.

Keywords: *Carbon dioxide, *Nitrogen, Equations of state, Density(Mass/volume), Reprints, *PVT data, *Isochoric processes, Gas mixtures, Corresponding states.

Comprehensive isochoric (P, V(sub m), T) measurements have been performed for pure CO₂ and for (0.982CO₂ + 0.018N₂). Based on these and other experimental results from the literature, a 32-term equation of state of the form suggested by Jacobsen and Stewart has been developed for pure CO₂. This equation was then used to demonstrate the effect of a small amount of N₂ on the (P, V(sub m), T) surface of CO₂-an effect which can be as great as 100% in the amount-of-substance density at fixed temperature and pressure. Finally, the equation of state for pure CO₂ was used in a conformal-solution model to calculate the mixture amount-of-substance densities which had been obtained in the study. In general the results of this calculation were very good--the model reproduced the experimental results to within an r.m.s. deviation of 0.26%.

000,480
PB90-271537 Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Measurement of the Heat of Fusion of Molybdenum by a Microsecond-Resolution Transient Technique.

Final rept.

J. L. McClure, and A. Cezairliyan. 1990, 8p
Pub. in International Jnl. of Thermophysics 11, n4 p731-737 Jul 90.

Keywords: *Heat of fusion, *Molybdenum, *Refractory metals, *Pulse heating, Temperature measurement, Resolution, Reprints.

A microsecond-resolution pulse-heating technique was used for the measurement of heat of fusion of molybdenum. The method is based on rapid resistive self-heating of the specimen by a high-current pulse from a capacitor discharge system and measuring current through the specimen, voltage across the specimen, and radiance temperature of the specimen as functions of time. Melting of the specimen is manifested by a plateau in the temperature versus time function. The time integral of the power absorbed by the specimen during melting yields the heat of fusion. Measurements gave a value of 36.4 kJ/mol for the heat of fusion of molybdenum with an estimated maximum uncertainty of + or - 6%.

000,481

PB90-271586

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.

Group-Theoretical Formalism for the Large-Amplitude Vibration-Rotation Problem in Methylamine-d1.

Final rept.

M. Oda, N. Ohashi, and J. T. Hougen. 1990, 29p
Pub. in Jnl. of Molecular Spectroscopy 142, p57-84 1990.

Keywords: *Methylamine, Group theory, Deuterium compounds, Hamiltonian functions, Reprints, Rotational states.

A group-theoretical formalism suitable for analyzing high-resolution spectra of monodeuterated methylamine, CH₃NHD, is presented. This formalism, which treats simultaneously the methyl-group internal rotation, the amino-group inversion, and the overall rotation, is derived using extended-group ideas, and represents a modification of the formalism previously derived for treating normal methyl amine. The modification is necessary primarily because the H and D atoms in the asymmetric amino group are expected to move different distances during the inversion motion. All matrix elements satisfying delta K = 0, + or -1, and + or -2 selection rules, and arising from operators linear or quadratic in components of the total angular momentum, are given in a form appropriate for carrying out a global fit of spectroscopic data.

000,482

PB90-271594

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.

Overview of Membrane Research at NIST/CCT.

Final rept.

J. J. Pellegriano. 1989, 19p
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of Membrane Technology/Planning Conference, Cambridge, MA., November 1-3, 1988, p1-18 1989.

Keywords: *Ion exchange membrane electrolytes, Polymers, Gases, Mathematical models, Research projects, Mass transfer, Inorganic compounds, Sorption, Surface chemistry, Permeability, Amino acids, Filtration, Fouling, Reprints, *Separation processes, *Membrane transport, Supported liquid membranes, Membrane pores.

The Membrane Separations group in the National Institute of Standards and Technology's Chemical Engineering Science Division has several active projects in applied and basic membrane research, including studies of gas transport in facilitated-transport ion-exchange membranes and basic modeling of transport processes in the nanopores of inorganic membranes. In the area of liquid separations, techniques have been developed for studying the surface sorption of macromolecules on ultrafiltration membranes and the subsequent fouling effects. Membranes of polyelectrolyte polymers have also been fabricated. The effects of chemical and structural modifications on the permeation of amino acids as model compounds have also

been studied. The paper outlines the programs and facilities, and some of the current results and future plans.

000,483

PB90-271602

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Diamond Anvil Cell for Physical and Chemical Investigations of Energetic Materials at High Pressures.

Final rept.

G. J. Piermarini, S. Block, and P. J. Miller. 1990, 22p
Pub. in Chemistry and Physics of Energetic Materials, p369-389 1990.

Keywords: High pressure tests, Polymorphism, Infrared spectroscopy, X ray diffraction, Reprints, *Diamond anvil cells, Hyperbaric chambers, Hyperbaric conditions, Optical microscopy.

Brief descriptions of the five generic types of diamond anvil high pressure cells are given with an assessment of their strengths and weaknesses for various kinds of scientific measurement applications. Three techniques applied successfully to the study of energetic materials, optical polarizing microscopy, infrared absorption spectroscopy, and energy dispersive x-ray powder diffraction, are described along with examples of some relevant data and results.

000,484

PB90-271644

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

State-Resolved Laser Probing of As₂ in a Molecular-Beam Epitaxy Reactor.

Final rept.

R. V. Smilgys, and S. R. Leone. 1990, 6p
Contract AFOSR84-0272
Sponsored by Air Force Weapons Lab., Kirtland AFB, NM.

Pub. in Jnl. of Vacuum Science and Technology B 8, n3 p416-421 May/June 90.

Keywords: Reprints, *Molecular beam epitaxy, *Arsenic dimers, Laser induced fluorescence, Vibrational states, Rotational states, Epitaxial growth.

Results are presented on the first state-resolved optical detection of As₂ in a molecular-beam epitaxy (MBE) reactor. Using the technique of laser induced fluorescence (LIF), the gas phase populations of vibrational and rotational states of As₂ emanating from a commercial As₄ oven-cracker source are probed. A Boltzmann fit of the populations of the first four vibrations indicates that these states are thermalized to the source temperature. Likewise, the rotational manifold of each vibration is consistent with thermalization at the same temperature. The method is capable of being an *in situ* real-time MBE diagnostic. Optical detection may provide complementary information to reflection high-energy electron diffraction (RHEED) that would not otherwise be available. Future applications of this technique may lead to new insights into epitaxial growth processes.

000,485

PB90-271685

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Vapor Pressures and Gas-Phase PVT Data for 1,1-Dichloro-2,2,2-trifluoroethane.

Final rept.

L. A. Weber. 1990, 4p
See also PB90-117987.
Pub. in Jnl. of Chemical and Engineering Data 35, n3 p237-240 Jul 90.

Keywords: *Vapor pressure, Fluorohydrocarbons, Density(Mass/volume), Refrigerants, Thermodynamic properties, Reprints, *PVT data, *Ethane/dichloro-trifluoro, Freon 123, Virial equation.

New data for the vapor pressure and gas-phase PVT surface of 1,1-dichloro-2,2,2-trifluoroethane (refrigerant 123) in the temperature range 338-453 K at densities up to 0.67 mol/L are presented. The data have been represented analytically to demonstrate the precision and to facilitate calculation of thermodynamic properties.

000,486

PB91-101139

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Direct Time-Resolved Observations of Vibrational Energy Flow in Weakly Bound Complexes.

Final rept.

M. P. Casassa. 1988, 13p
Pub. in Chemical Reviews 88, n6 p815-826 1988.

Keywords: *Molecular relaxation, Reprints, *Complexes, Predissociation, Photodissociation, Vibrational states, Vibrational energy transfer, Literature surveys, Van der Waals forces.

The article reviews direct time-resolved experiments which characterized vibrational energy flow and vibrational predissociation of weakly bound molecular complexes in the gas phase. It surveys the literature for the period 1980 through 1987.

000,487

PB91-101337

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.

Thermodynamic Property Formulation for Air. 1. Single-Phase Equation of State from 60 to 873 K at Pressures to 70 MPa.

Final rept.

R. T. Jacobsen, W. P. Clarke, S. G. Penoncello, and R. D. McCarty. 1990, 9p
See also PB90-254723.

Pub. in International Jnl. of Thermophysics 11, n1 p169-177 1990.

Keywords: *Thermodynamic properties, *Air, Liquefied gases, Equations of state, Specific heat, Acoustic velocity, Density(Mass/volume), Reprints.

A revised interim formulation for the thermodynamic properties of air has been developed for calculating properties of the vapor and estimating properties for the liquid at temperatures as low as 60 K. The formulation incorporates separate equations for the calculation of bubble-point and dew-point pressures and densities and for the ideal-gas heat capacity. A new fundamental equation of state is given for vapor and liquid states of air based upon available experimental data and predicted values of isochoric heat capacity for the liquid using corresponding states methods. The fundamental equation for air is explicit in nondimensional Helmholtz energy. The terms of the fundamental equation were selected from a larger set of 75 proposed terms using a least-squares fitting procedure. Representative graphical comparisons of calculated property values to experimental measurements are given. The estimated accuracy of calculated densities is generally + or - 0.2% except near the dew and bubble lines. Calculated heat capacities for the liquid must be considered only as estimates until substantiated by experimental measurements.

000,488

PB91-101410

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Comments on Entropy-Driven Ion-Molecule Reactions by M. Mautner.

Final rept.

S. G. Lias. 1987, 20p
Pub. in Structure/Reactivity and Thermochemistry of Ions, p381-399 1987.

Keywords: Thermochemistry, Reprints, *Ion molecule interactions, Rate constants.

The author's comments are included in a chapter by M. Henchman 'Entropy-Driven Reactions: Summary of a Panel Discussion'.

000,489

PB91-101584

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Near-Threshold Vibrational Excitation of HF by Electron Impact.

Final rept.

G. Snitchler, D. Norcross, A. Jain, and S. Alston. 1990, 4p
Contract DE-AL05-86ER53237, Grant NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC., and Department of Energy, Washington, DC. Pub. in Physical Review A 42, n1 p671-674, 1 Jul 90.

Keywords: *Hydrogen fluoride, Differential cross sections, Electron scattering, Excitation, Reprints, *Electron-molecule collisions, Vibrational states, Excited states.

Exchange effects are included exactly in these vibrational close-coupling calculations using a new separable representation, and short- and long-range interactions using a parameter-free correlation-polarization potential. Differential cross sections are similar to measurements, but differ as to the location of the threshold peaks, the relative importance of rotationally elastic versus inelastic transitions, and the validity of a critical assumption made in the electron-beam energy calibration. Polarization at intermediate distances is critical and the angular distribution of scattered electrons is anisotropic both near and well above threshold.

000,490

PB91-101600 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Molecular Physics Div.

Pulsed-Nozzle Fourier-Transform Microwave Spectroscopy of Laser-Vaporized Metal Oxides: Rotational Spectra and Electric Dipole Moments of YO, LaO, ZrO, and HfO.

Final rept.

R. D. Suenram, F. J. Lovas, G. T. Fraser, and K. Matsumura. 1990, 10p

Pub. in *Jnl. of Chemical Physics* 92, n8 p4724-4733, 15 Apr 90.

Keywords: *Hafnium oxides, *Yttrium oxides, *Zirconium oxides, *Rotational spectra, Microwave spectroscopy, Reprints, *Lanthanum oxides, *Electric dipole moments.

The rotational spectra of YO, LaO, ZrO, and HfO have been measured using a Fourier-transform microwave spectrometer in combination with a laser-ablation source. Here, a Q-switched Nd:YAG laser (532 nm) was used to vaporize the metal oxides from a target source rod located in the throat of a pulsed-molecular-beam valve. A description of the instrument is given. The electric dipole moments of the four species have been measured and compared to ab initio results, where available. The experimental values are given. This is the first determination of nuclear quadrupole coupling constants for a molecule containing the Hf atom.

000,491

PB91-101642 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Thermophysics Div.

Vapor-Liquid Equilibrium in Binary Systems of Chlorotrifluoromethane with n-Butane and Isobutane.

Final rept.

L. A. Weber. 1989, 4p

Pub. in *Jnl. of Chemical and Engineering Data* 34, n4 p452-455 Oct 89.

Keywords: *Halohydrocarbons, *Phase diagrams, *Butanes, Equations of state, Thermodynamic properties, Binary systems (Materials), Fugacity, Henry's Law, Gas laws, Solubility, Mixtures, Reprints, *Chlorotrifluoromethane, *Liquid-vapor equilibrium, Temperature dependence.

Vapor and liquid equilibrium phase compositions were determined at 310.93, 350.00, and 400.00 K for the binary systems of chlorotrifluoromethane (R 13) with n-butane and with isobutane. The data were fit with the Peng-Robinson equation of state. Henry's constants were derived, and their temperature behavior is compared with a new model calculation.

000,492

PB91-101659 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.

Chemisorption of Chlorosilanes and Chlorine on Si(111) 7x7.

Final rept.

L. J. Whitman, S. A. Joyce, J. A. Yarnoff, F. R.

McFeely, and L. J. Terminello. 1990, 10p

Pub. in *Surface Science* 232, p297-306 1990.

Keywords: *Surface chemistry, *Chemisorption, *Silicon, *Chlorine, *Silanes, Desorption, Reaction kinetics, Etched crystals, Chemical vapor deposition, Photoemission, X ray analysis, Reprints, Temperature effects, Synchrotron radiation, Auger electron spectroscopy.

The chemisorption of SiCl₄, Si₂Cl₆, and chlorine on Si(111) 7 x 7 has been characterized using soft X-ray photoemission with synchrotron radiation, thermal desorption spectroscopy, and Auger electron spectroscopy.

SiCl₄ dissociatively chemisorbs on room temperature Si(111) 7 x 7 with an extremely low sticking coefficient, with only SiCl remaining on the surface. In contrast, Si₂Cl₆ chemisorbs with about 500 times greater probability and then partly dissociates into SiCl_x (x = 1,2,3) fragments. A monolayer of Cl deposited directly also contains SiCl, SiCl₂, and SiCl₃ surface species, but they are created via reaction with substrate Si atoms and have lower Si2p core level binding energies. Upon heating the surface all the adsorbed Cl is removed via desorption of silicon chlorides, primarily SiCl₂, indicating that SiCl₄, Si₂Cl₆, and chlorine will etch Si(111) 7 x 7 if an additional reactant is not available to remove the surface Cl. Interestingly, the different reactivities of SiCl₄ and Si₂Cl₆ upon adsorption can be explained by the dynamics of different adsorption mechanisms.

000,493

PB91-112029 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.

Vibrational Relaxation at Surfaces.

Final rept.

R. R. Cavanagh, J. D. Beckerle, M. P. Casassa, E. J. Heilweil, and J. C. Stephenson. 1990, 11p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in *Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Picosecond and Femtosecond Spectroscopy from Laboratory to Real World*, v1209 p86-96 1990.

Keywords: Carbon monoxide, Platinum, Adsorbates, Energy transfer, Transient response, Vibration, Reprints, *Surface reactions, Vibrational relaxation.

Time-resolved techniques are applied to issues of vibrational energy transfer at surfaces. Primary attention is given to the relaxation of vibrationally excited diatomic adsorbates on metals. The sensitivity of the vibrational decay rate to the number of metal atoms in the solid is demonstrated. Preliminary results for the transient response of CO on Pt(111) are also reported. This latter measurement demonstrates the recently developed capability of monitoring adsorbate energy transfer processes at well defined surface sites. The observations appear to be consistent with relaxation through the excitation of electron/hole pairs in the substrate.

000,494

PB91-112037 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.

Laser-Induced Desorption: State-Resolved Evidence for Carrier Driven Processes.

Final rept.

R. R. Cavanagh, S. A. Buntin, L. J. Richter, and D. S. King. 1990, 9p

Contract DE-A105-84ER13150

Sponsored by Department of Energy, Washington, DC. Pub. in *Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Laser Photoionization and Desorption Surface Analysis Techniques*, v1208 p2-10 1990.

Keywords: *Desorption, Nitrogen oxide(NO), Substrates, Platinum, Silicon, Vibration, Reprints, *Laser induced desorption, Semiconductors.

Laser induced molecular desorption which is mediated by optically generated substrate carriers is considered. State-specific diagnostics are combined with desorption-laser wavelength dependence studies to clarify the excitation and desorption dynamics involved. Results from NO desorption from both metallic and semiconductor substrates are presented, along with theoretical models of the desorption processes.

000,495

PB91-112227 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.

Pumping and Probing: Vibrational Relaxation in Time Domain Spectroscopy.

Final rept.

J. W. Gadzuk. 1990, 7p

Pub. in *Applied Physics A* 51, p108-114 1990.

Keywords: *Adsorption, *Surfaces, Reprints, Vibrational relaxation, Time domain, Clusters.

Various aspects of experiments on vibrational relaxation of molecules adsorbed on metals are considered. The necessity for time-domain pump-probe con-

figurations is established. Since existing experiments to date have been carried out on small metal clusters special attention here is given to the role of quantum size effects and the resulting role of the discrete electron-hole pair excitation spectrum on the observed energy/vibrational relaxation times.

000,496

PB91-112516 Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Reactor Radiation Div.

Neutron Scattering Study of Layered Silicates Pillared with Alkylammonium Ions.

Final rept.

D. A. Neumann, J. M. Nicol, J. J. Rush, N. Wada, Y. B. Fan, H. Kim, S. A. Solin, T. J. Pinnavaia, and S. F. Trevino. 1990, 6p

Pub. in *Materials Research Society Symposium Proceedings*, v166 p397-402 1990.

Keywords: *Montmorillonite, *Vermiculite, *Clays, Neutron scattering, Inelastic scattering, Reprints, *Alkylammonium ions, MeV range 10-100, MeV range 100-1000.

Incoherent, inelastic neutron scattering has been used to study the vibrational spectra of tetramethylammonium montmorillonite and trimethylammonium vermiculite in the energy range 20-140 meV. For both systems, peaks are observed due to the internal modes of the intercalate and to the excitations of the hydroxyl groups within the host layers. For the montmorillonite sample, it is found that the steric constraints imposed on the tetramethylammonium ion by the bounding clay layers contribute an additional 28 meV to the rotational barrier of the methyl groups. This additional barrier is shown to be strongly related to the volume that the tetramethylammonium ion occupies. For the trimethylammonium vermiculite sample, normal mode analysis of the internal modes of the intercalated ion shows that the N-H bond is parallel to the c-axis of the host.

000,497

PB91-112540 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

Catalytic Decomposition of S2F10 and Its Implications on Sampling and Detection from SF6-Insulated Equipment.

Final rept.

J. K. Olthoff, R. J. Van Brunt, J. T. Herron, I. Sauer, and G. Harman. 1990, 5p

See also DE90C08571. Sponsored by Department of Energy, Washington, DC. Office of Energy Storage and Distribution.

Pub. in *Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Symposium on Electrical Insulation*, Toronto, Canada, June 3-6, 1990, p248-252.

Keywords: *Sulfur fluorides, *Decomposition reactions, Adsorption, Surface chemistry, Reaction kinetics, Stainless steels, Gas chromatography, Mass spectroscopy, Moisture content, Catalysis, Reprints.

Recent findings indicate that S₂F₁₀ is unstable with respect to decomposition on a surface. The paper reports the first results of a study investigating the mechanisms and rates of surface decomposition of S₂F₁₀ under various conditions. Initial results indicate that surface decomposition rates on stainless steel increase with increased water content, temperature, and surface-to-volume ratio, and with decreased gas pressure. The implications of these results for the preparation and storage of S₂F₁₀ samples are discussed. Additionally, the use of this surface decomposition mechanism to enhance the detection sensitivity of small concentrations of S₂F₁₀ in SF₆ using a gas chromatograph/mass spectrometer (GC/MS) is investigated. Detection sensitivities of 1 ppm by volume (ppm) of S₂F₁₀ in SF₆ are routinely achievable using this new technique.

000,498

PB91-112714 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Molecular Physics Div.

Vibrational Spectra of Molecular Ions Isolated in Solid Neon. III. N4(+).

Final rept.

W. E. Thompson, and M. E. Jacox. 1990, 7p

Contract ARO-25664-CH

See also PB90-128729. Sponsored by Army Research Office, Research Triangle Park, NC.

Pub. in Jnl. of Chemical Physics 93, n6 p3856-3862, 15 Sep 90.

Keywords: *Vibrational spectra, Infrared spectra, Reprints, *Molecular ions, *Nitrogen ions, Matrix isolation, Excited states, Solid neon, Photodecomposition.

When a Ne:N₂ = 100 or 200 mixture is codeposited at 5 K with a beam of neon atoms excited by a microwave discharge, a weak to moderately intense infrared absorption appears at 2237.6/cm which is assigned to the N₄(1+) molecular ion. The analysis of the infrared spectra of the nitrogen-15 substituted species of N₄(1+) supports the conclusion from earlier ab initio calculations and electron spin resonance observations that N₄(1+) has a linear, centrosymmetric ground-state structure. For the N₄(1+) species with noncentrosymmetric isotopic substitution, the in-phase end-atom stretching fundamental becomes infrared active and has also been observed. Although the anion responsible for overall charge neutrality of the deposit has not been definitively identified, secondary photolysis studies provide some information regarding its properties.

000,499

PB91-117978

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Ultrafast Infrared Response of Adsorbates on Metal Surfaces: Vibrational Lifetime of CO/Pt(111).

Final rept.

J. D. Beckerle, M. P. Casassa, R. R. Cavanagh, E. J. Heilwell, and J. C. Stephenson. 1990, 4p

Pub. in Physical Review Letters 64, n17 p2090-2093, 23 Apr 90.

Keywords: *Carbon monoxide, *Adsorbates, Infrared radiation, Transient response, Platinum, Adsorption, Surfaces, Reprints, Vibrational relaxation, Picosecond time, Lifetime.

A picosecond time-resolved infrared technique has been used to measure the transient response of vibrationally excited CO adsorbed on the surface of a Pt(111) single crystal. Transient-bleaching signal decay is interpreted as giving T(1) for damping of vibrationally excited CO. Transient absorption is discussed in terms of transitions from the excited adsorbate band to overtone levels.

000,500

PB91-118091

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Global Thermodynamic Behavior of Fluids in the Critical Region.

Final rept.

Z. Y. Chen, A. Abbaci, S. Tang, and J. V. Sengers. 1990, 15p

Contract DE-FG05-88ER13902

Sponsored by Department of Energy, Washington, DC. Pub. in Physical Review A 42, n8 p4470-4484, 15 Oct 90.

Keywords: *Thermodynamic properties, *Fluids, Equations of state, Critical point, Free energy, Carbon dioxide, Ethane, Steam, Reprints.

In a preceding publication (Z. Y. Chen, P. C. Albright, and J. V. Sengers, Phys. Rev. A 41, 3161 (1990)) a procedure for constructing a thermodynamic free energy of fluids was proposed that incorporates crossover from singular behavior at the critical point to regular behavior far away from the critical point. In the present paper this procedure, based on an approximate solution of the renormalization-group theory of critical phenomena, is further extended so that it can be used in conjunction with a six-term classical Landau expansion. The resulting thermodynamic free energy yields a satisfactory representation of the thermodynamic properties of fluids in a large range of temperatures and densities around the critical point, as is demonstrated by a comparison with experimental thermodynamic-property data for carbon dioxide, steam, and ethane.

000,501

PB91-118109

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Effects of Extinction on X-ray Powder Diffraction Intensities.

Final rept.

J. P. Cline, and R. L. Synder. 1987, 10p
Pub. in Advances in X-ray Analysis, v30 p447-456 1987.

Keywords: *X ray diffraction, *Powder(particles), *Extinction, Particle size, Quantitative analysis, Spray drying, Reprints.

The effects of particle size on integrated intensity measurements of X-ray powder diffraction were investigated. Six sets of two phase mixtures were spray dried to eliminate preferred orientation. Variables between each series included particle size and absorption contrast, the variable within each series was the relative quantity of the phases present. Data were collected at four wavelengths and were reduced to the reference intensity ratio (RIR). The RIR data indicated a reduction in diffracted intensity occurred varying directly with the particle size of the phase being examined. An early Zachariasen theory for the effects of primary extinction accounted for the trends observed.

000,502

PB91-118216

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Optothermal-Infrared and Pulsed-Nozzle Fourier-Transform Microwave Spectroscopy of Rare Gas-CO₂ Complexes.

Final rept.

G. T. Fraser, R. D. Suenram, and A. S. Pine. 1988, 11p

Pub. in Jnl. of Chemical Physics 88, n10 p6157-6167 1988.

Keywords: Carbon dioxide, Infrared spectroscopy, Microwave spectroscopy, Reprints, *Complexes, *Argon complexes, *Krypton complexes, *Neon complexes, Van der Waals forces.

Sub-Doppler infrared spectra of Ne-CO₂, Ar-CO₂, and Kr-CO₂ have been recorded near approx. 3613 and 3715/cm, in the region of the 2(nu sub 2, sup 0) + (nu sub 3)/(nu sub 1) + (nu sub 3) Fermi diad of CO₂, using anoptothermal molecular-beam color-center laser spectrometer. In addition, pulsed-nozzle Fourier-transform microwave spectra are reported for the ground vibrational states of the complexes. The infrared and microwave spectra are consistent with T-shaped complexes as shown originally by Steed, Dixon, and Klemperer for Ar-CO₂. The infrared band origins for the Ar and Kr complexes are red shifted. For Ne-CO₂, blue shifts are observed. The lower Fermi components are free of perturbation, whereas the upper components of Ar-CO₂ and Kr-CO₂ are perturbed. For Ar-CO₂ the perturbation is strong, shifting the positions of the Q-branch lines of the Ka=1-0 sub-band by as much as 500 MHz.

000,503

PB91-118240

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Laser-Excited Hot-Electron Induced Desorption: A Theoretical Model Applied to NO/Pt(111).

Final rept.

J. W. Gadzuk, L. J. Richter, S. A. Buntin, D. S. King, and R. R. Cavanagh. 1990, 17p

Contract DE-A105-84ER13150
Sponsored by Department of Energy, Washington, DC. Pub. in Surface Science 235, p317-333 1990.

Keywords: *Nitrogen oxide(NO), Platinum, Adsorbates, Surfaces, Reprints, *Laser induced desorption, Molecular dynamics, Hot electrons.

The authors present a theoretical model for stimulated desorption due to the interaction of energetic substrate carriers with molecular adsorbates. The model is based on the premise that optically excited hot electrons scatter into an unoccupied valence electron resonance of the adsorbate, thus forming a temporary negative molecular ion which then experiences an enhanced attraction towards the substrate. Neutralization of the ion returns the adsorbed molecule to one of the continuum states of the molecule/substrate potential energy surface, possibly in an internally excited state. The consequences of such a model are worked out using semiclassical wave packet dynamics which, in the short time limit relevant to the present situation, can be brought to an analytic realization. The model provides considerable insight into recent experiments on the laser-induced desorption of NO from Pt(111).

000,504

PB91-118299

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.

Rate Constants and Mechanism for the Reaction of Hydrogen Atoms with Aniline.

Final rept.

Y. Z. He, J. P. Cui, W. G. Mallard, and W. Tsang. 1988, 4p

Pub. in Jnl. of Physical Chemistry 92, p1510-1513 1988.

Keywords: *Anilines, *Decomposition reactions, Shock tubes, Reprints, Hydrogen atoms, Rate constants, Amino radicals, High temperature.

The authors have studied the hydrogen atom induced decomposition of aniline using a heated single pulse shock tube. Hydrogen atoms are generated from hexamethylethane decomposition. At sufficiently high aniline to hexamethylethane concentration the main reactions are abstraction of the amine hydrogen and the displacement of the amino group. The rate expressions have been found over the temperature range of 1000-1140K and at pressures near 3 atms of argon. These rate expressions are compared to earlier results on toluene and phenol.

000,505

PB91-118349

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Grazing-Angle X-ray Standing Waves.

Final rept.

T. Jach, and M. J. Bedzyk. 1990, 4p

Pub. in Physical Review B 42, n8 p5399-5402, 15 Sep 90.

Keywords: *Iodine, *X ray fluorescence, Standing waves, Substrates, Germanium, Impurities, Reprints, Grazing incidence, Surface reactions, Adatoms.

The authors have observed fluorescent radiation from surface adatoms of I on Ge(111) using x-ray standing waves created in the grazing-angle geometry. The authors demonstrate that standing waves which are determined by the real part of the x-ray wave vectors provide accurate atomic positions of adatoms or impurities parallel to the surface. The effect of changing evanescence due to the imaginary part of the wave vectors is directly visible in the standing-wave signal detected from the substrate. When combined with x-ray standing-wave results normal to the surface obtained from diffraction in the Bragg geometry, the measurements reveal that I reacted chemically with the (111) surface of Ge binds to the atop site of the Ge atom.

000,506

PB91-118364

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Influence of Adsorbed Potassium on Electron Stimulated Desorption of PF₃ on Ru(0001).

Final rept.

S. A. Joyce, J. A. Yarmoof, T. E. Madey, and P. Nordlander. 1990, 2p

Sponsored by Department of Energy, Washington, DC. Pub. in Vacuum, p738-739 1990.

Keywords: *Potassium, *Chemisorption, Chemical bonds, Rubidium, Adsorption, Reprints, *Phosphorus fluorides, Electron stimulated desorption, Low energy electron diffraction.

The authors have studied the coadsorption of PF₃ and K on Ru(0001) using LEED, TDS and ESDIAD (electron stimulated desorption, ion 3 angular desorption) of positive ions, negative ions, and metastable species. In the absence of potassium, both positive and negative ion ESDIAD show highly anisotropic, off-normal fluorine ion emission (F(1+), F(1-)) from PF₃ demonstrating that PF bonds are inclined away from the surface normal. In the presence of K, ESDIAD patterns of F(1+), F(1-), and metastable F(*) show normal emission, suggesting a reorientation or chemical reaction which results in fluorine bonding perpendicular to the surface. The yields of the various fluorine species vary strongly with potassium coverage; the results are interpreted in terms of a charge transfer model which includes the lateral anisotropy of the surface potential due to the presence of coadsorbed K.

000,507

PB91-118513

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Generalized Corresponding States and High-Temperature Aqueous Solutions.

Final rept.
J. M. H. Levelt-Sengers, and J. S. Gallagher. 1990, 10p
Pub. in *Jnl. of Physical Chemistry* 94, n20 p7913-7922 1990.

Keywords: *Electrolytes, Dielectric properties, Compressibility, Phase diagrams, Thermodynamic properties, Phase transformations, Nitrogen, Argon, Carbon dioxide, Sodium chloride, Reprints, *Aqueous solutions, *Corresponding states, High pressure, High temperature.

The limited scope of the law of corresponding states having been recognized since the turn of this century, scientists have devised several ways in which to generalize the principle. The generalization to nonspherical molecules led to Pitzer's acentric factor, which is widely used in engineering applications. Another generalization is that due to Rowlinson, Leland, and others and permits mapping of the properties of a fluid or fluid mixture onto those of a reference fluid. Several applications of this latter method to high-temperature aqueous electrolyte and nonelectrolyte systems are presented here. The purpose is to provide an alternative to the more traditional excess Gibbs free energy formulations, for applications where the solvent compressibility is large and the dielectric constant low. In all cases studied, simultaneous descriptions are obtained for many properties in the sub- and supercritical regime, such as phase boundaries, critical lines, Henry constants, and partial and apparent molar properties, including their infinite-dilution limits. The agreement with experimental data is semiquantitative. Advantages and drawbacks of the method are discussed.

000,508

PB91-118554 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Nitrogen Valence Electronic Structure in the Strong Chemisorption Limit: Molecular Adsorption on Cr(110) and O/Cr(110).

Final rept.
N. D. Shinn. 1990, 12p
Sponsored by Office of Naval Research, Arlington, VA., Department of Defense, Washington, DC., and Department of Energy, Washington, DC.
Pub. in *Physical Review B* 41, n14 p9771-9782, 15 May 90.

Keywords: *Nitrogen, *Chemisorption, Synchrotron radiation, Adsorption, Chromium, Surfaces, Chemical bonds, Work functions, Cryogenics, Oxygen, Reprints, Photoelectron spectroscopy, Chemical dissociation, Photoemission, Electronic structure.

Nitrogen adsorption and dissociation on clean and oxygen-dosed Cr(110) surfaces have been studied with angle-integrated synchrotron-radiation ultraviolet photoelectron spectroscopy (UPS) and work-function measurements. Consideration of the results in comparison with other nitrogen chemisorption studies shows that the bonding of nitrogen to Cr(110) is not well described by the usual sigma-donation and pi-backbonding concepts. A bonding geometry with both nitrogen atoms coordinated to chromium atoms is proposed in spite of the absence of surface hollow sites usually invoked to account for such a species.

000,509

PB91-133835 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.
Fugacity Coefficients of Hydrogen in (Hydrogen + 2-Methylpropane): Pressure Dependence.

Final rept.
T. J. Bruno, and S. L. Outcalt. 1990, 11p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in *Jnl. of Chemical Thermodynamics* 22, p873-883 1990.

Keywords: *Fugacity, *Hydrogen, *Butanes, Gas laws, Thermodynamics, Pressure, Reprints, *Binary mixtures, *Fugacity coefficient.

The fugacity coefficients of hydrogen in (hydrogen + 2-methylpropane) were measured with a physical-equilibrium technique at pressures of (5.13, 6.78, 10.17, and 13.50) MPa, all at a temperature of 403.15K. The physical-equilibrium technique involved the use of an experimental chamber that was divided into two separate regions by a semipermeable membrane through which hydrogen, but not 2-methylpro-

pane, could permeate. Measurement of the gas pressures on each side of the membrane, in addition to a measurement of the binary-mixture composition and the system temperature, allowed the calculation of the fugacity and fugacity coefficient of hydrogen in the mixture. The qualitative features of the measurements are discussed, and comparisons are made with predictions obtained from the Redlich-Kwong and Peng-Robinson models.

000,510

PB91-133843 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Thermodynamic Properties of Ammonium Halogen Stannates 1. Heat Capacity and Thermodynamic Functions of Deuterated Ammonium Hexachlorostannate (ND₄)₂SnCl₆ from 5.9 to 347 K.

Final rept.
J. E. Callanan, R. D. Weir, and E. F. Westrum. 1990, 9p
Pub. in *Jnl. of Chemical Thermodynamics* 22, p149-157 1990.

Keywords: *Specific heat, *Thermodynamic properties, *Tin inorganic compounds, Tin halides, Ammonium compounds, Entropy, Heat measurement, Deuterium compounds, Labeled substances, Isotopic labeling, Reprints.

The heat capacity of deuterated ammonium hexachlorostannate (ND₄)₂SnCl₆ was measured from 5.9 to 347 K by adiabatic calorimetry. The heat capacity is characterized by a lambda-shaped anomaly that reaches its maximum (53 R(R=8.31451 J/K/mol) at approximately 244 K. The value of Delta S for the anomaly is 0.48 R. Values of the standard thermodynamic quantities are tabulated to 350 K.

000,511

PB91-133850 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Thermodynamics of the Divalent Metal Fluorides. 2. Heat Capacity of the Fast Ion Conductor BaSnF₄ from 7 to 345 K.

Final rept.
J. E. Callanan, R. D. Weir, and E. F. Westrum. 1988, 10p
See also PB89-123913.
Pub. in *International Jnl. of Thermophysics* v9, n6 p1091-1100 Nov 88.

Keywords: *Specific heat, *Entropy, Adiabotic conditions, Thermodynamics, Reprints, *Barium tetrafluorostannate, Calorimetry, Low temperature, Fast ion conductors.

The heat capacity of the fast ion conductor BaSnF₄ was measured over the temperature range 7 < T < 345K using adiabatic calorimetry. Our results show that a phase transition is not present. However, an anomalous rise in the molar heat capacity, C(p,m), occurs in the region 210 < T < 310K; the entropy change of this rise amounts to delta/R=0.112. The anomaly coincides with the temperature range where a break in the slope of the electrical conductivity has been observed, which results in a threefold decrease in the activation energy required in the temperature region above the break at 272K. Standard molar thermodynamic functions are presented at selected temperatures from 5 to 345K.

000,512

PB91-134015 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
New Theoretical Aspects in DIET.

Final rept.
J. W. Gadzuk. 1990, 10p
Pub. in *Desorption Induced by Electronic Transitions, DIET IV, Springer Series in Surface Sciences*, v19 p2-11 1990.

Keywords: Electron transitions, Nitrogen oxide(NO), Oxygen, Palladium, Platinum, Reprints, *Electron stimulated desorption, *Laser induced desorption.

A number of stimulated desorption issues that have been addressed in terms of wave packet propagation over image-potential augmented, intermediate state potential curves will be discussed. Specifically, giant enhancements in ESD yields of O(a)/Pd(III) and laser-induced desorption for NO/Pt(III) will be considered.

000,513

PB91-134080 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Thermophysics Div.
Melting Curve of Tetrahydrofuran Hydrate in D₂O.

Final rept.
H. J. M. Hanley, G. W. Meyers, J. W. White, and E. D. Sloan. 1989, 7p
Pub. in *International Jnl. of Thermophysics* 10, n4 p903-909 Jul 89.

Keywords: *Melting points, *Hydrates, *Heavy water, Crystal structure, Phase diagrams, Temperature measurement, Reprints, *Tetrahydrofuran.

Melting points for the tetrahydrofuran/D₂O hydrate in equilibrium with the air-saturated liquid at atmospheric pressure are reported. The melting points were measured by monitoring the absorbance of the solution. Overall, the melting-point phase boundary curve is about 2.5K greater than the corresponding curve for the H₂O hydrate, with a congruent melting temperature of 281 + or - 0.5K at a D₂O mole fraction of 0.936. The phase boundary is predicted to within 5% if the assumption is made that the THF occupancy in the D₂O and H₂O hydrates is the same. The authors measure an occupancy of 99.9%. The chemical potential of the empty lattice in D₂O is estimated to be 5% greater than in H₂O.

000,514

PB91-134205 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Effective Core Potentials and Accurate Energy Curves for Cs₂ and Other Alkali Diatomics.

Final rept.
M. Krauss, and W. Stevens. 1990, 7p
Pub. in *Jnl. of Chemical Physics* 93, n6 p4236-4242, 15 Sep 90.

Keywords: *Diatomic molecules, *Alkali metals, *Dissociation energy, Cations, Spectroscopic analysis, Ground state, Energy levels, Reprints, *Excited states, *Effective core potentials.

Energy curves of Cs₂ that correlate to the ground (SS) and first excited asymptote (SP) are calculated using compact effective potentials (CEP) and core polarization potentials (CPP) which reduce the alkali atom to a single valence electron. Dissociation energies and equilibrium internuclear separations are in good agreement with experimental values. The long-range properties of the energy curves are analyzed to determine the region where the chemical interactions begin. Analogous energy curves and spectroscopic constants are obtained for the Rb₂ molecule. The ground state singlet and triplet energy curves are also determined for K₂. For completeness, the ground state spectroscopic constants are also reported for the Li and Na neutral and cation homonuclear diatomic molecules to illustrate the accuracy of the CEP and CPP for all the alkali atoms. Both doublet and quartet energy curves of the homonuclear anions also were examined. The dissociation energies and electron detachment energies of the doublet ground state for Rb₂(-1) and Cs₂(-1) are in good agreement with experiment. An assignment of the photoelectron spectra of Cs₂(-1) is possible from the electronic structure of the ground state and the excitation energies of the neutral states. Quartet excited states of Cs₂(-1) are calculated to be bound relative to the triplet Sigma(sub u)(+) neutral state but are metastable with respect to the ground singlet Sigma(sub g)(+) state. The accuracy of the ionic energy curves shows that the CEP and CPP are transferrable to the ionic systems.

000,515

PB91-134460 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.
Thermodynamic Properties of CFC Alternatives: A Survey of the Available Data.

Final rept.
M. O. McLinden. 1990, 14p
Sponsored by Department of Energy, Washington, DC.
Pub. in *International Jnl. of Refrigeration* 13, p149-162 May 90.

Keywords: *Halohydrocarbons, *Boiling points, *Vapor pressure, *Critical point, *Specific heat, Ideal gas, Tables(Data), Substitutes, Fluorohydrocarbons, Thermodynamics, Reprints, pVT data.

Physical & Theoretical Chemistry

The thermodynamic properties of ten halogenated hydrocarbons are collected from a variety of sources, including unpublished data. Considered are the triple point, normal boiling point and critical point parameters, and the temperature dependence of the vapour pressure, saturated liquid density and ideal gas heat capacity. Also considered are the single-phase p-V-T data. The saturation and ideal gas data are fitted to simple correlations. The fluids, which are potential alternatives to the fully halogenated chlorofluorocarbons, are R23, R32, R125, R143a, R22, R134a, R152a, R124, R142b and R123.

000,516

PB91-134841

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Elastic Effects during Late Stage Phase Transformations.

Final rept.

P. W. Voorhees, W. C. Johnson, and V. J. Laraja. 1986, 17p

Sponsored by National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA. Pub. in Proceedings of International Seminar Solute-Defect Interaction Theory and Experiment, Kingston, Canada, August 5-9, 1985, p409-425 1986.

Keywords: *Crystal defects, *Precipitation(Chemistry), *Texture, Thermodynamics, Surface energy, Stresses, Elastic properties, Solutes, Solutions, Residual stress, Surface roughness, Reprints, *Liquid-Solid interfaces, *Liquid-Liquid interfaces, Ostwald ripening, Gibbs-Thomson Equation.

The effect of elastic stress on coarsening in two-phase crystalline solids is examined using the recently developed thermodynamic description of curved interfaces in solids. For a system consisting of two coherent precipitates, it is shown that the elastic fields can induce a small precipitate to grow and a large precipitate to shrink, in contradiction to classic Ostwald ripening theory. It is shown that during precipitate growth the local concentration at the interface can depend strongly on the matrix supersaturation. The Gibbs-Thomson equation is derived for a growing spherical precipitate. It is shown that capillarity in such a solid is considerably different from that in a fluid-fluid system. Finally, the relationship between the misfit of a coherent precipitate and the surface energy is derived. It is shown that decreasing the misfit of the precipitate does not necessarily decrease the interfacial energy and that the sign of the change in surface energy with misfit depends explicitly on the signs and magnitudes of the surface residual stress and surface elastic constants.

000,517

PB91-134924

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Summary Abstract: The Chemisorption of SiCl₄, Si₂Cl₆, and Chlorine on Si(111) 7x7.

Final rept.

L. J. Whitman, S. A. Joyce, J. A. Yarnoff, F. R. McFeely, and L. J. Terminello. 1990, 2p
Pub. in Vacuum, p1056-1057 1990.

Keywords: *Silicon chlorides, *Silicon, *Chlorine, *Chemisorption, Reprints, Chemical vapor deposition, Soft x rays, Thermal desorption spectroscopy, Auger electron spectroscopy, Photoemission.

The chemisorption of SiCl₄, Si₂Cl₆ and Chlorine on Si(111) 7x7 has been studied with soft x-ray photoemission, thermal desorption spectroscopy, and Auger electron spectroscopy.

000,518

PB91-135012

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.

Investigations of Selectivity in Reversed-Phase Liquid Chromatography on Chemically Bonded C18 Phases.

Final rept.

S. A. Wise, L. C. Sander, and W. E. May. 1986, 22p
Pub. in Proceedings of Silanes, Surfaces, and Interfaces Symposium, Snowmass, CO., June 19-21, 1985, p349-370 1986.

Keywords: *Silanes, *Silicon dioxide, *Adsorbents, Surface properties, Synthesis(Chemistry), Aromatic polycyclic hydrocarbons, Polymers, Selectivity, Interfaces, Reprints, *Liquid chromatography, *Separation processes, Liquid-solid interfaces.

Octadecylsilane (C18) phases were prepared on a number of different silica substrates to investigate the factors that affect selectivity in reversed-phase liquid chromatography. The following factors were evaluated: (1) bonded phase type (monomeric and polymeric), (2) pore diameter and surface area of the silica substrate, and (3) C18 surface coverage. The greatest selectivity for the separation of polycyclic aromatic hydrocarbon (PAH) isomers was achieved for polymeric C18 phases prepared on wide-pore (150 Å diameter) silica and selectivity generally improves as the C18 surface coverage increases. The effects of solute shape and planarity have also been examined. PAH isomers were found to have significantly different retention characteristics on polymeric phases as compared to monomeric phases.

000,519

PB91-135038

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Photon Stimulated Desorption of Fluorine from Silicon Etched by XeF₂.

Final rept.

J. A. Yarnoff, S. A. Joyce, C. W. Lo, and J. Song. 1990, 10p

Pub. in Desorption Induced by Electronic Transitions, DIET IV, Springer Series in Surface Sciences, v19 p65-74 1990.

Keywords: *Silicon fluorides, *Fluorine, Etched crystals, Reprints, *Photon stimulated desorption, *Photoemission, Soft x-rays, Xenon fluorides.

The authors have measured soft x-ray photoemission and photon stimulated desorption (PSD) from silicon surfaces which were etched by XeF₂. These surfaces are covered with a layer approximately 20 Å thick composed of a mixture of silicon fluoride reaction intermediates. The relative intensities of both photoemission and PSD spectral features arising from each of the various SiF_x species depends strongly on the structure of the overlayer. Since photoemission measurements probe the entire reaction layer and PSD is sensitive to only the very outermost atomic layer, a comparison of these data can reveal structural details. The implications of these results on the structure of the reaction layer are discussed.

000,520

PB91-167460

(Order as PB91-167411, PC A05/MF A01)

National Inst. of Standards and Technology, Boulder, CO.

Vapor-Liquid Equilibrium of Carbon Dioxide with Isobutane and n-Butane: Modified Leung-Griffiths Correlation and Data Evaluation.

J. C. Rainwater, H. Ingham, and J. J. Lynch. 1990, 17p

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n6 p701-718, Nov/Dec 90.

Keywords: *Carbon dioxide, *Butanes, *Liquid-vapor equilibrium, Binary mixtures.

The Leung-Griffiths model as modified by Moldover and Rainwater is used to correlate high-pressure vapor-liquid equilibria of mixtures of carbon dioxide with n-butane and isobutane. Model correlations are compared against 10 independent experimental sources for these mixtures. Agreement is generally very good and comparable to mutual experimental discrepancies. The utility of the model as a data evaluation technique is demonstrated in that small suspect regions have been identified in certain data sets and the model predictions have been confirmed by subsequent measurements that agree with the model better than the earlier data.

Polymer Chemistry

000,521

PB90-135864

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Correlation of Cure Monitoring Techniques.

Final rept.

S. S. Chang, F. I. Mopsik, and D. L. Hunston. 1987, 12p

Pub. in Proceedings of International SAMPE (Society for the Advancement of Material and Process Engineers) Technical Conference (19th), p253-264 1987.

Keywords: *Curing, *Epoxy resins, Composite materials, Monitors, Process control, Mechanical properties, Viscosity, Thermal analysis, Dielectric properties, Fluorescence, Ultrasonic tests, Heat of reaction, Measurement, Viscous flow.

The mechanical properties of a finished composite or resin product depend strongly on the curing path followed during processing. To monitor the cure, a large number of properties which change with the degree of cure can be monitored. The properties may be sensitive to changes at the sub-molecule level to the bulk material level. Some of the methods, e.g., dielectric fluorescence and ultrasonic measurement techniques, may be suitable for on-line monitoring and process control. It is important to correlate the methods with flow characteristics during processing as obtained from viscosity measurements, and with the degree of cure as determined from thermal measurements. For an example, six different cure monitoring methods are used to follow cure in a model system and the results compared. The common traits, differences, and specific features are discussed in detail.

000,522

PB90-135872

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Heat of Reaction and Curing of Epoxy Resin.

Final rept.

S. S. Chang. 1988, 20p

Pub. in Jnl. of Thermal Analysis 34, n1 p135-154 1988.

Keywords: *Heat of reaction, *Curing, *Epoxy resins, Composite materials, Heat measurement, Process control, Monitors, Thermodynamics, Reaction kinetics, Imidazoles, Bisphenol-A, Differential thermal analysis, Reprints.

The heat of reaction and kinetics of curing of DGEBA type of epoxy resin with catalytic amounts of EMI have been studied by differential power-compensated calorimetry as a part of the program for the study of process monitoring for composite materials. A method of determination of heat of reaction from dynamic thermoanalytical instruments was given according to basic thermodynamic principles. The complicated mechanism, possibly involving initial ionic formation, has also been observed in other measurements, such as by time-domain dielectric spectroscopy. The behavior of commercially available DGEBA resin versus purified monomer DGEBA were compared. The melting point of purified monomeric DGEBA crystals is 41 deg C with a heat of fusion of 81 J/g. The melt DGEBA is difficult to crystallize upon cooling. The glass transformation of purified DGEBA monomer occurs around -22 deg C with a delta Cp of 0.60 J/K/g.

000,523

PB90-136607

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Fire Science and Engineering Div.

Behavior of Primary Radicals during Thermal Degradation of Poly(Methyl Methacrylate).

Final rept.

T. Kashiwagi, A. Inaba, and A. Hamins. 1989, 24p

Pub. in Polymer Degradation and Stability 26, p161-184 1989.

Keywords: *Free radicals, *Thermal degradation, *Polymethyl methacrylate, Plastics, Polymers, Cleavage, Molecular weight, Mass spectroscopy, Carbon monoxide, Carbon dioxide, Carbinols, Methane, Anions, Reaction kinetics, Reprints.

The behavior of the primary radicals formed from the random scission of anionically polymerized poly(methyl methacrylate) PMMA during thermal degradation is investigated by a theoretical and experimental study. It is proposed that the primary radical rearranges to form the polymer molecule with the unsaturated bond at a chain end. Two different degradation paths for this rearrangement are proposed via beta scission at the C-C bond of the pendant group instead of beta scission, as previously thought, at the backbone C-C bond. The products from the proposed degradation paths are CO, CO₂, CH₃OH, and CH₄.

The products for anionically polymerized PMMA samples with three different values of initial molecular weight are measured by a mass spectrometer. The quantities of CO and CO₂ are observed to decrease with an increase in initial molecular weight. This confirms that the two proposed degradation paths for the thermal degradation of PMMA are quite plausible.

000,524
PB90-149162 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Thermoreversible Gelation of Isotactic Polystyrene: Thermodynamics and Phase Diagrams.

Final rept.
J. M. Guenet, and G. B. McKenna. 1988, 5p
Pub. in *Macromolecules* 21, n6 p1752-1756 Jun 88.

Keywords: *Gelation, *Phase diagrams, *Polystyrene, *Thermodynamics, Molecular weight, Decalin, X ray diffraction, Microscopy, Chirality, Cooling, Heating, Reprints.

The thermodynamics of thermoreversible gelation of isotactic polystyrene in cis-decalin, trans-decalin and 1-chlorodecane was investigated. The gel formation and the gel melting were studied as a function of various parameters such as the cooling or heating rate and the polymer molecular weight. The temperature-concentration phase diagrams were established both from the cooling and the heating experiments. It is found that in both situations the shape of the phase diagram is the same with the same solvent but differs whether cis-decalin or trans-decalin is considered. The phase diagrams correspond to various types of compound: congruently melting compound in cis-decalin and compound characterized by a singular point in trans-decalin. In addition, it is shown from optical microscopy experiments and X-ray diffraction experiments that the threefold helical form reappears beyond 50% in trans-decalin but does not in cis-decalin.

000,525
PB90-149246 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.

Bubble Formation from a Sparger in Polymer Solutions-II. Moving Liquid.

Final rept.
A. K. Ghosh, and J. J. Ulbrecht. 1989, 9p
Pub. in *Chemical Engineering Science* 44, n4 p969-977 1989.

Keywords: *Polymers, *Bubbles, Rheology, Fermentation, Mixing, Chemical reactors, Photographic techniques, Reprints.

Bubble formation from orifices submerged in a continuous phase of viscous, shear-thinning and viscoelastic liquids has been investigated. A high-speed photographic technique was used to determine the bubble profile and the final bubble size. The experimental part of the investigation has afforded an insight into the dynamics of gas-liquid motion during the formation period of the bubble and the detachment criteria in polymeric liquids. A theoretical analysis has been developed by combining dimensional analysis and a force balance and a rheological equation to determine the bubble growth rate and the final bubble size. The role of the pseudoplasticity of the continuous phase on the size and shape of the bubble has been evaluated.

000,526
PB90-149519 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Preparation of Polymer Crystal Nuclei.

Final rept.
N. Ding, E. Amis, R. Salovey, and R. Briber. 1989, 8p
Pub. in *Jnl. of Polymer Science* 27, pTC p489-496 1989.

Keywords: *Polymers, *Crystallization, Suspending(Mixing), Quenching(Cooling), Toluene, Polyoxyethylene, Nucleation, Light scattering, Reprints, Transmission electron microscopy.

An alternative method has been developed to prepare suspensions of polymer crystals. The crystals are formed by rapidly freezing a clean toluene solution of poly(ethylene oxide) (PEO) to low temperature. When the frozen solution is warmed to room temperature, it provides a suspension of uniform and stable particles. The particles have been used as seeds for nucleating solution-grown PEO crystals. The diameters of the

seeds are measured by dynamic light scattering to be 0.16-0.8 micro m for solutions with concentrations ranging from 5 to 400 ppm. Transmission electron micrographs show the seeds to be clusters of square PEO lamellae. A possible mechanism for the seed formation is discussed.

000,527
PB90-154766 PC A04/MF A01
Clemson Univ., SC.

Ternary Reactions among Polymer Substrate-Organohalogen-Antimony Oxides under Pyrolytic, Oxidative and Flaming Condition.

Final rept. May 15, 1987.
M. J. Drews, C. W. Jarvis, and G. C. Lickfield. Jan 89, 64p NIST/GCR-89/558
Grant 60NANB-4D0033

Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Polymers, *Substrates, *Chemical reactions, *Halogen organic compounds, *Antimony oxides, *Pyrolysis, *Oxidation, Combustion products, Flameproofing, *Ternary systems, Fire resistant coatings, Solid phases, Calorimeters, Heat measurement, Textile processes, Polyethylene, Tables(Data), Bromination, Decabromodiphenyl oxide, Polybutylene terephthalate.

The objectives of the flame retardant chemistry study into the ternary reactions which occur among polymer substrates, organohalogen compounds and antimony oxides in the condensed phase under pyrolytic and combustion conditions were to elucidate in detail the principal solid state reactions which result in the formation of volatile antimony containing species and the role of the polymer substrate in the reactions; to establish a mechanistic basis for the role of the metal species in the degradation reactions which have been observed in the solid state; to relate the results from small scale degradation studies to the combustion behavior measured in the cone calorimeter and to attempt to establish useful parameters between the observed solid state chemistry and the combustion behavior.

000,528
PB90-163510 PC A06/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Institute for Materials Science and Engineering, Polymers: Technical Activities 1989.

L. E. Smith, and B. M. Fanconi. Jan 90, 121p
NISTIR-89/4150
See also report for 1988, PB89-166094.

Keywords: *Research management, *Polymers, Chemical properties, Mechanical properties, Composite materials, Blends, Dental materials, Medical supplies, *National Institute of Standards and Technology.

Technical Activities of the Polymers Division for FY 89 are reviewed. Included are descriptions of the 6 Tasks of the Division, project reports, publications, and other technical activities involving specialty polymers, chemical performance of polymers, mechanical performance of polymers, polymer composites, polymer blends and solutions, dental and medical materials.

000,529
PB90-170283 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Aging Effects and the Dependence of Modulus on Concentration in Isotactic Polystyrene/Cis-Decalin Gels.

Final rept.
G. B. McKenna, and J. M. Guenet. 1988, 3p
Pub. in *Polymer Communications* 29, n3 p58-60 Mar 88.

Keywords: *Aging tests(Materials), *Modulus of elasticity, *Compressive properties, *Concentration(Composition), *Resins, *Polystyrene, *Decalin, *Gels, Heat treatment, Polymers, Gelation, Reprints, Temperature dependence, Isotactic polystyrene.

Thermoreversible gels were formed by quenching solutions of isotactic polystyrene in cis-decalin. The room temperature modulus in compression of the gels was measured as a function of temperature of gel formation, aging time at temperature, and concentration of polystyrene in the gel. The results show that for gels formed at -20 C and -10 C, the modulus is independent

of aging time. Above zero degrees the modulus increases with increasing aging time. The shape of the log modulus-log concentration is independent of T(a) and T(gel), but the magnitude of the modulus depends upon both T(c) and T(gel).

000,530
PB90-170291 Not available NTIS
National Inst. of Standards and Technology (IMSE)
Gaithersburg, MD. Polymers Div.

Glass Formation and Glassy Behavior.

Final rept.
G. McKenna. 1989, 52p
Pub. in *Comprehensive Polymer Science - The Synthesis, Characterization, Reactions and Applications of Polymers*, Chapter 10, p311-362 1989.

Keywords: *Polymers, *Glass transition temperature, Thermodynamic properties, Kinetics, Molecular weight, Chemical composition, Entropy, Free energy, Molecular theory, Aging tests(Materials), Reprints.

The thermodynamics and kinetics of the glass transition are reviewed. The glass transition event is recognized as a kinetically observable phenomenon with a possible underlying second order thermodynamic transition influencing behavior. A discussion of thermodynamic transitions in the Ehrenfest sense is made and the glass transition related to it. It is pointed out that PVT experiments in glasses, due to kinetic effects, cannot be used to elucidate the thermodynamic nature of the glass transition event. Discussions of the configurational entropy theory of the glass transition and the free volume models are used to show the important molecular parameters which determine the glass transition temperature, e.g., molecular weight, cross-linking, composition of copolymers and blends. The kinetics of volume recovery in glasses is also presented within the framework of the modern phenomenological theories of the Narayanaswamy-Moynihan-KANF types. The Ngai coupling model is explained and the Robertson, Simha, Curro free volume is examined. Brief comments are made about physical aging and computer simulation.

000,531
PB90-170697 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Standard Polymers.

Final rept.
P. H. Verdier, and L. E. Smith. 1989, 12p
Pub. in *Determination of Molecular Weight*, Chapter 17, p505-516 1989.

Keywords: *Standards, *Polymers, *Synthetic elastomers, *Synthetic resins, Molecular weight, Polysaccharides, Reprints, Characterization.

The chapter surveys commercially available synthetic polymers for which molecular weight (and sometimes other properties as well) is given. Standards which merely happen to be made of polymeric materials are not included. In addition, the techniques and problems encountered with biopolymers are sufficiently different from those for synthetic polymers to warrant exclusion from the survey. An exception has been made for some polysaccharide standards whose nature and characterization appear to be comparable with those of synthetic polymers.

000,532
PB90-170796 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Molecular Weight and Concentration Dependences of the Terminal Relaxation Time and Viscosity of Entangled Polymer Solutions.

Final rept.
R. W. Rendell, G. B. McKenna, and K. L. Ngai. 1987, 7p
Pub. in *Macromolecules* 20, n9 p2250-2256 1987.

Keywords: *Molecular weight, *Concentration(Composition), *Polymers, *Solutions, *Viscosity, *Relaxation time, Mathematical models, Reprints, Intramolecular structures, Coupling, Entanglement.

A new model is presented for entangled polymer solutions which accounts for the observed molecular weight and concentration dependences of the zero-shear viscosity and the terminal relaxation time. The development, based upon the coupling model of relaxation, quantitatively describes how relaxation of a

primitive mode is modified by coupling through entanglements to its environment. The primitive mode is represented by a Rouse chain of Gaussian submolecules.

000,533
PB90-192436 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Morphological Partitioning of Chain Ends and Methyl Branches in Melt Crystallized Polyethylene by ¹³C NMR.

Final rept.
E. Perez, and D. L. Vanderhart. 1987, 17p
Pub. in Jnl. of Polymer Science 25, n8 p1637-1653 Aug 87.

Keywords: *Polyethylene, Microstructure, Separation, Nuclear magnetic resonance, Spectroscopy, Molecular structure, Crystallization, Melts, Polymers, Vinyl resins, Solids, Reprints, Carbon 13, Ethylene propylene diene copolymer.

The partitioning of methyl and vinyl ends between the crystalline and noncrystalline regions of polyethylene has been investigated using ¹³C NMR in the solid state. The polyethylene samples, which were crystallized from the melt, varied in molecular weight, polydispersity, crystallization rate and comonomer content. For the limited set of samples considered, the ratio of crystal to overall end concentration is independent of those variables. The ratio takes the value of 0.75 and 0.60 for the methyl and vinyl ends, respectively. When the crystalline fraction of the samples is taken into account, 50-75% of the total saturated ends and 42-63% of the total vinyls reside in the crystal. For an ethylene/propylene copolymer, 21-27% of the methyl branches were determined to be in the crystal. The level of incorporation puts methyl branches in a position intermediate between chain ends and ethyl branches.

000,534
PB90-192568 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Microstructure and Isotopic Labeling Effects on the Miscibility of Polybutadiene Blends Studied by the Small-Angle Neutron Scattering Technique.

Final rept.
S. Sakurai, H. Hasegawa, T. Hashimoto, I. G. Hargis, S. L. Aggarwal, and C. C. Han. 1990, 9p
Pub. in Macromolecules 23, n2 p451-459 1990.

Keywords: *Polybutadiene, Microstructure, Isotopic labeling, Solubility, Copolymers, Blends, Elastomers, Neutron scattering, Deuterium compounds, Phase diagrams, Reprints, Small angle scattering.

Deuterated polybutadiene and protonated polybutadiene (PBD/PBH) blends with various microstructures have been studied by the small-angle neutron scattering experiments. Correlation length, zero wavenumber structure factor, and interaction parameter have been obtained. All PBD/PBH blends exhibit UCST behavior. With the use of random copolymer theory, the interaction parameter has been successfully separated into interaction parameters between the same isotopically labeled 1,2-unit and 1,4-unit, the opposite isotopically labeled 1,2-unit and 1,4-unit, and the opposite isotopically labeled 1,2-unit and 1,2 unit or 1,4-unit and 1,4-unit.

000,535
PB90-193368 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Proton MAS NMR Method for Determining Intimate Mixing in Polymer Blends.

Final rept.
D. L. VanderHart, W. Herman, W. F. Manders, and R. S. Stein. 1987, 3p
Pub. in Macromolecules 20, n7 p1724-1726 1987.

Keywords: *Polymers, *Mixtures, *Nuclear magnetic resonance, Spectroscopy, Blends, Polystyrene, Deuterium compounds, Isotopic labeling, Protons, Hydrogen, Reprints, *Magic angle spinning(Free index).

A very simple proton NMR method is described for probing intimacy of mixing in polymer blends on a distance scale less than 1 nm. The method requires that one of the polymer constituents be nominally (98-99%) perdeuterated, and the other fully protonated; moreover, both polymers should be in a temperature range where they are relatively immobile. The dilute nature of the proton spins in the perdeuterated polymer implies that the spectrum of its residual protons

will be broken up into centerbands and spinning sidebands at rather low magic-angle spinning (MAS) frequencies. At these same frequencies, no such narrowing will be visible in the protonated homopolymer. In a blend of these two polymers, intimate mixing is probed via the attenuation of the narrowed centerband arising from the protons in the deuterated polymer. The narrowed resonances can be easily distinguished atop the broad resonance from the protonated polymer. In a mixture of deuterated (30%) and protonated (70%) atactic polystyrenes, which are expected to mix intimately, attenuation of the aromatic centerband at a MAS frequency of 2.2 kHz is found to be 85% compared to that expected for a totally phase-separated mixture. The experiment can be carried out using a high resolution spectrometer, although MAS capability is, of course, required.

000,536
PB90-193426 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Viscosity and Molecular Weight Distribution of Ultra-High Molecular Weight Polyethylene Using a High Temperature Low Shear Rate Rotational Viscometer.

Final rept.
H. L. Wagner, and J. G. Dillon. 1988, 16p
Pub. in Jnl. of Applied Polymer Science 36, n3 p567-582 1988.

Keywords: *Viscosity, *Molecular weight, *Polyethylene, Polymers, Plastics, Shear rate, Viscometers, Crystallization, Reprints, High temperature, Rotating cylinders, Fractionation.

To obtain accurate measurements of the limiting viscosity number (LVN) or the intrinsic viscosity of solutions of ultrahigh molecular weight polyethylene (UHMWPE), a low shear floating-rotor viscometer of the Zimm-Crothers type was constructed to measure viscosities at elevated temperatures (135 C) and near zero shear rate. The zero shear rate measurements for UHMWPE whole polymer and UHMWPE fractionated by hydrodynamic crystallization were compared with viscosity measurements at moderate and high shear rates (up to 2000/s) carried out in a capillary viscometer. The limiting viscosity number of UHMWPE decreases, as expected, with shear rate. The high shear rate data could not be extrapolated to yield the correct zero-shear rate viscosities. Fractionation of UHMWPE gave 10 fractions ranging in LVN from 9 to 50 dL/g. A tentative integral molecular weight distribution for the whole polymer was calculated on the basis of the Mark-Houwink equation, but because it had been previously established only for lower molecular weight polyethylenes, it may not be accurate. A correlation was found between the LVN's for the fractions in the two types of viscometers.

000,537
PB90-205907 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Monitoring the Quality of Mix of Polymer Melts with Particulate Fillers Using Fluorescence Spectroscopy.

Final rept.
A. J. Bur, J. Shibata, T. K. Trout, F. W. Wang, and C. L. Thomas. 1989, 7p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Polymer Engineering and Science 29, n24 p1759-1765 Dec 89.

Keywords: *Melts, *Polybutadiene, Fillers, Elastomers, Polymers, Aluminum oxide, Mixing, Monitors, Reprints, Fluorescence spectroscopy.

Fluorescence spectroscopy has been employed to monitor the mixing of polymer melts with filler material. The polymer melts were low molecular weight polybutadiene and PBAN, a terpolymer consisting of 85% butadiene, 11% acrylonitrile, 4% acrylic acid, and the filler material was aluminum oxide. To carry out the fluorescence observations, a dopant chromophore was mixed into the polymer melt at very low concentrations, 10(sup -4) to 10(sup -6) molar or 11 to 0.11 ppm by weight. The mixing experiments were carried out using a small laboratory mixer which had glass walls for viewing the fluorescence spectra from the dopant chromophore. Fluctuations in fluorescence intensity were observed to decrease as a function of mixing time indicating that the spatial distribution of the fluorescent chromophores was becoming more uniform. Concerning the mixing of polymer melt and filler, it is hypothesized that uniform mixing of ingredients is

achieved when fluorescence intensity as a function of time is constant. In order to obtain quantitative support for the hypothesis, a fluorescence microscope was used to measure fluorescence intensity and optical transmittance from microscopic regions of well-mixed and poorly mixed specimens.

000,538
PB90-206137 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Analysis of the Corrections to the Normal Force Response for the Cone and Plate Geometry in Single Step Stress Relaxation Experiments.

Final rept.
L. J. Zapas, G. B. McKenna, and A. Brenna. 1989, 23p
Pub. in Jnl. of Rheology 33, n1 p69-91 1989.

Keywords: *Stress relaxation tests, Experimental design, Rheological properties, Viscoelasticity, Conical bodies, Plates, Force, Stress analysis, Reprints, *Polybutylene.

An analysis and experimental results on a polyisobutylene solution are presented for the transient response in single step stress relaxation experiments in a cone and plate geometry. The experimental deviations from unity of the ratio of the first normal stress difference to the product of the strain times the shear stress are accounted for by including three important corrections in the analysis. First, it is shown that the finite time required to apply the step introduces corrections to the normal stresses which are greater than those for the shear stress. Second, the machine compliance introduces errors in the normal force by causing an increased gap separation which subsequently relaxes as the normal force relaxes. Third, the constrained geometry of the cone and plate results in the compliance corrections being 'magnified' by some 1600 times, leading to large corrections and apparent violations of the universal relation at long times. Experimental results for extension and compression in a parallel plate geometry are presented for different gap settings and used to demonstrate that the constrained cylinder problem in viscoelastic fluids is similar to that observed in elastic bodies.

000,539
PB90-206921 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Concentration Fluctuations in Mixtures of Linear and Star-Shaped Polymers.

Final rept.
T. P. Russell, L. J. Fetters, J. C. Clark, B. J. Bauer, and C. C. Han. 1990, 6p
Pub. in Macromolecules 23, n2 p654-659 1990.

Keywords: *Polystyrene, *Vinyl ether resins, Polymers, Phase diagrams, Blends, Transparency, Neutron scattering, Haze, Reprints, Poly(Vinyl methyl ether), Temperature dependence.

Mixtures of linear poly(vinyl methyl ether) (PVME) with four-armed star polystyrene (PS*) were studied to evaluate the effect of chain topology on the critical fluctuations in homogeneous polymer mixtures. It was found that the cloud point curve of the PS*/PVME mixtures were elevated by approximately 10 C over that of the corresponding linear mixtures. Use of deuterated PS* elevated the cloud point by another approximately 10 C. Small-angle neutron scattering (SANS) on mixtures of the deuterated PS* with PS* was used to evaluate the single chain structure factor of the PS*. The agreement between the theories of Benoit and Burchard for branched molecules and the experimental structure factor was excellent. Using the structure factor the concentration fluctuations in the homogeneous mixtures was investigated by SANS as a function of concentration and temperature. The inverse of the intensity at zero scattering vector, S(0)(sup -1), extrapolated linearly with the inverse temperature to yield the spinodal temperature Ts. The correlation length was found to be depend upon T-T(0))/T8(sup -v) where v = 0.5. The bare correlation length was found to depend upon composition in a manner similar to a previous study. Finally, the Flory-Huggins interaction parameter was found to vary with 1/T and to depend upon composition.

000,540
PB90-217803 Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.

Structure of the Polymer-Solvent Interface.

Final rept.

D. G. Miles, and J. W. Schmidt. 1990, 5p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in *Jnl. of Chemical Physics* 92, n6 p3881-3885, 15 Mar 90.

Keywords: *Polymers, Polarimetry, Polystyrene, Cyclohexane, Solvents, Molecular weight, Refractivity, Reprints, Liquid-liquid interfaces.

The first measurements of ellipticities from the liquid-liquid interface between polymer and solvent mixtures near the consolute points are reported. When scaled according to theory the ellipticities of high molecular weight polystyrene + solvent mixtures are consistent with those from simple, low molecular weight mixtures. The universal value of the scaled ellipticity is approximately 20% lower than that predicted by present theories.

000,541

PB90-218421

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Chain Dimension Determination of Deuterated Polybutadiene by Small-Angle Neutron Scattering on the Basis of Random Phase Approximation.

Final rept.

S. Sakurai, H. Hasegawa, T. Hashimoto, and C. C. Han. 1990, 5p

Pub. in *Polymer Communications* 31, p99-102 Mar 90.

Keywords: *Polybutadiene, Synthetic elastomers, Polymers, Neutron scattering, Markov chains, Deuteration, Random walk, Measurement, Isotopil labeling, Molecular structure, Reprints.

The chain dimension of a deuterated polybutadiene (DPB) which is mixed in the matrix of a protonated polybutadiene was measured by using the small-angle neutron scattering technique. The Kuhn's statistical segment length for the particular DPB with 20% 1,2-unit, 36% cis-1,4-unit, and 44% trans-1,4-unit was determined by two methods, the Zimm's method and the random phase approximation (RPA) calculation analysis. 6.88 Å is the more reliable statistical segment length for the DPB, which was obtained by the latter method. The advantages and shortcomings of both Zimm's method and RPA analysis for measuring single chain properties in bulk are also discussed.

000,542

PB90-235268

(Order as PB90-235243, PC A06)

National Inst. of Standards and Technology, Gaithersburg, MD.

Apparatus for Simultaneous Small Angle Neutron Scattering and Steady Shear Viscosity Studies of Polymer Melts and Solutions.

Bi-monthly rept.

A. I. Nakatani, H. Kim, and C. C. Han. 3 Oct 89, 8p

Included in *Jnl. of Research of the National Institute of Standards and Technology*, v95 n1 p7-14 Jan-Feb 90.

Keywords: *Vinyl ether resins, *Plastics, *Polymers, *Test equipment, *Polystyrene, Neutron scattering, Shear rate, Melts, Solubility, Blends, Binary systems (Materials), Deuterium, Process variables, Viscosity, Measurement, Small angle scattering.

The design and construction of an apparatus for studying the simultaneous small angle neutron scattering (SANS) and steady shear viscosity behavior of polymer melts and concentrated solutions is discussed. Successful operation of the device is demonstrated on a blend of 20 weight percent deuterated polystyrene and 80 weight percent poly(vinylmethylene). The effects of shear on the critical behavior of the blend are observed in the SANS behavior as a function of temperature and shear rate and indicate shear induced mixing behavior for the range of shear rates examined. The steady shear viscosity results alone are insufficient for detecting the transition from one to two places. The examination of shear effects in polymer blends is important for understanding the critical behavior of binary systems. Technologically, knowledge of the phase behavior of polymer blends under shear are important for the design and improvement of commercial blend processing.

000,543

PB90-241506

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Phase Behavior of Polymer Blends.

Final rept.

C. Han. 1990, 12p

Pub. in *Rubber Chemistry and Technology* 63, n1 p98-109 Mar/Apr 90.

Keywords: *Polymers, *Polystyrene, *Polybutadiene, *Vinyl ether resins, Blends, Elastomers, Deuteration, Neutron scattering, Phase diagrams, Heat of mixing, Isotopic labeling, Molecular weight, Molecular structure, Reprints, Temperature dependence.

Both deuterated polystyrene/poly(vinyl methyl ether) and deuterated polybutadiene/protonated polybutadiene blends have been studied by the small angle neutron scattering technique as a function of temperature, composition, molecular weight and microstructure (in the PBD/PBH case). It can be shown that the binary interaction parameter of the polymer blends can be obtained effectively and accurately. The free energy of mixing can be obtained and the phase diagram can be predicted. In the polybutadiene/polybutadiene case, UCST behavior has been observed and individual pair interaction parameters can be separated out. With the use of copolymer theory, phase behavior can be predicted.

000,544

PB90-254822

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Shear Stabilization of Critical Fluctuations in Bulk Polymer Blends Studied by Small Angle Neutron Scattering.

Final rept.

A. I. Nakatani, H. Kim, Y. Takahashi, Y. Matsushita,

A. Takano, B. Bauer, and C. C. Han. 1990, 16p
Pub. in *Jnl. of Chemical Physics* 93, n1 p795-810, 1 Jul 90.

Keywords: *Vinyl ether resins, *Polystyrene, *Polybutadiene, Neutron scattering, Binary systems (Materials), Shear rate, Deuterium, Isotopic labeling, Viscosity, Reprints, *Polymer blends, Temperature dependence, Small angle scattering.

The small angle neutron scattering (SANS) technique has been used to study the concentration fluctuations of binary polymer mixtures under shear. Two different polymer systems, deuterated polystyrene/poly(vinylmethylene) and deuterated polystyrene/polybutadiene, have been studied as a function of temperature and shear rate. Due to the small wavelength of the incident neutron radiation compared with light, the shear dependence of concentration fluctuations in the one-phase region and in the strong shear limit has been obtained from the q dependence of the scattering structure factor for the first time. From a detailed analysis of the scattering structure factor $S(\text{sub } q)$ a crossover value of the wave number $q(\text{sub } s)$ has been obtained as a function of temperature and shear rate. The crossover wave number represents the inverse of the lowest fluctuation mode which is not affected by shear. The temperature, viscosity, and shear rate dependence of the experimentally determined $q(\text{sub } s)$ agree well with a simple rotatory diffusion model and also the dynamic mode-mode coupling analysis of Kawasaki and Ferrell. The apparent spinodal temperature as a function of shear rate is shown to be consistent with the prediction of Onuki.

000,545

PB90-260944

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Small Angle Neutron Scattering Studies of Blends of Protonated Linear Polystyrene with Crosslinked Deuterated Polystyrene.

Final rept.

R. M. Briber, and B. J. Bauer. 1990, 9p

Pub. in *Materials Research Society Symposia Proceedings*, v171 p203-210 1990.

Keywords: *Polystyrene, Neutron scattering, Deuterium, Crosslinking, Isotope effect, Isotopic labeling, Thermodynamic properties, Synthesis (Chemistry), Free energy, Reprints, *Polymer blends, Small angle scattering.

Small angle neutron scattering (SANS) has been used to study the scattering function and thermodynamics of blends of linear protonated polystyrene (PSH) and crosslinked deuterated polystyrene (PSD). Two series of samples were synthesized. In both cases the sam-

ples were made by dissolving the linear PSH in deuterated styrene monomer containing a small amount of divinyl benzene as a crosslinker which was then polymerized to form the PSD network around the linear PSH chains. The samples were all made at a concentration of 50/50 by weight PSD/PSH. A special effort was made to keep the samples single phase so that SANS could be used to study the thermodynamics of the system and compare with theory. This entailed working at relatively low crosslink densities (<1 mole % crosslink units). Series 1 is a set of samples with the same crosslink density varying the length of the linear chain. Series 2 is a set of samples containing the same length linear chain varying the crosslink density systematically. By extrapolating $S(q)$ obtained from SANS to $q=0$ the zero angle scattering, $S(0)$, was obtained. $S(0)$ is inversely proportional to the second derivative of the free energy with respect to composition, $\Delta(\text{sup } 2)(\Delta\text{elta } f/\text{kt})/\Delta(\text{phi})(\text{sup } 2)$. Assuming additivity of the free energies of mixing and elasticity, the portion of the zero angle scattering due to elasticity is calculated.

000,546

PB90-261132

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Phase Behavior and Gelation of a Rod-Like Polymer in Solution and Implications for Microcellular Foam Morphology.

Final rept.

C. L. Jackson, and M. T. Shaw. 1990, 16p

Pub. in *Polymer* 31, p1070-1084 Jun 90.

Keywords: *Polymers, *Glutamates, *Liquid crystals, Gelation, Freezing, Benzene, Water, Dioxanes, Isotropy, Foam, Cellular materials, Rods, Reprints, Phase separation (Materials).

The phase separation and gelation of the rod-like macromolecule, poly(γ -benzyl-L-glutamate), were studied in an effort to understand the mechanism by which microcellular materials are made via thermally induced phase separation processes. Previous workers have studied similarly prepared materials from molecules which exist as random coils in solution. The microcellular materials were formed by lowering the solution temperature until phase separation and solvent freezing occurred. The solvent was removed by vacuum sublimation. An emphasis was placed on dilute isotropic solutions (<5 wt%) which yield low-density materials or 'foams'. Both one- (e.g. benzene) and two-component (e.g. dioxane/water) solvent systems were employed. The morphology produced by liquid-liquid phase separation and gelation was an open-celled, fibrous structure, which resembles a three-dimensional lattice. The cell diameters were in the range of 1-10 micrometers and the fibers which comprise the struts were 0.2 to 2.0 micrometers thick. Various experimental observations are discussed in terms of the theories and proposed mechanisms of phase separation in solutions of rod-like macromolecules. Calculations of the spinodal for the Flory theory of rod-like particles were also made to assess the possibility of placing the isotropic solutions into an unstable region.

000,547

PB90-261165

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Aspects of the Crystallization and Morphology of Poly(Phenylene Sulfide).

Final rept.

F. A. Khoury. 1990, 4p

Pub. in *Proceedings of SPE Annual Technical Conference and Exhibits* (48th), p1261-1263 1990.

Keywords: *Polymers, *Crystallization, Carbon fibers, Nucleation, Graphite, Polyacrylonitrile, Surface finishing, Spherulites, Shear modulus, Acrylic fibers, Lamellar structure, Reprints, *Poly(Phenylene sulfide).

A working model, embodying the preferential growth of lamellae parallel to the b-axis direction, and branching or interlamellar splaying hinged about the a-axis in the lamellae, is proposed for the precursor structures which have been observed to develop in the early stages of growth of PPS spherulites in bulk polymer at crystallization temperatures in the range 270C-280C. The manifestation of transcrystallization at temperatures in the range 270C-280C has been used as a criterion for comparing the ability of various carbon fibers to nucleate crystallization in PPS. Whereas the originally surface treated PAN-based low modulus (AS4),

and intermediate modulus (IM7) fibers did not induce trans-crystallization at these temperatures, all the higher modulus PAN-based (HMS4, HMU) and pitch-based (P75S, P100S, P120S) fibers did cause its occurrence. With the exception of the HMU fibers, all the other high modulus fibers were originally surface treated in production. Whether other factors, in addition to differences in graphitic order and crystallite size underlie the differences observed in the present study between nucleating ability of the higher modulus fibers as compared to the AS4 and IM7 fibers, remains an open question.

000,548
PB90-271057

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.

Small-Angle X-ray Characterization of Polymers.

Final rept.

J. D. Barnes, and F. I. Mopsik. 1988, 4p

Pub. in Proceedings of Annual Technical Conference and Exhibits of the Society of Plastics Engineers (46th), p1178-1181 1988.

Keywords: *Polymers, Microstructure, Reprints, X ray scattering, X ray cameras, Small angle scattering.

The paper describes the use of a digital small-angle X-ray camera at the National Bureau of Standards to characterize microstructure in polymeric materials. The camera is designed to detect scattering from structural elements in the size range from 3 to 100 nm. Entities that can be characterized using this facility include: phase diagrams of polymer blends, orientation texture developed by deformation, and sizes and shapes of multiphase domains. The camera uses a two-dimensional position sensitive detector, so that it is especially useful for cases where the scattering is anisotropic. The facility is supported by hardware and software for graphic display, image analysis, and mathematical modelling. The facility is available to scientists and engineers from outside NBS on the basis of Guest Worker and Industrial Research Associate agreements.

000,549
PB90-271396

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.

Formation and Melting of Solvent Crystals in Thermoreversible Polymer Gels.

Final rept.

C. L. Jackson, and G. B. McKenna. 1990, 3p

Pub. in Polymer Preprints 31, n2 p607-608 1990.

Keywords: *Solvents, *Polymers, *Gels, *Polystyrene, Decalin, Crystallization, X ray diffraction, Melting, Heat of fusion, Differential thermal analysis, Calorimeters, Reprints, *Thermoreversible materials, Isotactic.

Low-temperature studies of solvent crystallization in thermoreversible gels of isotactic-polystyrene (i-PS) in cis-decalin were made by wide angle x-ray scattering (WAXS) (100-240 K) and differential scanning calorimetry (DSC) (140-290 K). In the concentration range of 10-25% i-PS, it appears that two classes of solvent are present in the gel. The first class freezes into a small crystallites which shows a significant line broadening by WAXs, and a reduction in the bulk melting point by DSC. The second class is apparently unable to crystallize and is present as an adsorbed liquid, glass or highly disordered crystal which shows essentially no peaks in WAXS, and no measurable heat of fusion by DSC. At 30 wt.% i-PS in the gel, only the second class of solvent was observed by WAXS as evidenced by a broad amorphous peak. Although the results do not refute the formation of a polymer-solvent compound in the system as hypothesized earlier by Guenet (Macromolecules 1986, 19, 1961.), if such a compound exists it is highly disordered, since no new WAXS peaks were observed.

000,550
PB90-271412

Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Fire Science and Engineering Div.

Effects of Melt Viscosity and Thermal Stability on Polymer Gasification.

Final rept.

T. Kashiwagi, A. Omori, and H. Nanbu. 1990, 15p

Pub. in Combustion and Flame 81, p188-201 1990.

Keywords: *Polymers, *Polymethyl methacrylate, *Combustion products, *Gasification, *Polystyrene, Melt viscosity, Thermal degradation, Thermal stability,

Radiant flux density, Molecular weight, Mass transfer, Time dependence, Burning rate, Plastics, Reprints.

The effects of melt viscosity and thermal stability of a polymeric material on gasification rate under external radiant fluxes from 1.7 to 3.9 W/sq cm are studied. The effects of melt viscosity are determined by using two different initial molecular weight polystyrene (PS) samples (about a factor of 2 difference in molecular weight); the combined effects of thermal stability with melt viscosity are determined by using two different initial molecular weight polymethylmethacrylate (PMMA) samples (about a factor of 4 difference in molecular weight). The results show that thermal stability affects gasification rate but that the transport process of the in-depth degradation products through the molten polymer to the sample surface does not significantly affect gasification rate except at low external radiant flux. The global heat of gasification is sensitive enough to differentiate the effects of thermal stability of the sample, but its value also depends on external radiant flux; in addition, it decreases with an increase in exposure time. It indicates that the global heat of gasification is not a unique quantity for a polymeric material.

000,551

PB90-271677

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.

Self-Diffusion Measurements of a Probe in Various Bulk Polymers: A Temperature Dependence.

Final rept.

D. A. Waldow, H. Kim, C. C. Han, Q. Tran-Cong, and M. Yamamoto. 1990, 2p

Pub. in Polymer Preprints 31, n2 p145-146 1990.

Keywords: *Polymers, *Photochemical reactions, Probes, Rayleigh scattering, Measurement, Diffusion, Transition temperature, Dimerization, Reprints, *Self diffusion (Solid state), *Matrix materials, Forced vibration, Temperature dependence.

The temperature dependence of a photobleachable molecular probe in various polymer matrices has been studied using forced Rayleigh scattering (FRS). The probe molecule, a cyclophane derivative, is demonstrated to be a suitable probe for the FRS experiment due to the characteristics of the photodimerization reaction. The dynamic range of the FRS experiment enabled the measurement of the self diffusion coefficients over a range of nearly eight orders of magnitude. The temperature dependence of the self diffusion is well described by the Williams, Landel, Ferry (WLF) equation for all the polymer matrices studied. In addition, the data from the individual polymer matrices can be shifted by T_g and $\log(D(\text{sup } \theta))_{\text{sub } \theta}$ to construct a universal curve which is well described by the WLF equation with a single $C(\text{sup } g)_{\text{sub } 1}$ and $C(\text{sup } g)_{\text{sub } 2}$.

000,552

PB91-101543

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.

X-ray Analysis of a Liquid Crystal Phase Diacetylene Polymerization.

Final rept.

M. A. Schen, R. Briber, and J. Cline. 1990, 2p

Pub. in Polymer Preprints 31, n2 p151-152 Aug 90.

Keywords: *Polymerization, *Liquid crystals, *Acetylene, Phase diagrams, Microstructure, X ray diffraction, Scattering, Order disorder transformations, Reprints, *Diacetylene compounds, *Thermotropism, Temperature dependence, Temperature effects, Monomers, Smectite.

Recently the laboratory has been examining the characteristics of polymerizable rigid rod-like diacetylene monomers which show thermotropic liquid crystal phase behavior. The communication describes recent small angle and wide angle x-ray scattering results collected at room temperature and at elevated temperatures for a symmetrically disubstituted diacetylene monomer, 1,6-bis(4-oxybenzylidene,4'-n-octylani-line)2,4-hexadiyne, designated 1-OBOA, and its polymer. Based on scattering results and optical dark field microscopy, the monomer is seen to exhibit the smectic G or H phase in the region of 132C to 143C and the smectic C type in the region of 143C to 178C the material goes isotropic. Evidence for crystal phase polymorphism below 132C is also seen. Polymerizations conducted within the disordered smectic C and isotropic phases result in polymers devoid of small or wide angle scattering peaks and is taken to be amorphous. Polymer obtained from polymerization in the ordered

smectic G or H phase is nearly devoid of wide angle reflections but show an intense small angle reflection at a d-spacing slightly larger than in the nascent monomer, indicating that the polymer is two-dimensional disordered but still exhibits a layer-like microstructure in the third dimension.

000,553

PB91-112128

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.

Characterization of Branching Architecture Through 'Universal' Ratios of Polymer Solution Properties.

Final rept.

J. F. Douglas, J. Roovers, and K. F. Freed. 1990,

13p

Pub. in Macromolecules 23, n18 p4168-4180 1990.

Keywords: *Polymers, *Solutions, Hydrodynamics, Monte Carlo method, Interactions, Molecular structure, Reprints, Branching ratio, Characterization.

Experimental and Monte Carlo data for the dilute-solution properties of 'lightly branched' polymers (stars, combs, rings, etc.) are compared with the renormalization group predictions of Douglas and Freed. The comparisons focus on 'universal' dimensionless ratios of the mean dimensions of lightly branched polymers, relative to those of linear polymers having the same molecular weight. Complications associated with hydrodynamic solution properties and with the effect of ternary interactions are briefly discussed. Dimensionless ratios involving the polymer second virial coefficient, A_2 , are also tabulated and compared with theory.

000,554

PB91-112490

Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Polymers Div.

Shear Induced Phase Behavior of Polymer Blends by Small Angle Neutron Scattering.

Final rept.

A. I. Nakatani, H. Kim, and C. C. Han. 1990, 6p

Pub. in Materials Research Society Symposium Proceedings, v166 p479-484 1990.

Keywords: *Phase transformations, Shear rate, Shear flow, Neutron scattering, Solutions, Binary systems (Materials), Polystyrene, Polybutadiene, Synthetic elastomers, Rheology, Vinyl ether resins, Reprints, *Polymer blends, Small angle scattering.

The phase behavior of polymer blends and solutions can be changed dramatically by a flow field using a variety of flow geometries. Unlike simple binary fluids which require extremely high shear rates to produce only small shifts in the phase boundary, polymer phase behavior may be influenced by as much as 10 degrees with the application of much lower shear rates. However, there is a large body of conflicting data concerning the nature of these shear effects in polymers. The effects of shear on the phase behavior of polymer blends by small angle neutron scattering (SANS) are reported. Experiments were conducted using a specially constructed, concentric cylinder apparatus for in situ studies of concentrated polymer solutions and melts. Two separate systems will be discussed: (1) a blend of polystyrene and polybutadiene; (2) a blend of polystyrene and poly(vinylmethylether). Both systems exhibit shifts in the phase behavior which indicate shear induced mixing in agreement with previous results obtained by other techniques. The results will be interpreted within the context of existing theories of shear induced phase behavior.

000,555

PB91-112532

Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Polymers Div.

Combined SANS-SAXS Study of Blends of Styrene-Butadiene Block Copolymer with Deuterated Polybutadiene.

Final rept.

S. Nojima, R. J. Roe, D. Rigby, and C. C. Han. 1990,

8p

Pub. in Macromolecules 23, n19 p4305-4312 1990.

Keywords: *Copolymers, *Styrene butadiene resins, *Synthetic elastomers, Molecular structure, Neutron scattering, Polymers, X ray analysis, Deuteration, Micelles, Interfaces, Polybutadiene, Electron density (Concentration), Reprints, Polymer blends, Small angle scattering.

The structure of the blends containing styrene-butadiene diblock copolymer ($M(\text{sub } n) = 21,000$, styrene content 76.6% by weight) and deuterated polybutadiene ($M(\text{sub } n) = 1980$) has been studied by the combination of small-angle neutron and X-ray scattering techniques. Blends containing 3, 10, 20, 30, 40, and 50 wt % of the block copolymer were studied at temperatures spanning from room temperature to about 200 C. The small-angle neutron scattering arises as a result of the contrast in the scattering length density between the deuterated polybutadiene and the hydrogenated block copolymer, while the small-angle X-ray scattering arises as a result of the electron density contrast between the styrene and butadiene components. The structural information obtained by the techniques includes the mean distance between micelles (or microdomains), the thickness of the interfacial region, and the specific interfacial area. With blends of copolymer concentrations (3 and 10%) the effective radius of the micelle core, and the hard-sphere radius, (i.e., the radius of the nearest approach of neighboring micelles), were also determined.

000,556
PB91-118208 Not available NTIS
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Polymers Div.
Phase-Separation Kinetics of Mixtures of Linear and Star-Shaped Polymers.
Final rept.
B. Factor, T. Russell, B. Smith, L. Fetters, B. Bauer, and C. Han. 1990, 4p
Pub. in *Macromolecules* 23, n20 p4452-4455 1990.

Keywords: *Polystyrene, *Vinyl ether resins, Phase transformations, Light scattering, Decomposition, Mixtures, Separation, Reprints, *Phase separation kinetics, Strand breaks.

The phase separation of mixtures of four-armed star polystyrene with linear poly(vinyl methyl ether) was investigated by time-resolved light scattering. It was found that the kinetics of phase separation was essentially the same as that of the corresponding mixtures of linear polymers. The effect of chain topology was evident only when the molecular weights of the individual arms were large. This resulted in a reduced rate of phase separation. The linearized Cahn-Hilliard-Cook theory of spinodal phase separation qualitatively described the features of the experiments; however, the scattering vector dependence of the amplification factor deviated from the expected behavior.

000,557
PB91-134908 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.
Fluorescence Properties of a Rod-Like Polymer and Its Model Compound.
Final rept.
F. W. Wang, B. M. Fanconi, E. J. Heilweil, and R. E. Lowry. 1987, 1p
Pub. in *Abstracts of Papers of the American Chemical Society* 194, p71 Aug 87.

Keywords: *Fluorescence, *Polymers, Emission spectroscopy, Thiazoles, Rods, Chloroform, Methane, Sulfonic acids, Solvation, Solvolysis, Polyamide resins, Thin films, Reprints, *Fluorescence spectroscopy, Trifluoroacetic acid.

Steady-state and picosecond fluorescence measurements have been carried out on solutions of poly(p-phenylenebisthiazole) (PBT) and its model compound 2,6-diphenylbenzo(1,2-d:4,5-d')bisthiazole (hereafter referred to as t-bisthiazole). The emission spectrum of PBT in methane sulfonic acid remains practically the same at different excitation wavelengths. Fluorescence measurements of t-bisthiazole in mixed solvents of chloroform and trifluoroacetic acid showed that its excitation and emission spectra as well as its fluorescence lifetime are affected by protonation of its nitrogen atoms. Comparison of the fluorescence spectra of a PBT film and PBT/nylon film indicates that PBT molecules in the PBT/nylon film are aggregated.

General

000,558
PB90-183310 PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST (National Institute of Standards and Technology) Standard Reference Materials Catalog 1990-91.

Special pub.
R. L. Mckenzie, Jan 90, 169p NIST/SP-260
Also available from Supt. of Docs. as SN003-003-02994-7. Supersedes PB88-168323.

Keywords: *Catalogs(Publications), *Standards, Chemical analysis, Chemical composition, Quality assurance, Quality control, Concentration(Composition), Standardization, Measurement, *Standard reference materials, Calibration.

The catalog describes the Standard Reference Materials (SRMs) currently available from the National Institute of Standards and Technology, lists those in preparation, and provides ordering information. The descriptions provide nominal values for these SRMs. Certified values are provided in the certificates that accompany each SRM. Price Lists for SRMs are issued as separate supplements to the catalog and include new SRMs as they are issued.

CIVIL ENGINEERING

Construction Equipment, Materials, & Supplies

000,559
PB90-149220 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Thermodynamics of Calcium Silicate Hydrates and Their Solutions.
Final rept.
E. M. Gartner, and H. M. Jennings. 1987, 7p
Pub. in *Jnl. of the American Ceramic Society* 70, n10 p743-749 Oct 87.

Keywords: *Calcium silicates, *Cements, *Thermodynamics, Hydrates.

The solution that surrounds hydrating cement particles contains dissolved species which are important in the overall process. A method, based on the Gibbs-Duhem equation for a three component system, has been developed for computing the composition of one phase from values for its equilibrium solubility in a second phase. The method has been used to compute the CaO:SiO₂ ratio for two types of calcium silicate hydrate (C-S-H) gel, one of which is thought to form from hydrating tricalcium silicate (Ca₃SiO₅), and the other by precipitation from appropriate solutions. The results agree well with measured values reported in the literature. They have also been used to help define the probable composition of the C-S-H layer which forms on tricalcium silicate surfaces during the early stages of hydration when the reaction is slow. The free energies of formation have been estimated for two types of C-S-H formed from CaO, SiO₂, and H₂O. These results provide insight into the structure and composition of C-S-H, which is the most abundant product in portland cement systems.

000,560
PB90-151234 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Integrating Knowledge for the Identification of Cracks in Concrete Using an Expert System Shell and Extensions.
L. J. Kaetzl, J. R. Clifton, and D. P. Bentz. Dec 89, 34p NISTIR-89/4206

Keywords: *Concrete durability, *Cracking(Fracturing), Data acquisition, *Expert systems, Data bases, Knowledge bases(Artificial intelligence), Knowledge representation, Image processing.

An expert system has been developed for identifying the probable causes of cracks in concrete based on their shape and pattern, density and location. The system uses three forms of knowledge: facts and rules of thumb, databases, and digital imaging capabilities. Knowledge contained in the system is obtained from experts in the field, photographs taken of actual con-

crete failures and the classification of the failures into a database format. A PC based expert system shell and computer programs written specifically for the integration and use of knowledge were used to implement the expert system. The paper discusses the acquisition of the three forms of knowledge, its representation in the expert system environment and extensions developed to process information and enhance the user's interface. The potential for the use of speech recognition for recording conditions of field sites, and storage of large volumes of information using optical disk technology are discussed.

000,561
PB90-162116 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Frost-Resistance of Concrete.
J. R. Clifton. Jan 90, 22p NISTIR-90/4229

Keywords: *Frost action, *Concretes, Service life, Field tests, Mathematical models, Weathering, Damage, Aggregates, Forecasting.

Freezing of water in the pores of concrete is one of the major degradation processes of concrete. It results in cracking and reduced service life. Concrete exposed to frost conditions may rapidly degrade or be durable for decades. The report reviews the major factors affecting the frost resistance of concrete and test methods for evaluating the service life of concrete. Mathematical models which describe the mechanisms of frost damage and methodologies for predicting the durability of concrete exposed to frost conditions are reviewed to determine the relevance to service life predictions.

000,562
PB90-195009 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Serial Sectioning of Hardened Cement Paste for Scanning Electron Microscopy.
P. Stutzman. Mar 90, 24p NISTIR-90/4235

Keywords: *Cements, Inspection, Surfaces, Sequential sampling, Surface preparation, Knoop hardness, Polishing, Microstructure, Indentation hardness tests, *Serial sectioning, *Cement pastes, Scanning electron microscopy, Pastes, Thin plates.

Serial sectioning is a technique of making and examining thin sections of material to obtain information on three-dimensional structures from a series of two-dimensional images. Procedures were developed to make serial sections of hardened cement paste by the removal of thin layers by polishing. Backscattered electron imaging of the remaining paste block was used to record the paste microstructure after each section was removed. Procedures developed cover the polishing practice, the removal of thin layers by polishing, the estimation of layer thickness, and the location and alignment of specific regions for imaging.

000,563
PB90-235029 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Selection of Siliceous Aggregate for Concrete.
J. R. Clifton, and L. Knab. Jun 90, 22p NISTIR/4327
Sponsored by Nuclear Regulatory Commission, Washington, DC. Div. of Engineering.

Keywords: *Alkali aggregate reactions, *Concretes, Aggregates, Alkalies, Dissimilar materials bonding, Cements, Concrete structures, Masonry, Silicate cements, Corrosion environments, Durability, Radioactive waste disposal, Low-level radioactive wastes.

Alkali-aggregate expansive reactions are one of the potentially serious degradation problems that could affect the structural stability of underground concrete structures for disposing of low-level radioactive waste (LLW). It appears that all aggregates react to some degree with alkalis in cement. In the majority of cases the reactions are beneficial (e.g., increasing the bond between aggregate and hydrated cement paste) or innocuous. In some cases, however, the reactions result in the formation of expansive products which can cause serious cracking of the concrete. The report deals with the selection of siliceous aggregates to avoid deleterious alkali-aggregate expansions. Current practices used to prevent expansive alkali-silica reactions and the standard test methods used to identify reactive aggregates are first discussed. Then the re-

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sults of a study on using a new alkali-silica reactivity test to select siliceous aggregates for use in the concrete of LLW storage structures are presented. It is recommended that siliceous aggregates, selected for constructing underground vaults for disposal of LLW, have an expansion of less than 0.10% using the new test.

000,564
PB90-261801 PC A07/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Proceedings of the Workshop on Evaluation of Cement and Concrete Laboratory Performance.
 Final rept.
 J. H. Pielert. Jul 90, 146p NIST/SP-788
 Also available from Supt. of Docs. as SN003-003-03022-8. Held in Tel Aviv, Israel on September 6-7, 1989. Sponsored by Reunion Internationale des Labs. d'Essais et de Recherches sur les Materiaux et les Constructions, Cachan (France).

Keywords: *Meetings, *Cements, *Concretes, *Construction materials, Tests, Quality assurance, Proceedings, Precision, Compression tests, Methodology, *Interlaboratory comparisons, Calibration, Laboratory accreditation.

Contents: Current practice for assessing quality assurance systems in laboratories; R.N.E. - The French accreditation system for laboratories; Experience in obtaining R.N.E. accreditation; Link between test records on concrete and its ingredients obtained from different laboratories; Test frequency and precision of results; Experience with proficiency testing and round-robin testing in the United States; Evaluation of cement strength testing by four laboratories; Experience with interlaboratory testing in France; Comparative tests between 20 accredited laboratories; British comparative cube testing programs; Comparative investigation of compression testing machines for concrete cubes; Experience with a cement reference laboratory in Austria; Cooperation between a central cement laboratory and 60 plant laboratories; Quality assurance in the construction materials laboratory; Comparative compression cube tests between approved testing laboratories in Finland.

000,565
PB90-271339 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Permeability, Diffusivity, and Microstructural Parameters: A Critical Review.
 Final rept.
 E. J. Garboczi. 1990, 12p
 Pub. in Cement and Concrete Research 20, n4 p591-601 1990.

Keywords: *Cements, *Permeability, *Diffusivity, *Porous materials, *Transport properties, Microstructure, Concretes, Porosity, Rheological properties, Reprints.

It is important to understand the rates of diffusion of ionic species and the viscous flow of fluids in the pore structure of cementitious materials on the basis of microstructural parameters, as these rates control the rate at which degradation processes can proceed. Significant progress has been made in the related area of the diffusivity and permeability of sedimentary rocks in the last decade or so. The article has the following two purposes: to provide a critical review of popular theories linking microstructure and transport coefficients of porous materials, and to explore the applications of new concepts, developed for analyzing transport in sedimentary rocks, to understand transport processes in cementitious materials.

000,566
PB91-101113 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Structures Div.
Flaw Detection in Concrete by Frequency Spectrum Analysis of Impact-Echo Waveforms.
 Final rept.
 N. J. Carino, M. Sansalone, and N. N. Hsu. 1986, 31p
 Pub. in International Advances in Nondestructive Testing 12, p117-146 1986.

Keywords: *Concretes, *Nondestructive tests, Impact tests, Spectrum analysis, Concrete slabs, Thickness, Reprints, Impact echo method, Fast Fourier analysis, Frequency domain, Time domain.

Using a technique referred to as the impact-echo method, transient time domain waveforms obtained from the impact of a steel sphere on a concrete slab containing artificial flaws are recorded and analyzed in the frequency domain. It is shown that frequency spectrum analysis can be used to determine the thickness of plate structures and to locate internal flaws. The Fast Fourier Transform technique is used to compute the frequency content of input pulses and theoretical and experimental surface displacement waveforms. The effects on the frequency spectrum due to changes in the duration of the impact and due to changing the spacing between impact point and receiving transducer are studied. It was found that for accurate location of flaws within concrete using an impact-echo technique, the ultrasonic pulse-velocity method should not be used to determine the compression wave velocity in a test object.

000,567
PB91-112003 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Statistical Characteristics of New Pin Penetration Test.
 Final rept.
 N. J. Carino, and R. C. Tank. 1989, 9p
 Pub. in Cement, Concrete, and Aggregates, v2 n2 p100-108 1989.

Keywords: *Concretes, *Compression tests, *Compressive strength, Compressive properties, Mechanical properties, Penetration, Hardness tests, Water cement ratio, Standard deviation, Reprints.

Researchers at the University of Saskatchewan have developed a new test for estimating the in-place strength of concrete. The method, known as the pin penetration test, involves driving a small pin into the concrete surface using a spring-loaded driver. The penetration of the pin creates a small indentation whose depth is measured. The pin penetration is inversely related to the strength of concrete. The paper provides information about the within-test variability of the method and about the correlation relationship between compressive strength and pin penetration. Test results show that a standard deviation with a value of about 0.015 in. (0.038 mm) describes the within-test variability. The correlation relationship is non-linear for compressive strengths between 1000 and 5800 psi (6.9 to 40.0 MPa) and depends on the water-cement ratio of the concrete. For compressive strength less than about 4000 psi (27.6 MPa), the correlation relationship is not strongly dependent on water-cement ratio, and a straight line adequately represents the relationship. However, the correlation relationship obtained in the study differs from that reported by others.

000,568
PB91-112656 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Detecting Delaminations in Concrete Slabs with and without Overlays Using the Impact-Echo Method.
 Final rept.
 M. Sansalone, and N. Carino. 1989, 10p
 Pub. in ACI Materials Jnl. 86, n2 p175-185 Mar/Apr 89.

Keywords: *Concrete slabs, *Reinforced concrete, *Nondestructive tests, Wave propagation, Defects, Delaminating, Bituminous concretes, Stress waves, Corrosion, Pavements, Reprints, *Impact-echo method.

The report demonstrates the feasibility of detecting delaminations in reinforced concrete slabs using the impact-echo method, a nondestructive testing technique based on transient stress wave propagation. The results of two laboratory studies are discussed. One study involved detecting artificial delaminations embedded at unknown locations in a reinforced concrete slab. All the artificial delaminations in the slab were located. The second study was aimed at showing the feasibility of detecting delaminations in reinforced concrete slabs with asphalt concrete overlays. Two reinforced concrete slab specimens with corrosion-induced delaminations were tested. Prior to overlaying the slabs with asphalt concrete, the depths of delaminations as determined by impact-echo testing were verified by drilling at selected points. After the asphalt concrete overlays were applied, the slabs were retested. It was found that the impact-echo method could successfully locate the delaminations in the slabs through the asphalt concrete overlays.

000,569
PB91-112847 PC A04/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
User's Guide to CMMAP: Cement Microstructure Modelling and Analysis Package.
 D. P. Bentz, and E. J. Garboczi. Oct 90, 58p NISTIR-4442

Keywords: *Cements, *Microstructure, Diffusivity, Hydration, Permeability, Porosity, Mathematical models, Images, Computerized simulation, User manuals(Computer programs).

A collection of modelling and analysis programs dealing with cement microstructure has been assembled into a single package. The manual describes the custom user interface, CMMAP, which allows the user to access and execute the assembled software. Specific programs exist to create starting microstructures, simulate hydration, and analyze both starting and hydrated microstructures. Available analyses include evaluation of diffusion coefficients, simulation of mercury intrusion porosimetry, and assessment of the connectivity of phases within a cement microstructure. The menu-based interface program is described in detail and several examples are presented which demonstrate the capabilities of CMMAP.

Highway Engineering

000,570
PB90-149683 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Pore Structure of Concrete and Freezing Vulnerability.
 R. E. Philleo, and J. R. Clifton. Nov 89, 18p NISTIR-89-4186

Keywords: *High strength concretes, *Water cement ratio, *Moisture content, *Concrete durability, *Porosity, Plasticsizers, Permeability, Frost protection, Admixtures, Frost penetration.

High-performance concrete with water-to-cement ratio (w/c) of or below 0.38, when hydrated to the maximum possible level, should not contain any freezable water. Therefore, non-air-entrained concrete with such w/c should be immune to freezing. However, laboratory freezing and thawing studies on non-air-entrained concretes containing silica fume have given conflicting results. Reasons for the conflicting results are explored in the report by analyzing relationships between w/c, capillary porosity, and freezable water in concretes with low w/cs. The effects of adding silica fume to concrete on potential frost damage is also discussed.

000,571
PB90-204520 PC A06/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Preliminary Performance Criteria for the Bond of Portland-Cement and Latex-Modified Concrete Overlays.
 L. I. Knab, M. M. Sprinkel, and O. J. Lane. Nov 89, 114p NISTIR-89/4156

Prepared in cooperation with Virginia Transportation Research Council, Charlottesville, and Iowa Dept. of Transportation, Ames. Sponsored by Tri-Service Building Materials Committee, Washington, DC., and Naval Facilities Engineering Command, Alexandria, VA.

Keywords: *Concrete pavements, *Bridge decks, *Portland cement, *Bonding strength, Mechanical properties, Compressive strength, Shear strength, Loads(Forces), Bond stress, Comparisons, Performance evaluation.

Preliminary bond-strength performance criteria were developed for screening and selecting portland-cement concrete (PCC) and latex-modified concrete (LMC) materials to be overlaid on PCC pavements and PCC bridge decks subjected to normal civilian truck and automobile traffic. The criteria were developed based on direct shear bond test results from field cores from pavements and bridge decks which were considered to have performed satisfactorily, and laboratory- and field-cast specimens with PCC and LMC overlay materials. The criteria consist of minimum

direct shear bond strength levels and corresponding minimum compressive strength levels. A direct shear "guillotine"-type performance bond test method, developed at the Brookhaven National Laboratories, was specified using laboratory-cast specimens.

000,572
PB90-208273 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Calibration of Road Roughness Measuring Equipment. Volume 1. Experimental Investigation.
Final rept. Sep 85-Nov 88.
T. F. Vorburger, D. C. Robinson, S. E. Fick, and D. R. Flynn. Mar 89, 94p FHWA/RD-89/077
Contract DTFH61-85-Y-10004
See also Volume 2, PB90-208281. Sponsored by Federal Highway Administration, McLean, VA. Office of Engineering and Highway Operations Research and Development.

Keywords: *Calibrating, *Profilometers, Graphs(Charts), Surface roughness, Measuring instruments, Performance evaluation, *Pavement surface texture, Profile measurement.

An extensive series of measurements was made of the performance of a particular model of an inertial road profiling system (IRPS), including evaluation of the noncontact height sensors, the accelerometers used to establish the inertial reference frame, the distance encoder, the associated instrumentation, and the software used to convert the raw data into road elevation profiles. A field program was carried out which included rod-and-level surveys of several roads which were also profiled using the IRPS. The IRPS was also equipped with a commercial response-type road roughness measurement (RTRRM) system, with accelerometers to measure the vertical vibration of both the axle and the body of the vehicle, and with a linear potentiometer to measure the relative displacement between the axle and the body of the vehicle. Separate laboratory measurements were made to characterize the performance of the commercial RTRRM. Data collected with the RTRRM and with the auxiliary accelerometers and the linear potentiometer were compared with single-number ratings of road roughness as computed from the profiles measured using the IRPS.

000,573
PB90-208281 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Calibration of Road Roughness Measuring Equipment. Volume 2. Calibration Procedures.
Final rept. Sep 85-Nov 88.
T. V. Vorburger, D. C. Robinson, S. E. Fick, and D. R. Flynn. Mar 89, 35p FHWA/RD-89/078
Contract DTFH61-85-Y-10004
See also Volume 1, PB90-208273. Sponsored by Federal Highway Administration, McLean, VA. Office of Engineering and Highway Operations Research and Development.

Keywords: *Calibrating, *Profilometers, Surface roughness, Measuring instruments, *Pavement surface texture, Profile measurement.

Volume I documents an extensive series of measurements of the performance of a commercial inertial road profiling system (IRPS) and a commercial response-type road roughness measurement (RTRRM) system. Based upon the results of these measurements and upon an analysis of the operation of such equipment, calibration and testing guides, given in the present report, were developed to assist users in assessment of IRPS and RTRRM functionality and operating performance.

Soil & Rock Mechanics

000,574
PB90-170184 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Structures Div.
Energy Transfer Mechanism in SPT (Standard Penetration Test).
Final rept.
F. Y. Yekel. 1989, 6p
Pub. in Jnl. of Geotechnical Engineering, American Society of Civil Engineers 115, n9 p1331-1336 Sep 89.

Keywords: *Boring, *Soil tests, *Penetration resist-ance, Soil mechanics, Soil properties, Energy transfer, Field tests, Drilling, Penetration, Reprints.

A rigid-hammer model is used to investigate the effect of the blow count in the Standard Penetration Test on the energy transmission characteristics of the test and the correlation between the blow count and the soil resistance at sampler penetration. It is shown that the percentage of the impact energy used to advance the sampler decreases with an increase in blow count and increases somewhat with increasing drill rod size, and that several penetration cycles are required to transmit the energy at low blow counts. The effect of the blow count on the energy loss associated with short drill rod lengths is also investigated. It is shown that the energy loss associated with the short-rod effect is less than that predicted when total energy rather than useable energy is considered, and that the energy loss decreases with an increase in blow count.

COMBUSTION, ENGINES, & PROPELLANTS

Combustion & Ignition

000,575
DE89015147 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Particulate and Droplet Diagnostics in Spray Combustion: Annual Report and Program Plan, November 1986.
H. G. Semerjian. Nov 86, 45p DOE/CE/90213-T1
Contract A101-86CE90213
Portions of this document are illegible in microfiche products.

Keywords: *Sprays, *Atomization, *Combustion, Combustion Kinetics, *Droplets, Evaporation, Flames, *Liquid Fuels, Particulates, Progress Report, ERDA/400800, ERDA/320303.

The objective of this project is to investigate droplet evaporation, combustion and particulate formation processes in spray flames, using nonintrusive diagnostic techniques, and to delineate the effect of chemical and physical properties of liquid fuels on the above processes. The results of this study will provide an experimental data base, with well-defined boundary conditions, for the development and validation of spray combustion models. These models, in turn, can be used to develop computerized design methodologies, to predict combustor performance over a wider range of operating parameters, and to predict the effect of variations in fuel properties on combustion efficiency, radiative energy transfer, and pollutant emissions. 57 refs., 18 figs., 2 tabs.

000,576
DE89015148 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Particulate and Droplet Diagnostics in Spray Combustion: Annual Report and Program Plan, March 1988.
H. G. Semerjian. Mar 88, 31p DOE/CE/90213-T2
Contract A101-86CE90213
Portions of this document are illegible in microfiche products.

Keywords: *Sprays, *Combustion, *Droplets, Evaporation, Flames, *Liquid Fuels, Nozzles, Particulates, Planning, Progress Report, ERDA/400800, ERDA/320303.

The objective of this project is to investigate droplet evaporation, combustion and particulate formation processes in spray flames, using nonintrusive diagnostic techniques, and to delineate the effect of chemical and physical properties of liquid fuels on the above processes. The results of this study will provide an experimental data base, with well-defined boundary conditions, for the development and validation of spray

combustion models. These models, in turn, can be used to develop computerized design methodologies, to predict combustor performance over a wider range of operating parameters, and to predict the effect of variations in fuel properties on combustion efficiency, radiative energy transfer, and pollutant emissions. 44 refs., 6 figs., 2 tabs.

000,577
DE89015149 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Particulate and Droplet Diagnostics in Spray Combustion: Annual Report, April 1989.
H. G. Semerjian, and C. Presser. Apr 89, 41p DOE/CE/90213-T3
Contract A101-86CE90213
Portions of this document are illegible in microfiche products.

Keywords: *Kerosene, *Sprays, *Combustion, *Droplets, Flames, Liquid Fuels, Nozzles, Particulates, Progress Report, ERDA/400800, ERDA/023000.

The objective of this project is to investigate droplet evaporation, combustion and particulate formation processes in spray flames, using nonintrusive diagnostic techniques, and to delineate the effect of chemical and physical properties of liquid fuels on the above processes. During previous phases of this project, the design and fabrication of the variable swirl burner was completed, and the operating characteristics were evaluated over a wide range of operating conditions. Photography, high speed cinematography, and laser sheet beam scattering techniques were used to identify various regions of the spray flame, and to observe trajectories of large droplets and overall features of the flame. Complete data sets on a kerosene spray have also been obtained with both a pressure atomizer and an air-assist nozzle. 58 refs., 9 figs., 2 tabs.

000,578
DE90003095 PC A03/MF A01
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Kinetics Data Base for Combustion Modeling: Status Report, February 1, 1988-January 31, 1989.
J. T. Herron, and W. Tsang. 8 Jul 88, 13p DOE/ER/13471-T2
Contract A101-86ER13471
Portions of this document are illegible in microfiche products.

Keywords: *Combustion, *Data Base Management, *Hydrocarbons, Alkyl Radicals, Butenes, *Chemical Reaction Kinetics, Chemical Reactions, Data Compilation, Progress Report, ERDA/400800, ERDA/990220.

Work carried out at the National Bureau of Standards for the Basic Energy Sciences Division of the Department of Energy under Interagency Agreement A101-76PRO6016, Task Order No. 007, Amendment No. 5, "Kinetic Data Base for Combustion Modeling" is summarized. By the end of the present contract year, recommended values will be provided for the elementary chemical reactions of trans-2-butene and the alkyl radical with the species in the existing data base. The total number of elementary interactions which will be evaluated will exceed 1020. The data compilation part of the program is essentially current and the total number of reactions covered now exceeds 2500. 5 refs.

000,579
PB90-149360 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Pattern Differences in Laser Microprobe Mass Spectra of Negative Ion Carbon Clusters.
Final rept.
R. A. Fletcher, and L. A. Currie. 1988, 4p
Pub. in Microbeam Analysis, p367-370 1988.

Keywords: *Soot, *Mass spectra, Polyurethane resins, Combustion products, Wood, Reprints, *Carbon clusters, *Laser microprobe mass spectroscopy, Negative ions.

The Laser Microprobe Mass Analyzer was used to study negative carbon cluster ions from various soots which in turn were derived from pure material combustion experiments. Mass spectra of soots from wood, polyurethane, and heptane were compared to those of graphite. The main differences in the carbon clusters appear in the low mass range. Mass spectra of polyurethane soot contain evidence of molecular ion

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fragments and are easily distinguished from the spectra of the other three materials. The capacity to distinguish combustion products has application to combustion science and environmental studies.

000,580

PB90-151754

PC A03/MF A01

California Univ., Berkeley, Dept. of Mechanical Engineering.

Fire Propagation in Concurrent Flows, Final Progress Report.

Rept. for 1 Aug 88-31 Jul 89.

A. C. Fernandez-Pello. Dec 89, 26p NIST/GCR-89/569

Grant 60NANB-7-D0737

See also PB89-151781. Sponsored by National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Fire Research.

Keywords: *Air flow, *Flame propagation, *Fire tests, Combustion, Flames, Mathematical models, Experimental data, Velocity, Turbulence.

A research program is being carried out to study the mechanisms controlling the spread of fire in a forced gas flow. Particular emphasis is given to the case when the gas flow is concurrent with the direction of fire spread. The research tasks completed during the reporting period include an experimental study of the effect on the flame spread rate of the turbulence intensity of a concurrent air flow, and a theoretical analysis of the effect of a prescribed gas velocity profile on the flame spread rate predictions. The results of the experiments show that for flames spreading over thick PMMA sheets, the flame spread process is significantly affected by the turbulence intensity. For a fixed flow velocity, the flame spread rate decreases as the turbulence intensity is increased. This appears to be mainly due to the shortening of the flame length. Schlieren images of the process indicate that the decrease of the flame length may be the result of the intense entrainment of cold air in the flame at the higher turbulence intensities. The results of the theoretical analysis indicate that the gas velocity profile influences strongly the flame spread rate predictions.

000,581

PB90-169608

Not available NTIS

National Bureau of Standards (NIST), Gaithersburg, MD. Chemical Thermodynamics Div.

Enthalpies of Combustion of Triphenylphosphine and Triphenylphosphine Oxide.

Final rept.

D. R. Kirklin, and E. S. Domalski. 1988, 12p

Sponsored by Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD.

Pub. in Jnl. of Chemical Thermodynamics 20, n6 p743-754 1988.

Keywords: *Enthalpy, *Combustion, *Oxidation, *Phosphines, *Thermodynamics, Crystals, Carbon dioxide, Phosphoric acids, Heat measurement, Reprints, Combustion heat, Formation heat, Fusion heat, Vaporization heat.

The enthalpies of combustion of crystalline triphenylphosphine and triphenylphosphine oxide were determined at 298.15 K in an aneroid adiabatic rotating bomb calorimeter. The molar enthalpies of combustion and formation for the reactions with oxygen at 298.15 K are: $-10,295.33 \pm$ or -2.08 kJ/mol and $(207.88 \pm$ or $-3.52)$ kJ/mol respectively for triphenylphosphine and $(-9,971.90 \pm$ or $-1.90)$ kJ/mol and $(-115.55 \pm$ or $-3.42)$ kJ/mol respectively for triphenylphosphine oxide. The completeness of the combustion reactions were verified by determinations for carbon dioxide through absorption in Ascarite. Ion chromatography was used to analyze the bomb solution quantitatively for the nitrate, orthophosphate, pyrophosphate, and triphosphosphate ions. The enthalpies of fusion and melting temperatures were determined using differential scanning calorimetry. The values obtained for the enthalpies of fusion at the melting temperatures for triphenylphosphine and triphenylphosphine oxide are $(19.69 \pm$ or $-0.18)$ kJ/mol at 353.6 K and $(24.23 \pm$ or $-0.29)$ kJ/mol at 430.1 K, respectively. Second-order group contribution values were derived for calculating enthalpies of formation at 298.15 K from the experimental results on triphenylphosphine and triphenylphosphine oxide.

000,582

PB90-183328

PC A06/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.

How Due Process in the Development of Voluntary Standards Can Reduce the Risk of Anti-Trust Liability.

D. A. Swankin. Feb 90, 107p NIST/GCR-90/571

Sponsored by Swankin and Turner, Washington, DC.

Keywords: *Diffusion flames, *Radiant flux density, *Turbulence, Reaction kinetics, Combustion products, Mathematical models, Temperature, Test facilities, Combustion, Mie scattering, Mixtures.

A theoretical and experimental study of the structure and radiation properties of turbulent diffusion flames is described. Generalized state-relationship correlations, giving the mass fractions of major gas species as functions of local fuel-equivalence ratios, were developed for hydrocarbon/air diffusion flames. Instantaneous soot volume fractions and temperatures were measured in the fuel-rich (underfire) region of turbulent non-premixed acetylene, propylene, ethylene and propane flames burning in still air. Mixture fraction properties in turbulent carbon monoxide/air diffusion flames were measured in order to provide information needed to exploit the laminar flamelet concept for radiation predictions. A two-point Mie scattering system was developed to yield Favre- and time-averaged mean and fluctuating values, probability density functions, temporal spectra and correlations, and spatial correlations of mixture fractions. The continuum radiation properties of the underfire region of luminous acetylene and propylene flames burning in still air were studied. Instantaneous radiation intensities at 1000 and 2300 nm, where gas-band radiation is absent, were measured for paths passing through the axis of the flames; and reduced to yield mean and fluctuating values, probability density functions and power spectral densities of spectral radiation intensities.

000,583

PB90-188368

Not available NTIS

National Bureau of Standards (NIST), Gaithersburg, MD. Chemical Process Metrology Div.

Soot Particle Formation in Laminar Diffusion Flames.

Final rept.

R. J. Santoro, and J. H. Miller. 1987, 11p

Pub. in Langmuir 3, n2 p244-254 Mar/Apr 87.

Keywords: *Diffusion flames, *Soot, Combustion products, Reaction kinetics, Laminar flow, Combustion, Oxidation, Acetylene, Benzene, Experimental data, Temperature, Reprints.

Soot formation processes in laminar diffusion flames are described. Experimental results obtained at the National Bureau of Standards are reviewed and show that fuel molecules are rapidly converted to acetylene and other key precursors (such as the vinyl radical) in flame positions adjacent to, and on the fuel rich side of the high temperature reaction zone. These molecules react rapidly to form small aromatic species, such as benzene, and eventually small soot particles. The soot particle inception process occurs in times on the order of about one millisecond. Once formed, particles may grow rapidly by surface chemistry if they travel through flame regions with high concentrations of growth species such as acetylene. A systematic variation of the fuel flow rate shows that the final size that a particle, as well as the volume fraction occupied by soot particles, is determined by particle residence time in this growth region. During the time that surface growth is occurring, particle agglomeration leads to a decrease in total soot particle number concentration. As particles continue along streamlines they eventually cross the high temperature reaction zone where they may be oxidized.

000,584

PB90-190778

Not available NTIS

National Bureau of Standards (NIST), Gaithersburg, MD. Chemical Kinetics Div.

Effect of Fuel Structure on Pathways to Soot.

Final rept.

M. Frenklach, D. W. Clary, W. C. Gardiner, and S. E. Stein. 1986, 10p

Pub. in International Symposium on Combustion (21st), p1067-1076 1986.

Keywords: *Soot, *Reaction kinetics, *Combustion products, Chemical reactions, Diffusion flames, Combustion, Pyrolysis, Benzene, Ethylene, Molecular structure.

The influence of fuel structure on chemical reaction pathways leading to soot was investigated using detailed kinetic models for the conditions of shock-tube

pyrolysis of 1,3-butadiene, benzene and ethylene. It was found that reaction pathways to soot relax to the previously identified acetylene-addition mechanism in each case. Fuel molecular structure influences the growth process only at its early stages, first by providing more efficient reaction partners for the formation of aromatic molecules and second by affecting the generation of hydrogen atoms. The model explains the relative sooting tendencies of these fuels for shock tube pyrolysis conditions and agrees with recent observations in laminar diffusion flames.

000,585

PB90-193608

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Chemical Engineering, Silica Particle Synthesis in a Counterflow Diffusion Flame Reactor.

Final rept.

M. R. Zachariah, D. Chin, H. G. Semerjian, and J. L. Katz. 1989, 12p

Pub. in Combustion and Flame 78, p287-298 1989.

Keywords: *Silicon dioxide, *Diffusion flames, *Combustion products, *Particle size distribution, *Optical measurement, Burning rate, Dimensional measurement, Particle size, Light scattering, Temperature, Reaction kinetics, Reprints.

Silica particle formation was studied in a counterflow diffusion flame, under different operating conditions, in order to investigate the effect of process variables on particle formation. The counterflow geometry provides a one-dimensional flow field, along the stagnation streamline, which greatly simplifies interpretation of the particle formation process. Silane has been used as the source of silicon in hydrogen/oxygen/argon flames. Silica particle characteristics (size, number density, volume fraction) have been determined using dynamic light scattering and angular dissymmetry measurements. The effects of silane loading, temperature, equivalence ratio, and momentum ratio have been investigated. The results indicate that temperature plays a significant role in the formation process, by controlling the chemical kinetic rates and through physical changes in particle morphology. In cooler flames ($T =$ approximately 2000 K), significantly more surface growth is observed. Increasing flame temperatures tend to enhance homogeneous nucleation, leading to smaller particles in higher numbers. Results obtained in higher-temperature flames ($T =$ approximately 2500 K) suggest that, when the chemical kinetic rates increase substantially, particles of composition other than SiO_2 can also nucleate, which may then grow by silica deposition. It was also observed that, under conditions where particles were hot enough, sintering effects produced more spherical structures. The level of silane loading is seen to affect the final particle size obtained as well as the growth regimes that particles encounter prior to ejection from the reactor.

000,586

PB90-205188

PC A03/MF A01

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Fire Research.

Ignition and Lateral Flame Spread Characteristics of Certain Composite Materials.

T. Ohlemiller, and S. Dolan. Jan 89, 30p NISTIR-89/4030

Sponsored by David W. Taylor Naval Ship Research and Development Center, Annapolis, MD.

Keywords: *Composite materials, *Flammability testing, Ignition time, Honeycomb structures, Vinyl resins, Armor plate, Mathematical models, Flame propagation.

The Lateral Ignition and Flame Spread (LIFT) apparatus was used to obtain information on the ignition and lateral flame spread characteristics of two types of composite materials. The first type was a honeycomb sandwich panel; three different facings were tested with the material. The second type of material was a composite armor. There was a substantial variation in the ignitability of the various material combinations with a vinyl-faced honeycomb panel being the most ignitable and the composite armor being the least ignitable. The ignition behavior of the facings of all materials was correlated by a simple predictive model. Only the vinyl-faced honeycomb panel showed significant normal flame spread under the conditions examined though some flame advancement was seen with the others. All of the materials exhibited worse flammability properties at the edges as compared to the facings.

000,587
PB90-209602 PC A03/MF A01
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Center for Fire Research.
**Long-Range Plan for a Research Project on
 Carbon Monoxide Production and Prediction.**
 W. M. Pitts. Oct 89, 45p NISTIR-89/4185

Keywords: *Carbon monoxide, *Combustion products,
 *Fires, *Research projects, Fire hazards, Exhaust
 gases, Fire safety, Fire tests, Planning, *Center for Fire
 Research.

The document presents a five-year plan for the Center
 for Fire Research (CFR) Priority Research Project on
 Carbon Monoxide Prediction. Sections of the report
 provide a justification for the priority project, assess
 the current state of knowledge, summarize current relevant
 CFR research efforts, discuss specific research
 needs, list major assumptions utilized in formulating the
 research program, outline a research plan designed to
 meet the goals of the project and address the specific
 research needs, provide a rough timetable and budget,
 and present a discussion of the project philosophy and
 management.

000,588
PB90-217878 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Fire Measurement and Research Div.
**Role of Large Scale Turbulent Structures in the
 Lift-Off and Blow Out Behaviors of Turbulent Jet
 Diffusion Flames.**
 Final rept.
 W. M. Pitts. 1987, 4p
 Pub. in Chem. Phys. Processes Combust., p30/1-30/4
 1987.

Keywords: *Diffusion flames, *Turbulence, *Jet mixing
 flow, *Combustion stability, Jets, Flames, Reaction kinetics,
 Jet flow, Mixing, Reprints.

Past experimental studies and theoretical treatments
 of lift-off and blow out of turbulent jet diffusion flames
 are reviewed. New calculational procedures are summarized
 which allow these flame stability processes to be
 calculated utilizing time-averaged concentration and
 velocity profiles. Physical mechanisms which offer
 possible explanations for the success of these calculational
 procedures are described.

000,589
PB90-218777 PC A06/MF A01
 Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
**Structure and Radiation Properties of Turbulent
 Diffusion Flames.**
 Annual rept.
 Y. R. Sivathanu, M. E. Kounalakis, and G. M. Faeth.
 Feb 90, 107p NIST/GCR-90/570
 Grant 60NANB-8D0833
 Sponsored by National Inst. of Standards and Technology
 (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Diffusion flames, *Turbulence, *Thermal
 radiation, Radiant flux density, Combustion products,
 Test facilities, Experimental data, Turbulent flow,
 Mixing, Combustion, Reaction kinetics, Heat transfer.

A theoretical and experimental study of the structure
 and radiation properties of turbulent diffusion flames is
 described. Generalized state-relationship correlations,
 giving the mass fractions of major gas species as functions
 of local fuel-equivalence ratios, were developed for
 hydrocarbon/air diffusion flames. Instantaneous soot
 volume fractions and temperatures were measured in
 the fuel-rich (underfire) region of turbulent non-premixed
 acetylene, propylene, ethylene and propane flames
 burning in still air. Mixture fraction properties in
 turbulent carbon monoxide/air diffusion flames were
 measured in order to provide information needed to
 exploit the laminar flamelet concept for radiation
 predictions. A two-point Mie scattering system was
 developed to yield Favre- and time-averaged mean and
 fluctuating values, probability density functions, temporal
 spectra and correlations, and spatial correlations of
 mixture fractions. The continuum radiation properties
 of the underfire region of luminous acetylene and
 propylene flames burning in still air were studied. Instantaneous
 radiation intensities at 1000 and 2300 nm,
 where gas-band radiation is absent, were measured for
 paths passing through the axis of the flames; and
 reduced to yield mean and fluctuating values, probability
 density functions and power spectral densities of
 spectral radiation intensities.

000,590
PB90-242173 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Fire Measurement and Research
 Div.
**Concentration Measurements of OH- and Equilibrium
 Analysis in a Laminar Methane-Air Diffusion
 Flame.**
 Final rept.
 K. C. Smyth, P. J. H. Tjossem, A. Hamins, and J. H.
 Miller. 1990, 15p
 Pub. in Combustion and Flame 79, p366-380 1990.

Keywords: *Methane, *Flames, Soot, Laminar flow,
 Free radicals, Thermodynamic equilibrium, Fuels,
 Measurement, Concentration(Composition), Air,
 Diffusion flames, Reaction kinetics, Reprints, *Hydroxyl
 radicals, Laser induced fluorescence.

Absolute concentration measurements of hydroxyl
 radical have been made in a laminar, co-flowing methane-
 air diffusion flame using laser absorption and laser-
 induced fluorescence methods. The maximum OH
 radical concentration is found to be $1.8 \pm 0.2 \times 10$
 $(\text{sup } 16)/\text{cu cm}$ (mole fraction = 5.0×10 (sup -3))
 at a temperature of 2080 K, which is twice the value
 calculated assuming local total equilibrium but less
 than half that predicted from partial equilibrium ($\text{O}_2 +$
 $\text{H}_2 = 2\text{OH}$ radical). Evidence is presented that in
 general partial equilibrium does not exist for the fast,
 bimolecular chain branching and radical shuffle reactions
 in the flame. The overall chemical production-destruction
 rate profile of OH radical has been determined, as well
 as the rates of hydrogen abstraction reactions by hydroxyl
 radical to form the vinyl and ethynyl radicals. The
 results are used to identify the most rapid routes for
 the production of radical species important in
 chemical growth processes.

000,591
PB90-254616 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Fire Measurement and Research
 Div.
**Structure and Radiation Properties of Large Two
 Phase Flames.**
 Final rept.
 J. P. Gore, S. M. Skinner, D. W. Stroup, D.
 Madrzykowski, and D. D. Evans. 1989, 12p
 Sponsored by Minerals Management Service, Reston,
 VA.
 Pub. in Proceedings of ASME (American Society of
 Mechanical Engineers) Winter Annual Meeting on
 Heat Transfer in Combustion Systems, San Francisco,
 CA., December 10-15, 1989, p1-11.

Keywords: *Flames, *Temperature measurement,
 Radiation, Flux(Rate), Heptanes, Methane, Heat transfer,
 Turbulence, Two phase flow, Combustion, Reprints.

Measurements and predictions of temperatures and
 radiation for large two-phase, non-premixed flames
 burning heptane or crude oil and methane in air are
 reported. Analysis involves the locally-homogeneous
 flow approximation (LHF), a k-e-g turbulence model
 and the conserved scalar formulation. State relationships
 for the mixtures are estimated from those of the
 individual fuels. Radiative heat fluxes are obtained
 using the discrete transfer method and narrow band
 analysis. Methane/air flames are studied as a base-
 line. The analysis underpredicts the temperatures by
 ten percent and the heat fluxes by thirty percent for the
 two-phase flames.

000,592
PB90-261355 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Fire Measurement and Research
 Div.
Performance Testing for the Corrosivity of Smoke.
 Final rept.
 J. D. Ryan, V. Babrauskas, T. J. O'Neill, and M. M.
 Hirschler. 1990, 15p
 Pub. in Characterization and Toxicity of Smoke, ASTM
 STP 1082, p75-88 1990.

Keywords: *Smoke, *Corrosive gases, *Performance
 tests, Combustion products, Acidity, Corrosion tests,
 Corrosion, Fire tests, Gas analysis, Reprints.

It has traditionally been assumed that smoke corrosivity
 is directly correlated to the emission of acid gases.
 The results of recent experiments have shown that
 materials which do not release acid gases can, nevertheless,
 cause corrosion of metal surfaces, as deter-

mined by metal loss. In addition, for electrical equipment
 there are two other types of related nonthermal
 damage from combustion products which must be
 considered, viz., ohmic bridging and degradation of
 contacts. Laboratory tests proposed to date to measure
 the corrosive effects of combustion products all
 have significant deficiencies: some methods are not
 performance-based at all and are merely tests for pH.
 In others, unrealistic specimen heating or unrealistic
 exposure targets are used. To facilitate the development
 of a better test, a series of criteria have been
 developed. A specific test method was evolved from
 these criteria. The method is performance-based and
 incorporates realistic fire heating conditions.

000,593
PB90-271073 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg,
 MD. Fire Science and Engineering Div.
Time Dependent Simulation of Turbulent Combustion.
 Final rept.
 H. R. Baum, D. M. Corley, and R. G. Rehm. 1987, 4p
 Pub. in Chemical Physics Processes Combustion,
 p82/1-82/4 1987.

Keywords: *Diffusion flames, *Time dependence,
 *Eddies, *Turbulence, Turbulent flow, Combustion,
 Mathematical models, Simulation, Vortices, Mixing,
 Reprints.

The purpose of the work is the development of a
 mathematical model of diffusion controlled gas phase
 combustion appropriate for use in a large eddy simulation
 of turbulent reacting flows. The basic idea is that while
 the large eddy simulation of necessity is highly dependent
 upon the geometrical and physical boundary conditions
 prescribed by the macroscopic problem of interest,
 the combustion phenomena are influenced primarily
 by local conditions near the fuel/oxidizer interface.
 Thus, by focusing attention on regions near the
 interface, a combustion model applicable to a wide
 variety of scenarios can be developed. In order to
 carry out such a research program, two basic tasks
 must be accomplished. First, the large eddy simulation
 must be capable of tracking a coarse-grained representation
 of the interface, so that a local frame of reference
 for the combustion analysis can be established.
 Second, a solution to the combustion problem
 containing the local values of the large scale coarse-
 grained variables as ambient parameters must be
 obtained.

000,594
PB90-271800 PC A03/MF A01
 National Bureau of Standards (NEL), Washington, DC.
 Center for Fire Research.
FIREDOC Users Manual (Revised).
 N. H. Jason. Sep 87, 40p NBSIR-87/3562
 Supersedes PB88-110317.

Keywords: *Fire research, *Information dissemination,
 *Information retrieval, Manuals, *FIREDOC systems,
 *Fire Research Information Services, *Databases, On
 line systems, User manuals(Computer programs).

FIREDOC is the on-line bibliographic database which
 reflects the holdings (published reports, articles,
 books, and audiovisual items) of the Fire Research
 Information Services (FRIS), at the Center for Fire
 Research, National Bureau of Standards. The manual
 provides a step-by-step technique for entering and
 exiting the database via telecommunication lines, as well
 as a number of techniques for searching the database
 and processing the results of the searches.

000,595
PB91-107110 PC A14/MF A02
 National Inst. of Standards and Technology, Gaithersburg,
 MD.
**Preliminary Screening Procedures and Criteria for
 Replacements for Halons 1211 and 1301.**
 Technical note (Final).
 R. G. Gann, J. D. Barnes, S. Davis, J. S. Harris, R. H.
 Harris, J. T. Herron, B. C. Levin, F. I. Mopsik, K. A.
 Notarianni, M. R. Nyden, M. Paabo, and R. E. Ricker.
 Aug 90, 314p NIST/TN-1278
 Contract AF-89CS8204
 Also available from Supt. of Docs. as SN003-003-
 03040-6. Sponsored by Air Force Engineering and
 Services Center, Tyndall AFB, FL. Engineering and
 Services Lab.

Combustion & Ignition

Keywords: *Halohydrocarbons, *Fire resistant materials, *Flammability testing, Air pollution, Materials replacement, Methodology, Substitutes, Selection, *Flame retardants, *Fireproofing, *Halons, Ozone depletion, Global warming, Trifluorobromomethane, Difluorobromochloromethane.

The signing of the Montreal Protocol in 1987 demonstrated an international consensus that a variety of fully halogenated organic chemicals (halocarbons) were damaging stratospheric ozone. The current halogenated fire suppressants, or halons, were among the chemicals whose production is restricted by the Protocol. The likelihood of major reductions or a total ban on their production by the turn of the century is driving a search for alternative chemicals. No such search has been conducted since the late 1940s, when the U.S. Army conducted the study that led to today's predominant halogenated fire suppressants: halons 1301 (CF3Br) and 1211 (CF2ClBr). Halon 2402 (C2F4Br2) is in use to a lesser degree, as are halons 1001 and 1011. The project corresponds to a first step in a government/industry program to identify and qualify candidate replacements for halons 1301 and 1211 that will satisfy the needs of the major users for existing applications. Nine screening procedures have been defined for characterizing potential candidates for replacing halons, particularly 1211 and 1301, now in use for fire suppression applications.

000,596
PB91-107359 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.
New Approach to Fire Toxicity Data for Hazard Evaluation.
 Final rept.

V. Babrauskas, B. C. Levin, and R. G. Gann. 1987, 6p
 See also PB87-128138.
 Pub. in Fire Jnl. 81, n2 p22-23, 27-28, 70-71 Mar/Apr 87.

Keywords: *Toxicity, *Fire safety, *Flammability testing, *Combustion, Animals, Reprints, *Health hazards, *Fire gases, Risk assessment, Test methods.

An N-gas model involving a reduced dependence on animal testing is proposed both for obtaining fire toxicity data for hazard modeling and for premarketing screening of commercial products and materials. Current toxicity measures rely almost exclusively on animal testing. The proposed new approach is based on obtaining the time-dependent generation rates of a limited number of important toxic species using a suitable combustion apparatus, such as the Cone Calorimeter. The new approach will not entirely eliminate the need for animal testing, since a check-test will still be necessary, but it promises to substantially reduce the need for animals.

000,597
PB91-107383 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Monitoring the Fate of Chlorine from MSW Sampling through Combustion. Part 2. Combustion Studies.
 Final rept.

E. S. Domalski, K. L. Churney, A. E. Ledford, S. S. Bruce, T. J. Buckley, R. M. Parris, and S. N. Chesler. 1986, 14p
 See also PB88-155429 and DE86007299. Sponsored by Department of Energy, Washington, DC.
 Pub. in Chemosphere 15, n9-12 p1355-1368 1986.

Keywords: *Combustion products, *Air pollution, *Cellulose, *Polyvinyl chloride, Heat measurement, Calorimeters, Sands, Polymers, Thermoplastic resins, Chlorohydrocarbons, Reprints, *Volatile organic compounds.

Combustion measurements were carried out in a multi-kilogram capacity flow calorimeter on cellulose and cellulose/sand samples in 100% oxygen and several oxygen/nitrogen mixtures. Some measurements were made on cellulose/sand samples, which had 1 mass % of polyvinylchloride (PVC) as part of their composition, to study the conditions related to the formation/destruction of chlorinated organic compounds as combustion products. Qualitative identifications of a significant variety of chlorinated organic compounds have been made.

000,598
PB91-107508 PC A10/MF A02

National Inst. of Standards and Technology, Gaithersburg, MD.

Construction of an Exploratory List of Chemicals to Initiate the Search for Halon Alternatives.

Technical note (Final).
 W. M. Pitts, M. R. Nyden, R. G. Gann, W. G. Mallard, and W. Tsang. Aug 90, 210p NIST/TN-1279
 Contract AFEL-89CS8205

Also available from Supt. of Docs. as SN003-003-03031-7. Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.

Keywords: *Halohydrocarbons, *Fire resistant materials, *Air pollution, Reviews, *Flame retardants, *Fireproofing, *Halons, Ozone depletion, Global warming.

Production of the currently-used halogenated fire suppressants (halons) will be curtailed because of their contribution to stratospheric ozone depletion. The report, one of the first efforts toward identifying alternatives, documents the rationale for and selection of a set of approximately one hundred gases and/or liquids, covering a range of chemical and physical principles thought to affect flame suppression capability and stratospheric ozone depletion. An Appendix provides extensive information on each of the selected chemicals. Also included in the report are an introduction to combustion concepts, fire suppression mechanisms, test approaches for flame suppression effectiveness, and the mechanisms by which the current commercial halons can decrease stratospheric ozone.

Fuel & Propellant Tanks

000,599
PB90-187857 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
Survey of Instrumentation for Slush Hydrogen Systems.

Rept. for Dec 87-Jul 88.
 P. R. Ludtke, and P. J. Storch. 1989, 147p
 Contract NASA-C-3001-K
 Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
 Pub. in NASP Technical Memorandum 1054, 147p Apr 89.

Keywords: *Fuel tanks, *Hydrogen, *Monitors, *Fuel storage, *Sloshing, Measuring instruments, Flowmeters, Oscillations, Pressure, Temperature, Density.

The results of a survey of instrumentation suitable for use with slush hydrogen systems are presented. Both tank gauging and flow instrumentation are considered. The unique characteristics of slush hydrogen that dictate special instrumentation techniques are discussed. Pressure and temperature sensors, methods of measuring tank bulk density and transfer line of flow density, mass and volume flowmeters, liquid and slush level gauging, and visual access techniques for vessels and transfer lines are discussed. Finally, recommendations are given for slush instrumentation to be used in the near term, and a second category lists instrumentation or instrumentation techniques that require development for possible long-term use. Information concerning the NASA-MSFC slush hydrogen flow facility, the NBS slush hydrogen flow facility, and a review of techniques to control thermal acoustic oscillations are given in the appendices.

Reciprocation & Rotating Combustion Engines

000,600
DE89015819 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.
Aerodynamic Effects on Fuel Spray Characteristics: Air-Assist Atomizer.
 C. Presser, H. G. Semerjian, and A. K. Gupta. Jan 88, 29p DOE/CE/90213-T4, CONF-880802-11
 Contract A101-86CE90213
 22. international symposium on combustion, Seattle, WA, USA, 14-19 Aug 1988.
 Portions of this document are illegible in microfiche products.

Keywords: *Atomization, Aerodynamics, Combustion Properties, Flame Spraying, Flow Rate, *Fuel Injection Systems, *Kerosene, Nozzles, *Sprays, ERDA/421000.

Results are presented on the internal structure of a kerosene fuel spray, generated with an air-assist type nozzle. Effects of atomization air flow rate and combustion air swirl on droplet transport processes have been investigated. Spatially-resolved measurements have been obtained on mean droplet size, number density and velocity, at different combustion air swirl and atomization air flow rates. An ensemble light scattering technique, based on measurement of the polarization ratio, and laser velocimetry have been used for these measurements. The results indicate that as atomization air flow rate increases, the spray becomes confined to a narrower spray angle; in addition, mean droplet size decreases and number density increases significantly along the spray centerline. Larger droplets are found generally on the spray boundary, and smaller ones near the spray centerline. In all cases, there is a gradual increase in mean droplet size along the spray centerline with axial distance. Under burning conditions the flame plume becomes short and intense, with fewer droplets penetrating through the flame envelope. Combustion air swirl and atomization air have a significant effect on the transport of droplets and on combustion characteristics of spray flames. 20 refs., 9 figs.

Rocket Engines & Motors

000,601
PB90-192659 Not available NTIS
 National Inst. of Standards and Technology (NEL), Boulder, CO. Chemical Engineering Science Div.
Vortex Shedding Flowmeters for High Velocity Liquids.

Final rept.
 J. D. Siegwirth. 1989, 13p
 Sponsored by National Aeronautics and Space Administration, Huntsville, AL. George C. Marshall Space Flight Center.
 Pub. in International Jnl. of Heat and Fluid Flow 10, n3 p232-244 1989.

Keywords: *Flowmeters, *Liquid oxygen, Water, Reprints, *Space shuttle main engine, Vortex shedding.

The ability of the vortex shedding flowmeter to measure the liquid oxygen (LOX) flow in the ducts of the space shuttle main engine (SSME) has been examined. The LOX flow velocities are several times higher than the velocities found in conventional meter installations; in one duct the LOX flow velocity exceeds 50 m/s. The straight sections of these ducts seldom exceed ten diameters let alone the 25 diameters recommended in installation specifications for commercially available meters. A number of meter designs have been tested at the high flow velocities in the work substituting water for LOX. The test results suggest that a vortex shedding flowmeter could be used to measure LOX flow in these ducts without any flow conditioning.

COMMUNICATION

Common Carrier & Satellite

000,602
FIPS PUB 133 PC E01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Coding and Modulation Requirements for 2,400 Bit/Second Modems.
 2 Jun 86, 11p FEDSTD-1005A
 Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Keywords: *Telecommunications, *Requirements, Coding, Standards, Modems, Federal Standard 1005A, *Coding and modulation, *2400 bit/second modems, *Analog transmission channels, Federal Information Processing Standards Publication 133.

The standard establishes coding and modulation requirements for 2,400 bit/s modems owned or leased by the Federal government for use over analog transmission channels other than those derived from high-frequency radio facilities. It is based upon techniques described in CCITT Recommendations V.22 bis, V.26, and V.26 bis. The standard is to facilitate interoperability between telecommunication facilities and systems of the Federal government.

000,603
FIPS PUB 135 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Coding and Modulation Requirements for Duplex 9600 Bit/Second Modems.

24 Mar 81, 10p FEDSTD-1007
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, *Requirements, Coding, Standards, Modems, Federal Standard 1007, *Coding and modulation, *Duplex 9600 bit/second modems, *Analog transmission channels, Federal Information Processing Standards Publication 135.

The standard establishes coding and modulation requirements for duplex 9600 bit/s modems owned or leased by the Federal Government for use over four-wire, analog transmission channels. It is based upon CCITT Recommendation V.29. The standard is to facilitate interoperability between telecommunication facilities and systems of the Federal Government.

000,604
FIPS PUB 136 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Telecommunications: Coding and Modulation Requirements for Duplex 600 and 1200 Bit/Second Modems.

16 Jun 80, 9p FEDSTD-1008
Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, *Requirements, Standards, Coding, Modems, Federal Standard 1008, *Coding and modulation, *Duplex 600 and 1200 bit/second modems, *Analog transmission channels, Federal Information Processing Standards Publication 136.

The standard establishes coding and modulation requirements for duplex 600 bit/s and/or 1200 bit/s modems owned or leased by the Federal Government for use over analog transmission channels terminated by 'two-wire' circuits. It is based upon CCITT provisional Recommendation V.22. The standard is to facilitate interoperability between telecommunication facilities and systems of the Federal government.

000,605
FIPS PUB 137 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Analogue to Digital Conversion of Voice by 2,400 Bit/Second Linear Predictive Coding.

28 Nov 84, 11p FEDSTD-1015
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.
Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, *Requirements, Standards, Federal Standard 1015, *Analog to digital conversion of voice, 2,400 bit/second Linear Predictive Coding, Synchronous digitized voice telecommunication equipment, Federal Information Processing Standards Publication 137.

The Standard specifies interoperability requirements relating to the conversion of analog voice to 2,400 bit/s

digitized voice by Linear Predictive Coding with 10 reflection coefficients (LPC-10), and reversion back to analog voice. The primary objective of the standard is to facilitate the interoperability of Government communication facilities and systems that employ 2,400 bit/s digitized voice.

000,606
FIPS PUB 138 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Telecommunications: Electrical Characteristics of Balanced Voltage Digital Interface Circuits.

1 Jan 80, 4p FEDSTD-1020A
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Keywords: *Telecommunications, Compatibility, Voice communication, Integrated circuits, Data processing equipment, Federal Standard 1020A, Data communication, *Electrical characteristics, *Balanced voltage digital interface circuits, Federal Information Processing Standards Publication 138.

The standard specifies the electrical characteristics of balanced voltage digital interface circuits normally implemented in integrated circuit technology that are to be employed for the interchange of serial binary data, timing, and control signals between voice or data telecommunication equipment where information is being conveyed at the DC baseband level at data signaling rates up to 10 megabits/s. The purpose of the standard is to facilitate interoperability between telecommunication facilities and systems of the Federal Government and compatibility of these facilities and systems at the computer-communications interface with data processing equipment (systems) of the Federal Government.

000,607
FIPS PUB 139 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Interoperability and Security Requirements for Use of the Data Encryption Standard in the Physical Layer of Data Communications.

3 Aug 83, 7p FEDSTD-1026
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, Requirements, Standards, Security, Data processing, Federal Standard 1026, *Interoperability and security requirements, *Data Encryption Standard, *Data communications, Federal Information Processing Standards Publications 139.

The standard specifies interoperability and security related requirements for using encryption at the Physical Layer of the Open Systems Interconnection (OSI) Reference Model in telecommunication systems conveying Automatic Data Processing (ADP) and/or narrative text information. The algorithm used for encryption is the Data Encryption Standard (DES), described in Federal Information Processing Standards Publication 46. Requirements contained in the standard relate to the interoperation of Physical Layer Data Encryption Equipment, or their interoperation with associated Data Terminal Equipment or Data Circuit-terminating Equipment. The standard is to facilitate the interoperation of Government data communication facilities and systems that require cryptographic protection using the Data Encryption Standard (DES) algorithm and is also to prevent the disclosure of plain text.

000,608
FIPS PUB 140 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

General Security Requirements for Equipment Using the Data Encryption Standard.

14 Apr 82, 15p FEDSTD-1027
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, *Requirements, Standards, Algorithms, Security, Protection, Federal

Standard 1027, *General security requirements, *Data Encryption Standard, Federal Information Processing Standards Publication 140.

The standard specifies the minimum general security requirements that are to be satisfied in implementing the Data Encryption Standard (DES) algorithm in a telecommunication environment. The DES itself specifies an algorithm used for cryptographically protecting certain U.S. Government information. (The algorithm is described in Federal Information Processing Standards Publication 46). The requirements defined in the standard affect the security of equipment implementing the DES algorithm. The standard addresses the following security objectives: To prevent inadvertent transmission of plain text; To prevent theft, unauthorized use, or unauthorized modification of DES cryptographic equipment while installed; To prevent unauthorized disclosure or modification of key variables while in DES cryptographic equipment; To provide interoperability between key variable loaders and DES cryptographic equipment, and facilitate the use of standardized keying material for U.S. Government applications of the DES algorithm; and to prevent data encryption when a critical cryptographic failure condition exists, and to generate an alarm upon detection of a critical cryptographic failure.

000,609
FIPS PUB 141 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Interoperability and Security Requirements for Use of the Data Encryption Standard with CCITT Group 3 Facsimile Equipment.

4 Apr 85, 5p FEDSTD-1028
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, *Requirements, Security, Facsimile transmission, Federal Standard 1028, *Interoperability and security requirements, *Data Encryption Standard, CCITT Group 3 Facsimile equipment, Federal Information Processing Standards Publication 141.

The standard specifies interoperability and security related requirements for the use of encryption with CCITT (i.e. International Telegraph and Telephone Consultative Committee) Group 3-type facsimile equipment. The algorithm used for encryption is the Data Encryption Standard (DES), described in Federal Information Processing Standards Publication 46. The standard is to facilitate the interoperation of Government facsimile equipment that requires cryptographic protection using the Data Encryption Standard (DES) algorithm and is also to prevent the disclosure of facsimile documents.

000,610
FIPS PUB 142 PC E01
National Inst. of Standards and Technology, Gaithersburg, MD.

Telecommunications: Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits.

31 Jan 80, 5p FEDSTD-1030A
Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, Compatibility, Voice communication, Integrated circuits, Data processing equipment, Federal Standard 1030A, Data communication, *Electrical characteristics, *Unbalanced voltage digital interface circuits, Federal Information Processing Standards Publication 142.

The standard specifies the electrical characteristics of unbalanced voltage digital interface circuits normally implemented in integrated circuit technology that are to be employed for the interchange of serial binary data, timing, and control signals between voice or data telecommunication equipment where information is being conveyed at the DC baseband level at data signaling rates up to 100 kilobits/s. The purpose of the standard is to facilitate interoperability between telecommunication facilities and systems of the Federal Government and compatibility of these facilities and

Common Carrier & Satellite

systems at the computer-communications interface with data processing equipment (systems) of the Federal Government.

000,611

FIPS PUB 143

PC E01

National Inst. of Standards and Technology, Gaithersburg, MD.

General Purpose 37-Position and 9-Position Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment.

10 Jun 85, 5p

Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, Standards, Requirements, Data processing, Federal Standard 001031, *Data communications, *General purpose 37-position and 9-position interface, *Data terminal equipment and data circuit-terminating equipment, Federal Information Processing Standards Publication 143.

The standard specifies the functional and mechanical interface characteristics for data terminal equipment (DTE) and data circuit-terminating equipment (DCE) used primarily in data communication applications over analog telecommunications networks. Federal telecommunication standards are to facilitate interoperability between telecommunications facilities and systems of the Federal Government and compatibility of these facilities and systems, at the computer-communications interfaces, with data processing equipment.

000,612

FIPS PUB 144

PC E06

National Inst. of Standards and Technology, Gaithersburg, MD.

Data Communication Systems and Services User-Oriented Performance Parameters.

28 May 85, 21p FEDSTD-1033

Also available from Supt. of Docs. Prepared in cooperation with National Communications System, Arlington, VA. Sponsored by General Services Administration, Washington, DC.

Three ring vinyl binder also available, North American Continent price \$7.00; all others write for quote.

Keywords: *Telecommunications, *Standards, Performance, Services, Federal Standard 1033, *Data communication systems, American National Standard X3.102, Federal Information Processing Standards Publication 144.

The standard, by adoption of American National Standard X3.102-1983, defines 21 data communication performance parameters that are applicable to all classes of data communication systems independent of topology, protocol, code, or other design characteristics. It supersedes Interim Federal Standard 001033 dated August 29, 1979. The purpose of the standard is to provide Federal agencies with a uniform means of specifying the performance of data communication systems and services as perceived by end users.

000,613

PB90-146440

PC A20/MF A03

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Working Implementation Agreements for Open Systems Interconnection (OSI) Protocols.

T. Boland, Dec 89, 475p NISTIR-89/4198

Also available from Supt. of Docs. Proceedings of the NIST Workshop for Implementors of OSI Plenary Assembly, Gaithersburg, MD., September 15, 1989.

Keywords: *Computer networks, Data processing security, Data processing terminals, *Protocols, *Open Systems Interconnection, Message processing.

The document records current agreements on implementation details of Open Systems Interconnection Protocols among the organizations participating in the NIST/OSI Workshop Series for Implementors of OSI Protocols. The decisions are documented to facilitate organizations in their understanding of the status of agreements. It is a standing document that is updated after each workshop (about 4 times a year.)

000,614

PB90-169368

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Optical Calibration of Accurate Particle Sizing Standards at the U.S. National Bureau of Standards.

Final rept.

T. R. Lettieri, 1987, 12p

Pub. in *Optical Particle Sizing - Theory and Practice*, p611-622 1987.

Keywords: *Optical communication, *Calibrating, *Particle size, Measurement, Particle shape, Microscopy, Standards, Light scattering, Electromagnetic scattering, Reprints, *National Institute of Standards and Technology, Microspheres.

The paper discusses the need for accurate calibration artifacts in the optical particle sizing community, and details work at the U.S. National Bureau of Standards toward the development of such materials using optical techniques for certification.

000,615

PB90-198953

PC A04/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Architectures for Future Multigigabit Lightwave Networks.

W. E. Burr, Mar 90, 69p NISTIR-90/4240

Keywords: *Fiber optics, *Network synthesis, *Optical communication, Voice communication, Video signals, Data transmission, Digital techniques, Switching theory, *Network analysis theory, Pulse communication, *Passive optical networks, Packet switching.

Architectures for future fiber optic networks for voice, video and data applications are considered. Broadband Integrated Services Digital Network (B-ISDN) will be introduced for these applications sometime after 1995. B-ISDN will be based on fast switching of rather small (48-byte) packets. The packet switches themselves will probably be electronic and will take advantage of the ability of semiconductor electronic technology to build very complex, regular, repetitive structures. Packet switching provides a flexible, efficient means of sharing bandwidth limited communications resources. Developing fiber optic technology, however, offers another revolutionary alternative, the Passive Optical Network (PON), based on the realization that the inherent bandwidth of the fiber is immense and using optical frequency division multiplexing to exploit this. The PON has significant advantages over centralized packet switching in some applications (particularly video distribution), is simpler, facilitates the addition of new services, can be begun and extended in small increments, and requires much less initial investment in the network. However, the PON depends upon the commercial development of several components, such as tunable lasers and coherent receivers, which have so far been proven only in laboratories.

000,616

PB90-212192

PC A99/MF A04

National Inst. of Standards and Technology, Gaithersburg, MD.

Stable Implementation Agreements for Open Systems Interconnection Protocols. Version 3, Edition 1, December 1989.

Special pub. (Final).

T. Boland, Mar 90, 679p NIST/SP-500/177

Based on the Proceedings of the NIST Workshop for Implementors of OSI Held at Gaithersburg, Maryland. Also available from Supt. of Docs. as SN003-003-02921-1. Supersedes PB89-193312.

Keywords: *Agreements, *Computer networks, *Computer communications, Standards, *Open systems interconnection, *Protocols, NIST Special Publication 500-177, Data communications, Packet data transfer.

The document records current Stable Agreements for Open Systems Interconnection Protocols among the organizations participating in the NIST/OSI Workshop Series for Implementors of OSI Protocols.

000,617

PB90-218116

Not available NTIS

National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Ku-Band Satellite Two-Way Timing Using a Very Small Aperture Terminal (VSAT).

Final rept.

D. A. Howe, 1987, 12p

Pub. in Proceedings of Annual Frequency Control Symposium (41st), Philadelphia, PA., May 27-29, 1987, p149-160.

Keywords: *Spacecraft communication, *Time measurement, Phase measurement, Frequency stability, White noise, Signal to noise ratio, Phase angle, Accuracy, Reprints, *Superhigh frequencies, Earth terminals, Noise measurement.

The National Bureau of Standards (NBS) Boulder Laboratory has recently completed installation of a 6.1 meter Ku-band satellite earth station and has acquired two 1.8 meter portable earth terminals and commercial spread-spectrum modems. This equipment was procured for the purpose of doing two-way time transfer experiments in collaboration with other time-keeping laboratories. Each portable earth terminal, often called VSAT for 'very small aperture terminal' is a complete Ku-band earth station with 70 MHz input and outputs. The VSAT can provide full duplex capability to transmit to and receive from a geostationary satellite of the fixed satellite service (FSS). Thus, two-way time comparisons can be done directly between NBS and a portable VSAT through a Ku-band satellite. Phase measurements have been performed of earth station and VSAT facilities in various loop-around schemes using a satellite simulator. Absolute phase delay measurements show reproducibility to better than 1 ns over a 16-day sample time. This suggests the potential for accuracy to this level given an appropriate calibration.

000,618

PB90-218199

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.

Gateway between MHS (X.400) and SMTP.

Final rept.

D. Tang, M. Anzenberger, P. Markovitz, and M. Wallace, 1988, 8p

Pub. in Proceedings of Computer Standards Conference on Computer Standards Evolution: Impact and Imperatives, Washington, DC., March 21-23, 1988, p7-14.

Keywords: Coding, Decoding, Constraints, Optimization, Reprints, *Gateways, *Electronic mail, *Protocols, *Department of Defense, Communications networks, Open system interconnection(OSI) protocols, Architecture(Computers).

The MHS/SMTP electronic mail gateway is one of two jointly proposed application layer gateway projects being developed for the Defense Communications Agency. The Message Handling System (MHS) is defined in the Consultative Committee for International Telephone and Telegraph (CCITT) X.400 Series of Recommendations, October, 1984. The Simple Mail Transfer Protocol (SMTP) is specified by RFC821 and RFC822 (where RFC is 'request for comments'), the military standards developed for mail handling in the Department of Defense (DoD) networks. This gateway will allow DoD and Open Systems Interconnection (OSI) users to interoperate during the period that DoD is migrating to the use of OSI protocols. Based on the analysis of the two protocols, a set of gateway requirements was defined, and an architecture was selected to satisfy the requirements. The paper includes: a summary of both sets of protocols, the gateway requirements, the gateway architecture, the mapping mechanisms for service elements, the Protocol Data Unit (PDU) encoding/decoding scheme, and the major constraints and problems encountered in the study. The paper begins with a general overview, and will progress towards a detailed set of instructions for designing an optimal gateway.

000,619

PB90-221805

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Wavelength Measurement System for Optical Fiber Communications.

Technical note.

G. E. Obarski, Feb 90, 46p NIST/TN-1336

Also available from Supt. of Docs. as SN003-003-03017-1.

Keywords: *Optical communication, Near infrared radiation, Helium neon lasers, Semiconductor lasers, *Wavelength measurement, *Lambdameters, Single mode, Optical fibers, Distributed feedback lasers, Instability, Red(Color).

A wavelength standard in the form of a lambdameter for measurement of single-mode sources used in optical fiber communication is described. The sources of interest are mainly diode laser emitting at 1.3 and 1.5

micrometers, but the system can be used in the near IR and red regions of the spectrum. Accuracy in wavelength measurement is verified to be less than 0.1 ppm at the 0.63 micrometer HeNe line by comparing separately each of two adjacent modes from a HeNe laser that is frequency-stabilized by a polarization technique, with a single mode from a second similarly frequency-stabilized HeNe laser. Wavelength instability of a commercially packaged 1.52 micrometer distributed-feed-back diode laser was measured to be in the range + or - 1 ppm.

000,620
PB90-264110 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Evaluation of Hands-Free Communication Systems.
B. A. Bell, A. G. Perrey, and M. J. Treado. Aug 90, 88p NISTIR-90/4230
Sponsored by National Inst. of Justice, Washington, DC.

Keywords: *Telecommunication, Signal to noise ratio, Amplification, Distortion, Frequency response, Sensitivity, Performance evaluation, Graphs(Charts), *Hands free communication systems, Harmonic distortion, Gain.

Hands-Free Communication Systems (HFCS) are used by law enforcement agencies, fire departments, rescue squads, and the Armed Forces, where tasks require the communications operator's hands to be free. Four such HFCSs were tested to measure their operational characteristics of voltage gain/frequency response, signal-to-noise ratio, total harmonic distortion, and sensitivity.

000,621
PB90-269556 PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Stable Implementation Agreements for Open Systems Interconnection Protocols. Version 3, March 1990. Change Page Index, June 1990.
Special pub. (Final).
Jun 90, 168p NIST/SP-500-177-SUPPL-2
Also available from Supt. of Docs. See also PB90-212192 and PB90-257627.

Keywords: *Computer networks, Standards, Agreements, Implementation, Protocols, *Open systems interconnections.

The document records, in replacement page format, all changes to stable material current (according to Version and Edition number) as of the previous Workshop (March 16, 1990). In this case, that would be NIST SP 500-177, Version 3, Edition 1 with previous Change Pages incorporated.

000,622
PB90-269598 PC A07/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Guidelines for the Evaluation of Message Handling Systems Implementations.
Special pub. (Final).
S. Trus, C. Royster, and P. Markovitz. Aug 90, 128p NIST/SP-500/182
Also available from Supt. of Docs. as SN003-003-03039-2. Sponsored by Army Information Systems Command, Fort Huachuca, AZ., Air Force Communications Command, Scott AFB, IL., and Internal Revenue Service, Washington, DC.

Keywords: *Message processing, *Electronic mail, Implementation, Specifications, Computer performance evaluation, Guidelines, *Open systems interconnections, Government Open Systems Interconnection Profile, GOSIP system.

The document advances the goals of the Government Open Systems Interconnection Profile (GOSIP) by providing guidelines for evaluating Message Handling Systems (MHS) implementations. The guidelines can assist a user in the determination of which implementation, among several candidates, will best meet the functional and performance requirements of that user. Specifically, the document contains: (1) guidelines for evaluating the functional specifications of MHS implementations, (2) guidelines for measuring the performance of MHS implementations, and (3) guidelines for matching the functional and performance specifications of an MHS implementation to the functional and performance requirements of the user.

Communication & Information Theory

000,623
PB90-136557 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Length and Mass Div.
Frequency Dependencies of Precision Resistors.
Final rept.
R. D. Cutkosky. 1988, 2p
Pub. in Review of Scientific Instruments 59, n2 p381-382 1988.

Keywords: *Resistors, *Frequency stability, Electric conductors, Frequency control, Frequency standards, Temperature measurement.

A variety of ac and dc resistors were examined for frequency dependence from dc to 400 Hz. It is concluded that several choices are available for use as standards in resistance thermometry.

000,624
PB90-136581 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Numerical Modeling of Capacitive Array Sensors Using the Finite Element Method.
Final rept.
P. R. Heyliger, J. C. Moulder, P. J. Shull, M. Gimple, and B. A. Auld. 1988, 8p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v7A p501-508 1988.

Keywords: *Capacitors, *Mathematical models, *Arrays, *Detectors, Electrostatic probes, Numerical analysis, Dielectrics, Surface defects, Fatigue(Materials), Crystal defects, *Finite element method.

The electrostatic field equations governing the behavior of a capacitive array sensor are solved using a two-dimensional finite element method. The response of the probe to surface flaws in conductors and dielectrics is examined by calculating the change in the probe's admittance as it is scanned across the flaw. The change in admittance, delta Y, is obtained by evaluating a line integral involving the electrostatic potential and its normal derivative. Results of parametric studies are reported showing the relative effects of the specimen's dielectric constant and flaw size on probe signals.

Policies, Regulations, & Studies

000,625
PB90-169756 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Adoption of Standard Time.
Final rept.
I. R. Bartky. 1989, 32p
Pub. in Technology and Culture 30, n1 p25-56 Jan 89.

Keywords: *Time standards, Clocks, Standardization, Railroads, Predetermined time, Reprints, *Universal time, General Time Convention.

In response to pressures from scientists, whose scientific pursuits required simultaneous observations from scattered points, railroad-superintendents and managers implemented a standard time system on November 18, 1883 tailored to their companies' train schedules. The paper documents the history of the adoption of standard time.

000,626
PB90-187717 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
Fundamentals of Two-Way Time Transfers by Satellite.
Final rept.
D. W. Hanson. 1989, 5p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p174-178.

Keywords: Communication satellites, Reprints, *Time transfers, Atmospheric effects, Sagnac effect, Two way, Reciprocity.

Two-way time transfer by satellite will eventually offer one of the highest accuracy systems at reasonable

costs. Advantages of two-way transfer over other techniques are given. The paper introduces the principles of two-way time transfer with emphasis on its use with commercial communications satellites. It discusses the limitations imposed by the atmosphere, the equipment, and the rotating, noninertial reference system on the assumption of reciprocal paths.

000,627
PB90-187725 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
NIST-USNO (National Institute of Standards and Technology-United States Naval Observatory) Time Comparisons Using Two-Way Satellite Time Transfer.
Final rept.
D. A. Howe, D. W. Hanson, J. L. Jespersen, M. A. Lombardi, W. J. Klepczynski, P. J. Wheeler, M. Miranian, W. Powell, J. Jeffries, and A. Myers. 1989, 6p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p193-198.

Keywords: Frequency stability, Synchronism, Random noise, Reprints, *Time transfers, Flicker noise, SBS-3 satellite, Two way.

NIST and USNO began making two-way satellite time transfers on August 12, 1987. The time transfers are made using the SBS-3 satellite and take place three times per week. The paper describes the equipment used to make the transfers, the data reduction procedures, and the results obtained.

000,628
PB90-187741 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
Impact of Atmospheric Non-Reciprocity on Satellite Two-Way Time Transfers.
Final rept.
J. Jespersen. 1989, 7p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p186-192.

Keywords: Communication satellites, Ionospheric propagation, Frequency standards, Time lag, Reprints, *Time transfers, *Atmospheric effects, Reciprocity, Two way.

In the two-way time transfer method, no knowledge is necessary concerning the locations of the slave and the master clock stations relative to the satellite, nor does one need any knowledge of the atmospheric delay. In this method, signals are exchanged back and forth, via a satellite transponder, between the master and slave stations. Because of the two-way signal exchanges, the path delay cancels out in the relevant calculations leaving only the difference in the clock readings at the master and slave stations. However, the cancelling of path delay is critically dependant on the assumption that the signal path delay from master to satellite to slave is equal to the delay from slave to satellite to master--that is, the paths are reciprocal. In actual practice this is hardly ever the case.

000,629
PB90-188558 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
Two-Way Satellite Time Transfers between and Within North America and Europe.
Final rept.
L. Veenstra, and D. W. Hanson. 1989, 7p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p179-185.

Keywords: *Communication satellites, North America, Europe, Reprints, *Time transfers, *Ground stations, *INTELSAT satellites, Two way, MITREX.

A satellite operated by the International Telecommunications Satellite Organization (INTELSAT) and located at 307 deg East longitude (53 deg West) provides new and unique capabilities for the coordination of time scales in North America and Europe using the two-way technique. A network of coordinated clocks using small satellite earth stations collocated with the time scales is possible. Antennas as small as 1.8 m at K-band and 3 m at C-band transmitting powers of less than 1 W will provide signals with timing jitters of less

Policies, Regulations, & Studies

than 1 ns using the MITREX spread spectrum modems. The technical details of the satellite and requirements on satellite earth stations are given. The resources required for a regular operational international time transfer service is analyzed. A typical satellite earth station with time transfer capability is described in some detail.

000,630

PB90-188574

Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.**Stability of Frequency Locked Loops.**

Final rept.

F. L. Walls. 1989, 5p

Pub. in Proceedings of Symposium on Frequency Standards and Metrology (4th), Ancona, Italy, September 5-9, 1988, p145-149 1989.

Keywords: *Frequency standards, *Frequency stability, Oscillators, Reprints.

The perceived frequency stability of passive frequency standards is determined in short-term by the performance of the local oscillator used to probe the reference resonance. Previous analyses of this problem were limited to simple servos and the use of the Allan or two-sample variance for determining fractional frequency stability. Under these conditions the fractional frequency stability of the local oscillator could only approach that of the inherent stability of the reference resonance as $\tau(\text{sup } -1)$. This paper shows that using more complex servos and a more general method of measuring fractional frequency, it is often possible for the frequency stability of the local oscillator to approach that of the reference as $\tau(\text{sup } -2)$. This new approach becomes much more important as the fractional frequency stability of passive references significantly exceeds that of available (or low cost) local oscillators.

000,631

PB90-257684

PC A03/MF A01

National Inst. of Standards and Technology, Boulder,
CO.**Time Domain Frequency Stability Calculated from the Frequency Domain Description: Use of the SIGINT Software Package to Calculate Time Domain Frequency Stability from the Frequency Domain.**

F. L. Walls, J. Gary, A. O'Gallagher, R. Sweet, and L. Sweet. Sep 89, 35p NISTIR-89/3916

Keywords: *Frequency stability, Metrology, Computer applications, Computer calculations, Allan variance, Interactive systems, Time domain, Frequency domain, SIGINT system.

The report describes the use of SIGINT, a new interactive software package which facilitates the calculation of time domain frequency stability in terms of the Allan variance as a function of measuring time from frequency domain data. Except for the graphic output, the code is written in standard FORTRAN 77 and runs on AT compatible computers that have a math co-processor. It also runs on many other systems; however, calls to an available graphics library will need to be substituted for those that are included in this version. The program uses either a user defined function for the input noise or default functions that describe the noise types commonly found in oscillators, amplifiers, frequency multipliers, frequency dividers, and general signal processing equipment. These default functions make it simple to analyze the time domain frequency stability as a function of measuring bandwidth using realistic first-, second-, or third-order low-pass filters or the simplified infinitely sharp cutoff parameter. The default functions are also set up to examine the effect of various servo parameters on the performance of a frequency source locked to a frequency reference.

000,632

PB90-260902

Not available NTIS

National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.**Ensemble Time and Frequency Stability of GPS Satellite Clocks.**

Final rept.

D. W. Allan, and T. K. Pepler. 1988, 4p

Pub. in Proceedings of Annual Frequency Control Symposium (42nd), Baltimore, MD., June 1-3, 1988, p465-467.

Keywords: *Frequency stability, Cesium frequency standards, Atomic clocks, Time, Reprints, Satellite-borne instruments, Global positioning system.

In anticipation of cross-link ranging in GPS and the establishing of GPS ensemble time, the authors investigated the frequency stability characteristics of the clocks in the constellation. Once those characteristics were ascertained they then optimally combined the clock readings in the NBS time scale algorithm to generate a GPS space clock ensemble. Frequency drifts of a few parts in 10 to the 16 power per day were observed in the GPS cesium beam frequency standards on board the space vehicles. The GPS space clock ensemble frequency stability reached about 2 parts in 10 to the 14 power. Not only is this comparable to some of the best clock ensembles at major timing centers throughout the world, but the calculated time dispersion for autonomous GPS performance has significant implications. The reference for the analysis was the NBS time scale.

000,633

PB90-261017

Not available NTIS

National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.**Outlook for Advances in the Realization of the SI Unit of Time.**

Final rept.

R. E. Drullinger. 1989, 5p

Pub. in Proceedings of Triennial World Congress of International Measurement Confederation (11th), Houston, TX., October 17, 1988, p89-92 1989.

Keywords: *Time measurement, Time standards, Frequency standards, Reviews, Reprints, International system of units.

The field of time and frequency standards is highly dynamic with active research on the techniques that will lead to the next several generations of standards. In parallel with the development of laboratory standards is the technology of time dissemination. The paper briefly reviews the techniques that will lead to the next 5 orders of magnitude improvement in the realization of the SI unit of time.

000,634

PB90-261082

Not available NTIS

National Bureau of Standards (NML), Boulder, CO.
Time and Frequency Div.**Effect of Humidity on Commercial Cesium Beam Atomic Clocks.**

Final rept.

J. E. Gray, H. E. Machlan, and D. W. Allan. 1988, 6p

Pub. in Proceedings of Annual Symposium on Frequency Control (42nd), Baltimore, MD., June 1-3, 1988, p514-518.

Keywords: *Atomic clocks, *Humidity, Test chambers, Frequency stability, Cesium, Random noise, Reprints, Annual variations.

Because a dependence of the frequency of commercial cesium beam clocks on humidity has been observed by others, NBS chose to control the humidity in one of the environmental chambers for the NBS clock ensemble. On 9 February 1988 the relative humidity was changed from a few percent to 48%. All of the clocks underwent a change in frequency. The resulting frequency changes were of different sign and of varying magnitudes among the clocks. In some, the changes were an order of magnitude larger than the flicker noise FM levels associated with the corresponding clocks. The implications of such changes are quite significant in the generation of International Atomic Time (TAI) and of Universal Coordinated Time (UTC). The possibility of annual variations in the time scales of the principal timing centers as well as in TAI and UTC will be discussed.

000,635

PB90-261181

Not available NTIS

National Bureau of Standards (NML), Boulder, CO.
Time and Frequency Div.**Preliminary Comparison between GPS and Two-Way Satellite Time Transfer.**

Final rept.

W. J. Klepczynski, P. J. Wheeler, W. Powell, J.

Jeffries, A. Myers, R. T. Clarke, W. Hanson, J.

Jespersen, and D. Howe. 1988, 7p

Sponsored by Naval Observatory, Washington, DC.

Pub. in Proceedings of Annual Symposium on Frequency Control (42nd), Baltimore, MD., June 1-3, 1988, p472-477.

Keywords: *Time standards, *Time measurement, Spacecraft communication, Linear regression, Communication satellites, Comparison, Reprints, Space

communication, Global positioning system, Time transfer.

The time scales of the U.S. Naval Observatory in Washington, D.C. and the National Bureau of Standards in Boulder, Colorado were compared during the same time periods by the common view mode using the satellites of the Global Positioning System (GPS) and by the two-way mode using a U.S. domestic communications satellite. Data collected over a 3-month period showed residuals from a linear regression of 10 nanoseconds for the two-way technique and 30 nanoseconds for common view GPS. The two-way technique achieved better than 500 ps of precision with less than 2 minutes of data. Absolute calibration of either technique was not attempted during the measurement period.

000,636

PB90-271016

Not available NTIS

National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.**Estimating Combined Errors Due to Propagation and Ephemeris and Their Effect on Time and Frequency Transfer.**

Final rept.

D. W. Allan, and P. P. Lin. 1987, 5p

Pub. in Proceedings of Annual Frequency Control Symposium (41st), Philadelphia, PA., May 27-29, 1987, p144-148.

Keywords: Frequency standards, Spacecraft communication, Ephemerides, Errors, Reprints, *Time transfer, *Frequency transfer, Global positioning system, Weighting functions.

There is now a global network of timing centers with frequency standards having stabilities of a few parts in 10 to the 14 power which are monitoring the GPS. It has been shown that by taking differences of the common-view time differences between two timing centers and between pairs of satellites, one can arrive at a statistically optimum estimate for a weighting factor for each common-view path. With this approach, GPS common-view measurement noise of a few parts in 10 to the 14 power is achievable for an integration time of 1 day. Using the above weighting factors, the paper develops an algorithm for estimating a weighted linear error of the differential ephemeris plus propagation errors for each satellite. This can be done between any pair of timing centers which have receivers and clocks with adequate stability. As most of the time transfer receivers operate at the L1 frequency (1.575 GHz), this technique reveals information regarding the accuracy of the ionospheric models broadcast at this frequency as part of the GPS data word. Once the individual satellite's differential propagation and ephemeris errors are estimated, the statistical properties of each can be combined to obtain a statistically weighted estimate of the common-view measurement variations limiting the comparison of the clocks between the two remote sites.

000,637

PB91-100909

PC A16/MF A02

National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.**Characterization of Clocks and Oscillators.**

Technical note (Final).

D. B. Sullivan, D. W. Allan, D. A. Howe, and F. L.

Walls. Mar 90, 354p NIST/TN-1337

Also available from Supt. of Docs. as SN003-003-

030-19-8.

Keywords: *Oscillators, *Clocks, Frequency measurement, Time measurement, Frequency stability, Phase measurement, Metrology, Allan variance, Phase noise, Noise measurement.

This is a collection of published papers assembled as a reference for those involved in characterizing and specifying high-performance clocks and oscillators. It is an interim replacement of NBS Monograph 140, Time and Frequency: Theory and Fundamentals, an older volume of papers edited by Byron E. Blair. The current volume includes tutorial papers, papers on standards and definitions, and a collection of papers detailing specific measurement and analysis techniques. The discussion in the introduction to the volume provides a guide to the content of the papers, and tables and graphs provide further help in organizing methods described in the papers.

000,638

PB91-107532 PC A08/MF A01
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
Time and Frequency Users Manual (Revised 1990).
Special pub. (Final).
G. Kamas, and M. A. Lombardi. Sep 90, 160p NIST/
SP-559
Supersedes PB80-143993. Also available from Supt.
of Docs. as SN003-003-03050-3.

Keywords: *Frequency measurement, *Time measurement, *Spacecraft communication, *Atomic clocks, *High frequencies, *Low frequencies, *Standards, *Oscillators, *Sources, *Radio broadcasts, *User manuals, *Loran C, *Calibration.

The book is for the person who needs information about making time and frequency measurements. It is written at a level that will satisfy those with a casual interest as well as laboratory engineers and technicians who use time and frequency every day. It includes a brief discussion of time scales, discusses the roles of the National Institute of Standards and Technology (NIST) and other national laboratories, and explains how time and frequency are internationally coordinated. It also describes the available time and frequency services and how to use them. It discusses the accuracies that can be achieved with the different services, and the pros and cons of using various calibration methods.

Radio & Television Equipment

000,639

PB91-107268 PC A04/MF A01
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Measurement of Electric Field Strength Near Higher Powered Personal Transceivers.
J. Adams, D. Wu, and A. Budlong. May 90, 60p
NISTIR-90/3938

Keywords: *Law enforcement, *Transmitter receivers, *Electric fields, *Very high frequencies, *Ultrahigh frequencies, *Portable equipment, *Walkie talkies, *Electrical measurement, *Health hazards, *Hand held.

The report contains the results of tests conducted on typical transceivers in the four frequency bands used by the law enforcement community: 30-50, 150-174, 400-520, and 806-866 MHz. The fields were measured at distances likely to be encountered in practice. Electric field strengths were measured at a number of points near 5-W personal transceivers. The points were located on cylinders of revolution around the antenna with radii of 7, 9.5, 12, 14.5, 17, and, in some cases, 27, 37, and 47 cm. At shorter distances, these measured values exceeded the exposure limits suggested in ANSI Standard C95.1-1982.

Verbal

000,640

PB90-500539 CP\$650.00
National Inst. of Standards and Technology (NCSL),
Gaithersburg, MD. Advanced Systems Div.
DARPA Resource Management Continuous Speech Database (RM1). Speaker-Independent Training Data (for CD-ROM).
Data file.
J. Garofolo, and D. Pallett. Nov 89, CD-ROM NIST/
DF/DK-90/008
See also PB89-226666 and PB90-500547.
The data file is contained on a CD-ROM in the ISO 9660 Standard CD-ROM data format for use with an MS-DOS CD-ROM Extension drive.

Keywords: *Data file, *Speech recognition, CD-ROM, *Resource management, *Training.

The second RM1 release, NIST Speech Disc 2-3.1 (November 1989), consists of a single CD-ROM disc containing the Speaker-Independent Training Data. In this portion of the corpus, 80 speakers each read the 2 'dialect' sentences plus 40 sentences from the Resource Management text corpus, for a total of 3360

recorded sentence utterances. Any given sentence from a set of 1600 Resource Management sentence texts was recorded by two subjects, while no sentence was read twice by the same subject. The material has been used to develop speaker-independent models for the Resource Management task.

000,641

PB90-500547 CP\$750.00
National Inst. of Standards and Technology (NCSL),
Gaithersburg, MD. Advanced Systems Div.
DARPA Resource Management Continuous Speech Database (RM1). Development Test and Evaluation Test Data and Scoring and Speech Header Software. NIST Speech Disc 2-4.1. (for CD-ROM).
Data file.
D. S. Pallett, and J. S. Garofolo. Jan 90, CD-ROM
NIST/DF/DK-90/009
See also PB90-500539.
The data file is contained on a CD-ROM in the ISO 9660 Standard CD-ROM data format for use with an MS-DOS CD-ROM Extension drive.

Keywords: *Data file, *Speech recognition, *Phonology, CD-ROM, *Resource management, *Training, *Data conversion.

The third-release, NIST Speech Disc 2-4.1, consists of a single CD-ROM disc containing all speaker-dependent and speaker-independent system test material used in DARPA benchmark tests conducted in March and October of 1987, June 1988, and February and October 1989, along with scoring and diagnostic software and documentation for those tests. The disc contains a total of 4320 recorded test sentence utterances. A NIST-developed library of software to manipulate the speech file header structure for the series of NIST-produced speech corpora on CD-ROM is included. In cooperation with the European Multi-Lingual Speech Input/Output Assessment Methodology and Standardization Project (SAM), software is provided to permit conversion of the speech data on this series of CD-ROMs into the corresponding 'associated file' format used within the SAM community.

General

000,642

PB90-187675 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
New 'Filtered Allan Variance' and Its Application to the Identification of Phase and Frequency Noise Sources.
Final rept.
J. Gros Lambert, J. J. Gagnepain, F. Verotte, and F. Walls. 1989, 5p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p326-330.

Keywords: *Noise generators, *Simulation, *Phase, *Reprints, *Noise(Electrical and electromagnetic), *Allan variance, *Identification, *Frequency, *Fractals.

In part one different digital noise generators are described. In part two these noise sources are used to generate sample series which simulate frequency samples as given by a counter. Applying the Allan variance to the samples of six generators yields the expected theoretical slopes. It is well known that both white phase and flicker phase noises give in time domain when using Allan variance the same characteristic in log-log plot slope, which corresponds to τ (sup -2). In the present work a new method is used. It consists in filtering the f (sup -1) and f (sup 0) phase noise (simulated by the previous noise generators) by means of a digital filter in time domain (using the Z transform), which yields f (sup -3) and f (sup -2) noises, which thus can be identified by Allan variance. The combination of the digital filter and the Allan variance corresponds to a new variance, which is described and compared to the well known 'Modified Allan Variance'.

000,643

PB90-188566 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Biases and Variances of Several FFT (Fast Fourier Transform) Spectral Estimators as a Function of Noise Type and Number of Samples.

Final rept.
F. L. Walls, D. B. Percival, and W. R. Ireland. 1989, 6p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p336-341.

Keywords: *Spectrum analysis, *Variance(Statistics), *Oscillators, *Amplifiers, *Bias, *Reprints, *Noise(Electrical and electromagnetic), *Fast Fourier transforms, *Mixers(Electronics).

The authors theoretically and experimentally investigate the biases and the variances of Fast Fourier transform (FFT) spectral estimates with different windows (data tapers) when used to analyze power-law noise types (f (sup 0), f (sup -2), f (sup -3), and f (sup -4). There is a wide body of literature for white noise but virtually no investigation of biases and variances of spectral estimates for power-law noise spectra commonly seen in oscillators, amplifiers, mixers, etc. Biases (errors) in some cases exceed 30 dB. The experimental techniques introduced here permit one to analyze the performance of virtually any window for any power-law noise. This makes it possible to determine the level of a particular noise type to a specified statistical accuracy for a particular window.

000,644

PB90-221797 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Generating Standard Reference Electromagnetic Fields in the NIST (National Institute of Standards and Technology) Anechoic Chamber, 0.2 to 40 GHz.

Technical note.
D. A. Hill, M. Kanda, E. B. Larsen, G. H. Koepke, and R. D. Orr. Mar 90, 47p NIST/TN-1335
Also available from Supt. of Docs. as SN003-003-03016-3.

Keywords: *Anechoic chambers, *Standards, *Very high frequencies, *Ultrahigh frequencies, *Superhigh frequencies, *Extremely high frequencies, *Waveguides, *Radiofrequency power, *Pyramidal horns.

The NIST anechoic chamber is used to generate standard (known) EM fields for frequencies from 200 MHz to 40 GHz. The transmitting antennas used are open-ended rectangular waveguides from 200 to 500 MHz and pyramidal horns from 450 MHz to 40 GHz. The uncertainty in the electric field is currently estimated to be \pm or $-$ 1.0 dB. A number of changes and additions are planned to improve the accuracy, repeatability, and efficiency of the system.

COMPUTERS, CONTROL & INFORMATION THEORY

Computer Hardware

000,645

PB90-135831 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg,
MD. Advanced Systems Div.
Performance Measurement Instrumentation at NBS (National Bureau of Standards).
Final rept.
R. J. Carpenter. 1989, 26p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Instrumentation for Future Parallel Computing Systems, p159-184 1989.

Keywords: *Performance evaluation, *Measurement, *Computer systems hardware, *Measuring instruments, *Reprints, *Multiprocessors, *Parallel computers.

The complexity of achieving near-optimum performance from multiprocessor parallel computers demon-

Computer Hardware

strates a need for performance measurement. However, when multiple processors are acting in concert on a single problem, perturbations caused by measurement can be unacceptable. Additional hardware can reduce the perturbation caused by measurement, and can be offered in several stages of refinement and cost. The hardware can often be offered as an option; it is necessary to provide access to the required signals in the system's original design.

000,646

PB90-154774

PC A03/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Introduction to Heterogeneous Computing Environments.

Special pub. (Final).

J. F. Barkley, and K. Olsen. Nov 89, 38p NIST/SP-500/176

Also available from Supt. of Docs. Library of Congress catalog card no. 89-600784.

Keywords: *Computer networks, Distributed networks, Computer communications, Local area networks, Protocols, *Heterogeneous Computing Environments.

The report provides an introduction to the concept of a heterogeneous computing environment. It characterizes heterogeneous computing environments from the point of view of the generic services provided. Standards are necessary in order to implement heterogeneous computing environments. The report provides an introduction by example to the types of technical standards that are necessary in a heterogeneous computing environment and illustrates how such standards can be used to provide services.

000,647

PB90-156894

PC A04/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.

NVLAP (National Voluntary Laboratory Accreditation Program) Program Handbook. Computer Network Interface Protocol X.25. Requirements for Accreditation.

J. Horlick. Mar 89, 52p NISTIR-89/4036

Keywords: *Computer networks, *Protocols, Interfaces, Laboratories, Computer communications, Testing, Assessments, *Accreditation.

The document explains the operational and technical requirements of the National Voluntary Laboratory Accreditation Program for Computer Network Interface Protocol testing. All of the steps leading to the accreditation are discussed. Technical requirements are explained indicating how the NVLAP criteria are applied.

000,648

PB90-193434

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems Components Div.

Coming to OSI: Network Resource Management and Global Reachability.

Final rept.

S. Wakid, P. Brusil, and L. LaBarre. 1987, 1p

Pub. in Data Commun. 16, n13 p137-138, 141-142, 145-146, 149-150 Dec 87.

Keywords: *Computer networks, Reprints, *Protocols, *OSI, Communication networks, Computer architecture, Resource management, Distributed processing.

As computers proliferate in the workplace, there is an increased need for workers to share information and processing resources distributed both within their local environment as well as across several other islands of workers and/or computers. The need to share distributed information and processing resources is currently being satisfied by interconnecting computers by means of communications systems composed of potentially concatenated LAN and WAN subnets. The paper discusses how the OSI architecture and its management framework satisfy the communication needs of distributed processing users, viability of VLSI implementations of OSI protocols, and how user communities currently dependent on non-OSI protocols can transition to OSI-based networking. Examples of how OSI and non-OSI suites can co-exist and cooperate are given.

000,649

PB90-207770

PC A03/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.

Workloads, Observables, Benchmarks and Instrumentation.

G. E. Lyon, and R. D. Snelick. Apr 90, 24p NISTIR-90/4275

Sponsored by Defense Advanced Research Projects Agency, Arlington, VA., and Department of Energy, Washington, DC.

Keywords: *Tests, *Models, Measurement, Trees(Mathematics), *Computer performance evaluation, Computer architecture.

Main emphasis is upon a compact user-level summary that captures the performance variabilities of a system. A dependency tree provides a clear, static declaration of the relationships among a very limited number of major system resources that explain most performance variance. The approach is especially effective with hardware instrumentation that decouples workload from observation, for otherwise a compact set of observables may be unavailable. The tree supports simple predictions and promotes more meaningful comparisons of workloads. Accounting for the sources of performance variation shown in the tree can inspire new methods of assessment; a 'time dilation' technique illustrates this for loosely-coupled systems with local clocks.

000,650

PB90-228024

PC A03/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.

Emulation Through Time Dilation.

J. K. Antonishek, and R. D. Snelick. May 90, 14p

NISTIR-4331

Proceedings of the Distributed Memory Computing Conference (5th), Charleston, SC., April 1990. Sponsored by Defense Advanced Research Projects Agency, Arlington, VA., and Department of Energy, Washington, DC.

Keywords: Models, Computerized simulation, Computation, *Multiprocessors, *Computer performance evaluation, Hypercube computers, Computer communications, Computer calculations, Time dilation.

Computation and communication are the primary dichotomy of loosely-coupled multiprocessor resources. Modeling and simulation are the techniques used to estimate machine performance based on the speed of these resources. The accuracy of the resulting performance estimates is often questionable, since such techniques cannot usually take into account all of the system detail: They become intractable in effort. Any real, hardware implementation of a multicomputer immediately fixes the speed of its resources, and can only yield a single point on the performance curve. The authors have implemented a third technique, called time dilation, to evaluate the performance of loosely-coupled multiprocessors by varying the ratio of computation speed to communication speed. This technique requires a high-speed clock and a test multicomputer system. Time dilation provides a way to measure accurately the performance of a given program on a variation of the physical transport system of a real machine.

000,651

PB90-265323

PC A09/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Conformance Test for FDDI Medium Access Control (MAC).

Z. Liu, and W. E. Burr. Jul 90, 189p NISTIR-90/4267

Keywords: *Computer networks, *Fiber optics, Standards, Conformity, Tests, Computer programs, Tables(Data), *Access control, Protocols, FDDI(Fiber Distributed Data Interface).

The Fiber Distributed Data Interface (FDDI) is an emerging standard for a 100 Mbit/s fiber optic token ring Local Area Network. The FDDI Medium Access Control (MAC) data link layer protocol standard specifies a complex protocol which controls the normal operation of the FDDI network. The report contains a proposed test for the conformance of implementations of FDDI MAC. The tests are written in the Combined Tree and Tabular Notation (TTCN) and automatically converted to a C language program by a TTCN to C translator.

000,652

PB90-271164

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.

Toward Real-Time Animation of Holographic Video Images.

Final rept.

J. C. Boudreaux, and T. R. Lettieri. 1987, 7p

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Visual Commun. Image Process. II, v845 p462-468 1987.

Keywords: *Three dimensional display systems, Computer graphics, Holography, Reprints, Computer animation, Real time.

A proposed system is described for the generation, display, and animation of three-dimensional holographic video images.

000,653

PB91-101485

Not available NTIS

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.

Multiprocessor Performance-Measurement Instrumentation.

Final rept.

A. Mink, R. Carpenter, G. Nacht, and J. Roberts.

1990, 13p

Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Pub. in Computer 23, n9 p63-75 Sep 90.

Keywords: Computer systems hardware, Parallel processors, Reprints, *Multiprocessors, *Computer performance evaluation, Computer architecture, Very large scale integration.

The paper focuses on multiple-instruction-stream, multiple-data-stream (MIMD) multiprocessor systems, both loosely-coupled and tightly-coupled. The premise is that multiprocessor performance measurement requires some level of hardware support to reduce perturbation to the executing processes. Basic elements of performance measurement data acquisition are event detection (triggering) and data capture (sampling). An overview of various approaches to triggering and sampling is reviewed. Two implementations of multiprocessor performance measurement instruments, a hybrid tool and a hardware tool, are summarized and their limitations discussed. A concluding discussion of current efforts is presented which is to combine the beneficial aspects of two previous tools into a VLSI chip set that has a wider range of utilization since it will be more cost effective to integrate into machines than circuit boards.

000,654

PB91-112615

Not available NTIS

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.

Hybrid Performance Measurement Instrumentation for Loosely-Coupled MIMD Architectures.

Final rept.

J. Roberts, J. Antonishek, and A. Mink. 1990, 7p

Pub. in Proceedings of Conference on Hypercubes, Concurrent Computers, and Applications (4th), Monterey, CA., March 6-8, 1989, v1 p237-243 1990.

Keywords: Parallel processors, Measurement, Reprints, *Computer performance evaluation, *Multiprocessors, Computer systems performance, Computer architecture.

The event trace measurement concept is reviewed, along with a previous design of a hybrid measurement tool which acquires this class of measurement on a tightly-coupled shared-memory MIMD architecture. A number of issues must be considered when applying this type of measurement tool to loosely-coupled, distributed-memory machines because of their architectural differences. A discussion of these issues is presented which includes synchronization, and centralized vs. distributed functions. Based on this discussion, a design of a hybrid measurement tool for a loosely-coupled multiprocessor is described that incorporates several new features not found in the original design.

000,655

PB91-112623

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.

National Bureau of Standards Program in Open System Interconnection.

Final rept.
R. Rosenthal. 1987, 5p
Pub. in Proceedings of International Symposium on Interoperable Information Systems, Tokyo, Japan, February 25-27, 1987, p2/1-2/5.

Keywords: *Computer networks, *Standards, Tests, Reprints, National Institute of Standards and Technology, Protocols, Open system interconnection, Computer performance evaluation.

The paper briefly describes the National Institute of Standards and Technology program in computer networking. The program supports research activities in conformance testing of network protocols, performance measurement, management and modeling of network systems, and coordination activities conducted with Government and industry representatives.

000,656

PB91-118166 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.

Benchmarking.

Final rept.
K. Dymond. 1989, 12p
Pub. in Encyclopedia of Computer Science and Technology, v20, sup5 p25-36 1989.

Keywords: *Bench marks, Units of measurement, Reprints, *Computer systems performance, Computer performance evaluation.

Benchmarking, a technique for performance analysis of computer systems, is surveyed. The uses and types of benchmarks, some recommendations for their use in measurement, and the origin of some well-known benchmarks are described. The properties of benchmarks, units of measurement, and the prospects for an experimental science of benchmarking are also discussed.

Computer Software

000,657

AD-A203 789/3 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 880708S1.09149 SoftTech, Inc., Ada 86, Version 3.21, VAX 11/780-11/785 (Host) to Intel iAPX 80286 Target.

Rept. for 8 Jul 88.
8 Jul 88, 69p Rept no. NBS-88VSOF535-3

Keywords: *Compilers, Identification, Length, Numbers, *Standardization, Test and evaluation, Validation, Value, *Ada programming language.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. This information is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,658

AD-A203 840/4 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 880708S1.09147 SoftTech, Inc., Ada 86, Version 3.21, VAX 11/780-11/785 Host and Intel iAPX 80286 Target.

Rept. for 8 Jul 88.
8 Jul 88, 70p Rept no. NBS-88VSOF535-2

Keywords: *Compilers, Identification, Length, *Standardization, Test and evaluation, Validation, *Ada programming language.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. This information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,659

AD-A204 439/4 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 880708S1.09148 SoftTech, Inc., Ada 86, Version 3.21, VAX 11/780-11/785 (Host) to Intel iAPX 80286 Target.

Rept. for 8 Jul 88.
8 Jul 88, 70p Rept no. AVF-NBS-88VSOF535-2

Keywords: *Compilers, Identification, Length, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

The Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between the compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. This information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,660

AD-A204 506/0 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 880616S1.09146 Naval Underwater Systems Center, ADAVAX, Version 1.7 w/ OPT, VAX 8600 (Host) to VAX 8600 (Target).

16 Jun 88, 56p Rept no. AVF-NBS88VUSN525-2

Keywords: *Compilers, Identification, Length, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada

Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,661

AD-A204 779/3 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 880608S1.09144, Honeywell Bull, GCOS 8 Ada Compiler, Version 2.1, DPS 8000, DPS 8/70, DPS 90 (Target).

8 Jun 88, 41p Rept no. NBS-88VHFS505

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,662

AD-A204 780/1 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report: Compiler Name: ADE/32 Revision 3.00, Certificate Number: 880527S1.09114, Host: MV/20000 under AOS/VS, Revision 7.56. Target: ROLM HAWK/32 under ARTS/32, Revision 2.7.

27 May 88, 70p Rept no. NBS-88VROL540-2

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform

Computer Software

to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,663
AD-A204 904/7 PC A04/MF A01
 National Bureau of Standards, Gaithersburg, MD.
Ada Compiler Validation Summary Report. Certificate Number: 880527S1.09113. Host: MV/20000 under AOS/VS, Revision 7.56. Target: ROLM HAWK/32 under AOS/VS, Revision 7.56.
 27 May 88, 68p Rept no. NBS-88VROL540-1

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

000,664
AD-A204 928/6 PC A04/MF A01
 National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report. Certificate Number 880728S1.09141 DDC-I, Inc., DACS-386/UNIX, Version 4.2, ICL DRS 300 Host and Target.
 28 Jul 88, 68p Rept no. AVF-NBS-88VDDC545-2

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

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000,665
AD-A205 339/5 PC A03/MF A01
 National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report. Certificate Number: 880715S1.09153. InterACT Corporation, InterACT Ada 1750A Compiler System, Release 3.0 VAX 11/785 Host, Fairchild F9450/1750A Target.
 Rept. for 15 Jul 88.
 15 Jul 88, 45p

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,666
AD-A205 444/3 PC A04/MF A01
 National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report: DACS-386/DDC-I, Inc. UNIX, Version 4.2, RC900 (386/UNIX V Workstation) Host and Target.
 Summary rept.
 28 Jul 88, 67p Rept no. NBS-88-VDDC-545

Keywords: *Compilers, Identification, Length, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of the integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,667
AD-A205 654/7 PC A04/MF A01
 National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada (Trade Name) Compiler Validation Summary Report. Certificate Number: 880728S1.09142, DDC-I, Inc., DACS-68020/SUN, Version 4.2 (1.0), SUN-3/50 Workstation. Completion of On-Site Testing: 28 July 1988.
 28 Jul 88, 54p

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,668
AD-A205 655/4 PC A04/MF A01
 National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada (Trade Name) Compiler Validation Summary Report. Certificate Number: 880527S1.09112, Data General Corporation ADE, Version 3.00, MV/20000. Completion of On-Site Testing: May 27, 1988.
 27 May 88, 68p

Keywords: *Compilers, Standardization, Test and evaluation, Validation, Value, High level languages, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,669
AD-A205 656/2 PC A04/MF A01
 National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada (Tradename) Compiler Validation Summary Report. Certificate Number: 880708S1.09152, Soft-Tech, Inc. Ada 86, Version 3.21 VAX 11/780 - 11/785 Host and Intel IAPX 80386P Target. Completion of On-Site Testing: July 8, 1988.
 8 Jul 88, 70p

Keywords: *Compilers, Validation, Test and evaluation, Standardization, *Ada programming language, *Validation summary report.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

000,670
AD-A206 490/5 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report: Soft-Tech Inc., Ada 86 Version 3.21, VAX 11/780-11/785 (Host) to Intel iAPX 80338 (Target).
Jul 88, 70p

Keywords: *Compilers, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, High level languages, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,671
AD-A206 491/3 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report: Naval Underwater Systems Center, Adavax, Version 1.7 w/NO OPT, VAX 8600 (Host) to VAX 8600 (Target).
16 Jun 88, 56p

Keywords: *Compilers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation depend-

encies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,672
AD-A208 303/8 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.
Ada Compiler Validation Summary Report: Certificate Number: 880719S1.09155 Naval Underwater Systems Command ADAUYK44 (ALS/N Ada/M), Version 1.0 VAX 11/785 Host and AN/UYSK-44 Target.
19 Jul 88, 45p Rept no. NBS88VUSN525-4
Availability: Document partially illegible.

Keywords: *Compilers, High level languages, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standards, it must be understood that some differences do exist between implementations. The Ada Standards permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. This information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,673
AD-A208 453/1 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Ada Compiler Validation Summary Report: Digital Equipment Corporation, VAX Ada Version 2.0, VAX 8800 (Host) to MicroVAX (Target), 89127S1.10034.
Report for 27 Jan 89-1 Dec 90.
27 Jan 89, 77p

Keywords: *Compilers, *High level languages, Standardization, Test and evaluation, Validation, *Ada programming language, Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

000,674

AD-A208 474/7 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Ada Compiler Validation Summary Report: Compiler Name: DACS-80336 Protected Mode, Version 4.3 Certificate Number 8903241S1.10068 Host: MicroVAX II under MicroVMS, Version 4.6. Target: Intel 80386 iSBC 386/21 Under Base Testing Completed 24 Mar 89 1989 ACVC 1.10.
Summary rept.
25 Apr 89, 80p

Keywords: *Compilers, High level languages, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,675

AD-A208 475/4 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.
Ada Compiler Validation Summary Report: Certificate Number: 880624S1.09132, Control Data Corporation CYBER 180 Ada Compiler, Version 1.1 HOST and TARGET COMPUTER: CYBER 180-930-31.
Summary rept. Jun 88-Jun 89.
Jun 89, 56p

Keywords: *Compilers, High level languages, Computers, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,676

AD-A208 498/6 PC A06/MF A01
National Bureau of Standards, Gaithersburg, MD.

Computer Software

Ada Compiler Validation Summary Report: Certificate Number: 880719S1.09154, Naval Underwater Systems Command, ADAUYK43 (ALS/N Ada/L), Version 1.0, VAX 11/785 Host and AN/UYK-43 Target.

19 Jul 88, 108p AVF-NBS88VUSN525-3

Keywords: *Compilers, High level languages, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,677

AD-A208 513/2 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 890113S1.09160 Encore Computer Corporation Parallel Encore Verdex Ada Development System Version 5.5 Encore Multimax 320 Target.

9 Jan 89, 42p

Keywords: *Compilers, High level languages, Computers, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an ADA compiler and evaluating the results. (KR)

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AD-A208 514/0 PC A05/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 890324S1.10067 DDC, Inc. DACS-80186, Version 4.3 MicroVAX II Host and Intel 80186 iSBC 186/03A Target.

24 Mar 89, 81p

Keywords: *Compilers, High level languages, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains

all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

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AD-A208 515/7 PC A03/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number 890113S1.09161 Encore Computer Corporation Encore Verdex Ada Development System Version 5.5 Encore Multimax 320 Host, Encore Multimax 320 Target.

9 Jan 89, 42p

Keywords: *Compilers, High level languages, Computers, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,680

AD-A208 652/8 PC A04/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report: Certificate Number: 880708S1.09150 SoftTech, Inc., Ada 86, Version 3.21, VAX 11/780-11/785 Host and Intel iAPX 80286P Target.

8 Jul 88, 70p

Keywords: *Compilers, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation depend-

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000,681

AD-A208 830/0 PC A05/MF A01
National Bureau of Standards (ICST), Gaithersburg, MD. Software Standards Validation Group.

Ada (Trade Name) Compiler Validation Summary Report: Certificate Number: 890127S1.10033. Digital Equipment Corporation VAX Ada Version 2.0 VAX 8800 Host and VAX 8800 Target.

27 Jan 89, 77p Rept no. AVF-NIST89DEC510-1-1.10

Keywords: *Compilers, Standardization, Test and evaluation, Validation, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

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AD-A209 138/7 PC A04/MF A01
National Bureau of Standards, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 880708S1.09151, SoftTech, Inc., Ada 86, Version 3.21 VAX 11/780-11/785 Host and Intel iAPX 80386P Target.

8 Jul 88, 66p

Keywords: *Compilers, High level languages, Identification, Length, Numbers, Standardization, Test and evaluation, Validation, Value, *Ada programming language, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

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AD-A214 907/8 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 890818S1.10131 Concurrent Computer Corporation, MC-Ada Version 1.2, Concurrent 6600 with MC68030 CPU, MC68882 Floating Point Host and Concurrent 6600 with MC68030 CPU, Lightning Floating Point Target.
18 Aug 89, 51p

Keywords: *Ada programming language, *Compilers, Floating point operation, Identification, Length, Lightning, Numbers, Standardization, Targets, Test and evaluation, Value, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,684

AD-A215 057/1 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report Certificate Number: 890727S1.10128 Encore Computer Corporation Encore Verdex Ada Development System Version 5.5 Encore Multimax 320 Host and Encore Multimax 320 Target.
27 Jul 89, 46p

Keywords: *Ada programming language, *Compilers, Computers, Standardization, Test and evaluation, Value, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,685

AD-A215 201/5 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 890818S1.10130 Concurrent Computer Corporation, MC-Ada Version 1.2, Concurrent 6600 with MC68030 CPU, MC68882 Floating Point Host and Concurrent 6600 with MC68030 CPU, MC68882 Floating Point Target.
18 Aug 89, 51p

Keywords: *Ada programming language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

000,686

AD-A215 202/3 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 890727S1.10127 Encore Computer Corporation, Encore Verdex Ada Development System, Version 5.5 Encore Multimax 320 Host and Encore Multimax 320 Target.
27 Jul 89, 48p

Keywords: *Ada programming language, *Compilers, Computers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

000,687

AD-A215 480/5 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Encore Computer Corporation, Encore Verdex Ada Development System, Version 5.5, Encore Multimax 320 (Host and Target), 890727S1.10129.
27 Jul 89, 48p

Keywords: *Compilers, Computers, Programming languages, Test and evaluation, *ADA Compiler, *Validation summary reports, *Ada programming language, Standards.

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Keywords: Ada programming language; Ada compiler validation summary report; Ada compiler validation capability; ACVC; Validation testing; Ada validation office; Ada joint program office. (jes)

000,688

AD-A218 464/6 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report. Certificate Number: 890901S1.10147, Control Data Corporation ADA/VE, Ver. 1.3 CYBER 932 Host and CYBER 932 Target. Completion of On-Site Testing: September 1, 1989.
1 Sep 89, 48p

Keywords: *Ada programming language, *Compilers, Facilities, Standardization, Test and evaluation, *Validation summary reports.

All the dependencies observed during the process of testing this Ada compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. The purpose of validating is to ensure conformity of the compiler to the Ada Standard by testing that the compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behavior that is implementation dependent, but is permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, and during execution. Keywords: Ada programming language; Ada compiler validation summary report; Ada compiler validation capability; Ada validation testing; Ada validation office; Ada validation facility; Ada joint program office. (emk)

000,689

AD-A219 438/9 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 890804S1.10142 Loral/RoIm MilSpec Computers ADE, Revision 3.01 MV 1000 Host and HAWK/32 Target.
4 Aug 89, 83p

Keywords: *Ada programming language, *Compilers, Specifications, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies—for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (KR)

000,690

AD-A219 439/7 PC A04/MF A01

Computer Software

National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 890901S1.10132. Owner: Nippon Telegraph and Telephone Corporation Implementor: SofTech, Inc. AdaDIPS, Version 1.0 NTT DIPS V20 Host and NTT DIPS V20 Target.
1 Sep 89, 61p

Keywords: *Ada programming language, *Compilers, Standards, Test and evaluation, *Validation summary reports.

This validation summary report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. (EDC)

000,691

AD-A219 440/5 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 890831S1.10146 Bull HN Information Systems, Inc. GCOS 8 ADA Compilation System, Version 2.3 DPS 9000 Host and DPS 9000 Target.
31 Aug 89, 40p

Keywords: *Compilers, Test and evaluation, *Ada programming language, *Validation summary reports, Standards.

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing be implemented that is not in the Standard. Keywords: Military publications, Periodicals, Reports. (eg)

000,692

AD-A219 441/3 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 890804S1.10141 Loral/Rolm Mil-Spec Computers ADE, Revision 3.01 MV 10000 Host and HAWK/32 Target.
4 Aug 89, 83p

Keywords: *Compilers, Computers, *Ada programming language, Specifications, Test and evaluation, *Validation summary reports, Standards.

This Validation Summary Reports (VSR) describes the extent to which a specific ADA Compiler conforms to the ADA Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. The purpose of validating is to ensure conformity of the compiler to the Ada Standard by testing that the compiler properly implements legal language constructs and that it identifies and rejects illegal language constructs. The testing also identifies behavior that is implementation dependent, but is permitted by the Ada Standard. Six classes of tests are used. These tests are designed to perform checks at compile time, at link time, and during execution. (SDW)

000,693

AD-A220 908/8 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891116S1.10233, InterACT Corporation, InterACT Ada Mips Cross-Compiler System Release 1.0, MicroVAX 3100 Cluster Host and MIPS R2000 in an Integrated Solutions, INC Advantage 2000 Board (Bare Machine).
16 Nov 90, 51p

Keywords: *Ada programming language, *Compilers, Integrated systems, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between the compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,694

AD-A220 944/3 PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Software Standards Validation Group.

Ada Compiler Validation Summary Report. Certificate Number: 890924S1.10231, Bull HN Information Systems, Inc. GCOS 8 Ada Compilation System, Version 2.3 DPS 8000 Host and DPS 8000 Target. Completion of On-Site Testing: 24 September 1989.
22 Jan 90, 40p

Keywords: *Ada programming language, *Compilers, Information systems, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,695

AD-A221 010/2 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891116S1.10232 InterACT Corporation InterACT Ada 1750A Compiler System Release 3.3 VAX11 Host and Fairchild 9450/1750A in a HP 64000 Workstation Target.
16 Nov 89, 58p

Keywords: *Ada programming language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results. (kr)

000,696

AD-A223 336/9 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891027S1.10184, DDC International A/S, DACS for Sun-3 -> Lynwood/LynX, Version 4.4(1.1), Sun-3/50 Workstation Host and Lynwood J430 Target.
Final rept.
27 Oct 89, 66p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,697

AD-A223 337/7 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891027S1.10183, DDC International A/S DACS for Sun-3/SunOS, Version 4.4 (1.1), SUN-3/60 Workstation Host and SUN-3/60 Workstation Target.
Final rept.
27 Oct 89, 63p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada

Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,698
AD-A223 366/6 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 891201S1.10212 U.S. Navy Ada/L, Version 2.0 (/OPTIMIZE Option) VAX 8550 and VAX 11/785 Hosts and AN/UYK-43 Target.

Final rept.
1 Dec 90, 92p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,699
AD-A223 367/4 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891027S1.10186 DDC International A/S DACS-386/UNIX, Version 4.4 RC900 Host and RC900 Target.

Final rept.
27 Oct 89, 74p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is

derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,700
AD-A223 377/3 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 891201S1.10211 U.S. Navy Ada.L, Version 2.0 (NO OPTIMIZE Option) VAX 8550 and VAX 11/785 Hosts and AN/UYK-43 Target.

Final rept.
1 Dec 89, 92p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,701
AD-A223 415/1 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 900121S1.10251 Computer Sciences Corporation MC Ada V1.2.Beta/Concurrent Computer Corporation Concurrent/Masscomp 5600 Host To Concurrent/Masscomp 5600 (Dual 68020 Processor Configuration) Target.

Final rept.
23 Apr 90, 50p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,702
AD-A223 495/3 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 891201S1.10214 U.S. Navy Ada/M, Version 2.0 (/OPTIMIZE Option) VAX 8550 and VAX 11/785 Hosts AN/UYK-44 Target.

Final rept. 1 Dec 89-1 Dec 90.
1 Dec 89, 89p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer values. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,703
AD-A223 538/0 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: U.S. Navy AdaVAX, Version 3.0 (/OPTIMIZE Option), VAX 8600 and VAX 11/785 (Host and Target), 891130S1.10210.

Final rept. 30 Nov 89-30 Nov 90.
30 Nov 89, 77p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,704
AD-A223 579/4 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891201S1.10215 U.S. Navy Ada/M, Version 2.0 (/No Optimize Option) VAX 8550 and VAX 11/785 Host and AN/AYK-14 Target.

Final rept. 12 Jan 89-12 Jan 90.
12 Jan 90, 88p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

Computer Software

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies.

000,705

AD-A223 581/0 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891201S1.10216 U.S. Navy Ada/M, Version 2.0 (/Optimize Option) VAX 8550 and VAX 11/785 Host and AN/AYK-14 Target.

Final rept. 12 Jan 89-12 Jan 90.

12 Jan 90, 88p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types.

000,706

AD-A223 596/8 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 890615S1.10126 Data General ADE, Revision 3.01, MV 15000 Host and MV 15000 Target, MV 10000 Host and MV 10000 Target.

Final rept. 15 Jun 89-15 Jun 90.

15 Jun 90, 83p

Keywords: *Ada programming language, Ada Compiler Validation Summary Report, Ada Compiler Validation Capability, Validation testing, Ada validation office, Ada validation facility, *Validation summary reports.

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard.

000,707

AD-A223 597/6 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891130S1.10209 U.S. Navy AdaVAX, Version 3.0 (/NO Optimize Option) VAX 8350 and VAX 11/785 Hosts and VAX 8350 and VAX 11/785 Target.

Final rept.

30 Nov 89, 77p

Keywords: *Ada programming language, *Compilers, Compiler validation summary report, Ada compiler validation capability, *Validation summary reports.

This Validation Summary Report (VSR) describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability (ACVC). An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies.

000,708

AD-A223 693/3 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number 891201S1.10213 U.S. Navy Ada/M Version 2.0 (/NO Optimize Option) VAX 8550 and VAX 11/785 Hosts and AN/UYK-44 Target.

Final rept.

1 Dec 89, 90p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the requirements of the Ada Standard, The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,709

AD-A223 736/0 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891027S1.10185 DDC INTERNATIONAL A/S DACS-386/UNIX, Version 4.4 ICL DRS300 Host and ICL DRS300 Target.

Final rept.

30 Apr 90, 72p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and

any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,710

AD-A223 764/2 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Ada Compiler Validation Summary Report: Certificate Number: 891128S1.10234 Apollo Computer Inc., Domain ADA, Ver 3.0.MBX DN 4000 Host and MVME 133A-20 Target.

Final rept.

28 Nov 89, 52p

Keywords: *Ada Programming Language, *Compilers, Standardization, Test and evaluation, *Validation summary reports.

This Validation Summary Report describes the extent to which a specific Ada compiler conforms to the Ada Standard, ANSI/MIL-STD-1815A. This report explains all technical terms used within it and thoroughly reports the results of testing this compiler using the Ada Compiler Validation Capability. An Ada compiler must be implemented according to the Ada Standard, and any implementation-dependent features must conform to the requirements of the Ada Standard. The Ada Standard must be implemented in its entirety, and nothing can be implemented that is not in the Standard. Even though all validated Ada compilers conform to the Ada Standard, it must be understood that some differences do exist between implementations. The Ada Standard permits some implementation dependencies--for example, the maximum length of identifiers or the maximum values of integer types. Other differences between compilers result from the characteristics of particular operating systems, hardware, or implementation strategies. All the dependencies observed during the process of testing this compiler are given in this report. The information in this report is derived from the test results produced during validation testing. The validation process includes submitting a suite of standardized tests, the ACVC, as inputs to an Ada compiler and evaluating the results.

000,711

FIPS PUB 156 PC A99
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Information Resource Dictionary System (IRDS); Category: Software Standard; Subcategory: Data Management Applications. American National Standard for Information Systems.

Final rept.

A. H. Goldfine. c5 Apr 89, 801p

Also available from Supt. of Docs. Also pub. as American National Standards Committee, New York rept. no. ANSI-X3.138-1988. Prepared in cooperation with American National Standards Committee, New York, and Computer and Business Equipment Manufacturers Association, Washington, DC.

Three ring vinyl binder also available: North American Continent price \$7.00; all others write for quote.

Keywords: *Data management, Standards, Specifications, American National Standard Information Resource Dictionary System, Federal Information Processing Standards Publication 156, *Computer software, Information resource management.

The publication announces the adoption of the American National Standard Information Resource Dictionary System (IRDS), ANSI X3.138-1988, as a Federal Information Processing Standard (FIPS). The IRDS specifies a computer software system that provides facilities for recording, storing, and processing descriptions of an organization's significant data and data processing resources. The IRDS includes the func-

tions performed by data dictionary systems or information repositories. The standard specifies two user interfaces: the full syntax and semantics of a Command Language, and the semantics of a menu-driven Panel Interface. The purpose of the standard is to promote portability of valuable information resources within and among Federal agencies. The standard is the reference authority for use by implementors in developing information resource dictionary systems, and for use by other computer professionals in understanding the precise syntactic and semantic rules of the standard.

000,712

PB90-135898 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Computer Systems as Scientific Theories: A Popperian Approach to Testing.

Final rept.

J. C. Cherniavsky. 1987, 12p

Pub. in Proceedings of Annual Pacific Northwest Software Quality Conference (5th), Portland, OR., October 19-20, 1987, p297-308.

Keywords: *Tests, *Computer program verification, Computer program reliability, Computer software.

Karl Popper developed a theory of scientific discovery based upon the testability of the theory. A theory was scientific if it were possible to choose experiments that could refute the theory. The author borrows from Popper and presents a theory of testing that is based on the careful choice of test cases. He shows that well-tested programs are as correct as programs subjected to mathematical proof. In demonstrating this, he draws on recent work in the development of theory of distinguishability.

000,713

PB90-150368 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Overview of the IGES (Initial Graphics Exchange Specification)/PDES (Product Data Exchange Standards) Testing Project. Version 1.0.

M. R. Pearson, M. E. Palmer, J. L. Crusey, C. L. Bracken, and L. A. Mankins. Dec 89, 33p NISTIR-89-4207

See also PB89-166102.

Keywords: *Tests, Proving, Verifying, Specifications, Dictionaries, *Product data exchange standards, *Computer software, Computer program verification.

The report provides an overview of some of the test methods currently being developed by the Testing Project of the IGES/PDES Organization. The charter and structure of the IGES/PDES Testing Project is defined, and three different types of IGES testing are explained: verification testing, application validation testing, and interoperability testing. Also included is the Glossary of Terms which has been compiled for the IGES/PDES Testing Project.

000,714

PB90-170234 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.
Knowledge-Based Front-End Input Generating Program for Building System Simulation.

Final rept.

S. T. Liu, and G. E. Kelly. 1988, 11p

Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v94 pt1 p1074-1084 1988.

Keywords: Computerized simulation, Reprints, *Pre-processors, *Input output processing, *Knowledge bases(Artificial intelligence), Front end processors, Data base management, Prolog programming language, National Institute of Standards and Technology.

A knowledge-based input preprocessor for building system simulation programs was developed at the National Bureau of Standards for the modular, dynamic building and HVAC systems simulation program HVACSIM+. The complexity of the HVACSIM+ program requires the user to have extensive knowledge of all the inputs, outputs, and parameters required by each component module in order to set up a data input file that will correctly link the multiple inputs and outputs of the user selected component modules from the HVACSIM+ library. The data input process is very te-

dious and time-consuming. The paper describes the development of a front-end program to generate the required data to link the multiple inputs and outputs of the user selected component modules. A microcomputer based language, Prolog, was used to program the data base of the input and output requirements of each component module in HVACSIM+ and to perform correct linking of those variables. A data base editing program was developed that would delete, insert, and re-link a component module in an already generated data file.

000,715

PB90-171059 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Unrestricted Algorithms for Mathematical Functions.

Final rept.

F. W. J. Olver. 1985, 12p

Sponsored by Army Research Office, Research Triangle Park, NC., and National Science Foundation, Washington, DC.

Pub. in Proceedings of International Conference on Special Functions: Theory and Computation, October 10-12, 1984, Torino, Italy, p237-248 1985.

Keywords: *Algorithms, *Functions(Mathematics), Exponential functions, Logarithm functions, Numerical precision, Reprints, Floating point arithmetic.

An unrestricted algorithm is one that will accept any values of the input variables, including any specified accuracy in the output. The construction of unrestricted algorithms for mathematical functions renews interest in the problems of combatting overflow and underflow and controlling error propagation. To help solve these problems a new form of computer arithmetic is proposed, together with a modification and generalization of the conventional definitions of absolute and relative error. Progress with the construction of unrestricted algorithms for elementary and transcendental functions is reviewed briefly.

000,716

PB90-183260 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
NIST (National Institute of Standards and Technology) Network Common Memory User Manual.

D. Libes. Feb 90, 21p NISTIR-90/4233

Keywords: Computer networks, Computer systems programs, *Memory(Computers), *Distributed data bases, User manuals(Computer programs), Distributed computer systems.

The manual describes how to use the NIST Network Common Memory System (CMS). The CMS provides a common memory that may be shared among processes distributed across a local area network. Unlike other shared memory systems, CMS accesses variables by name rather than by address. These and other features make the system more comparable to a primitive distributed database than a shared memory system. CMS currently runs on Berkeley UNIX systems but can be supported on any POSIX-like system which provides a stream protocol at the transport layer. Interfaces exist for usage from C and Franz Lisp.

000,717

PB90-183278 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Packet-Oriented Communication Using a Stream Protocol or Making TCP/IP on Berkeley Unix a Little More Pleasant to Use.

D. Libes. Feb 90, 11p NISTIR-90/4232

Keywords: Computer systems programs, Standards, Computer networks, *Protocols, *Computer communications, Packets(Communication).

The only DoD protocols supporting the Transport Layer in the OSI Model are UDP and TCP. UDP is packet-oriented while TCP is stream-oriented. It is often useful to mix characteristics of both. The paper describes a software package that stimulates the useful properties of UDP while using TCP. Also included are some functions for easier establishment of connections than by using TCP/IP primitives. In addition, some observations gained during the experience of implementing this on a 4.2BSD UNIX system are described.

000,718

PB90-198946 PC A05/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Secure Data Network System (SDNS) Network, Transport, and Message Security Protocols.

C. Dinkel. Mar 90, 89p NISTIR-90/4250

See also PB90-188061. Sponsored by National Security Agency/Central Security Service, Fort George G. Meade, MD.

Keywords: *Secure communication, Pulse communication, Data transmission, Computer programming, *Computer security, *Computer networks, *Protocol(Computers).

The Secure Data Network System project, known as SDNS, implements computer to computer communications security for distributed applications. The internationally accepted Open Systems Interconnection (OSI) computer networking architecture provides the framework for SDNS. SDNS uses the layering principles of OSI to implement secure data transfers between computer nodes of local area and wide area networks. The publication includes four security protocol documents developed by the National Security Agency (NSA) as output from the SDNS project. SDN.301 provides the framework for security at layer 3 of the OSI Model. Cryptographic techniques to provide data protection for transport connections or for connectionless-mode transmission are described in SDN.401. Specifications for message security service and protocol are contained in SDN.701. Directory System Specifications for Message Security Protocol are covered in SDN.702.

000,719

PB90-204512 PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Data Administration: Standards and Techniques. Proceedings of the Annual DAMA (Data Administration Management Association) Symposium (2nd).

J. J. Newton, and F. E. Spielman. Apr 90, 164p

NISTIR-90/4292

Held in Gaithersburg, Maryland on May 3, 1989. Sponsored by Data Administration Management Association, Washington, DC. National Capital Region, Federal Data Management Users Group, Washington, DC., and Association for Federal Information Resources Management, Washington, DC.

Keywords: *Standards, *Meetings, Models, Systems engineering, Information systems, *Data base administrators, *Data management, Data structures, Data integrity, Resource management.

The document represents the proceedings of a one-day symposium held at the National Institute of Standards and Technology on May 3, 1989. It includes the following papers: Data Architecture: The transition from Business Model to Data Model; Standards: Role of Data Standards in Establishing a Data Quality Program; Techniques: Bridging the Gap between the Strategic Plan and Systems Development; Standards: Using Standards to Support Data Sharing; Techniques: Data Integration Issues in Systems Development; and The Data Administrator: Achieving Excellence.

000,720

PB90-216813 PC A04/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Object Database Management Systems: Concepts and Features.

Special pub. (Final).

C. E. Dabrowski, E. N. Fong, and D. Yang. Apr 90, 64p NIST/SP-500/179

Also available from Supt. of Docs. as SN003-003-03007-4.

Keywords: Programming languages, Models, *Object database management systems, *Data base management systems, Object-oriented programming, Data bases, Data structures.

The last decade has seen the emergence of object concepts and their infusion into information systems technology. This phenomenon began with the advent of programming languages that included object concepts. More recently, object concepts have been merged with database management system technology, resulting in the production of some object database

Computer Software

management systems. As a result, the term object database management system (ODBMS) is now becoming a recognized and important topic in the database community. The purpose of the report is to provide managers and software analysts a state-of-the-art review of object concepts and to describe features associated with object database management systems.

000,721

PB90-218454

Not available NTIS

National Bureau of Standards (NML), Boulder, CO, Time and Frequency Div.

Automatically Running Command Files at Any Future Time.

Final rept.

J. Levine. 1986, 6p

Pub. in RSX Multi-Tasker, pRSX-6-RSX-10 1986.

Keywords: Reprints, *File management systems, Job shop scheduling, Command files, Indirect command processor.

It is often useful to be able to run indirect command files late at night or on a certain day each month. The note describes a task that can submit an indirect command file at any time in the future. The author uses this task to perform certain operations at 01:00:00 on the first day of every month, but the principle may be easily adapted to other situations.

000,722

PB90-219627

PC A03/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Guide to Software Acceptance.

Special pub. (Final).

D. R. Wallace, and J. C. Cherniavsky. Apr 90, 42p

NIST/SP-500/180

Also available from Supt. of Docs. as SN003-003-03008-2. Prepared in cooperation with Georgetown Univ., Washington, DC.

Keywords: Guidelines, Verifying, Requirements, Acceptability, Quality control, Tests, Criteria, Methodology, Management planning, *Software acceptance, *Computer software, Life cycles(Software), Data processing security, Computer interfaces.

Software acceptance is a life cycle process which includes acceptance of interim and final software products for both new and maintained software systems. The guide assists buyers in understanding acceptance issues relative to a basic life cycle model and some of its variants. The guide identifies six categories (functionality, performance, interface quality, overall software quality, security, and software safety) for which acceptance criteria must be defined. The guide identifies issues to be considered when establishing acceptance criteria. Finally the guide directs managers in planning and implementing a software acceptance program, with emphasis on the final software acceptance testing.

000,723

PB90-241514

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Network Architecture Div.

U.S. Government Procurement of Open Systems Products and Services.

Final rept.

J. F. Heafner. 1988, 3p

Pub. in Computer Standards and Interfaces 7, n1-2 p209-211 1988.

Keywords: *Government procurement, Standards, Purchasing, Computer networks, Reprints, *Open systems, Computer communications, Protocols, OSI.

The United States Government has helped with the development of open systems for the past eight years, with the expectation of its widespread use. Open systems now stand on the threshold of products and use. As a leader in the phase of its development, the government has prepared a procurement standard for the purchase of Open Systems Inc. products and services. The paper describes the procurement document.

000,724

PB90-254558

Not available NTIS

National Bureau of Standards (ICST), Gaithersburg, MD. Information Systems Engineering Div.

Fourth Generation Software Tools for Prototyping.

Final rept.

E. N. Fong, and D. K. Jefferson. 1984, 11p

Pub. in Proceedings of International Computer Symposium, Taipei, Taiwan, December 12-14, 1984, 10p.

Keywords: *Computer programming, *Programming languages, Prototypes, Experimentation, Reprints, *Software engineering, User requirements, Software tools.

A new generation of computer languages has been developed to reduce the barriers between end-users and computers. The phenomenon is described in the report as 'fourth generation software tools for prototyping.' The report consists of two main parts: the first part introduces the concept of prototyping with a fourth generation language, and the second part describes an experiment using two such software tools.

000,725

PB90-265273

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Translating Express to SQL: A User's Guide. National PDES Testbed Report Series.

K. C. Morris. 8 May 90, 23p NISTIR-4341

Keywords: Parsers, Translators, Data dictionaries, Test beds, *Fedex sql computer program, *Express programming language, Software tools, Relational data base, SQL programming language, User manuals(Computer programs).

The document describes the procedure used by the fedex sql software to translate an Express schema into the SQL statements which generate a relational database schema for storing STEP data.

000,726

PB90-269580

PC A03/MF A01

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Information Systems Engineering Div.

PHIGS Validation Tests (Version 1.0): Design Issues.

Special pub. (Final).

J. Cugini, M. T. Gunn, and L. S. Rosenthal. Jul 90,

21p NIST/SP-500/181

Also available from Supt. of Docs. See also PB90-265216.

Keywords: *Standards, *Computer graphics, Testing, Validation, Programmers Hierarchical Interactive Graphics System, PHIGS system, Computer software.

Conformance testing for the Programmer's Hierarchical Interactive Graphics System (PHIGS) standard presents certain novel difficulties, especially the indirect effect of many functions, and the inaccessibility to the program of visual effects. The model of logic inference offers a way to organize a system of the complexity needed to overcome these problems. This complexity makes the use of certain database concepts quite valuable in allowing users to comprehend the system. Special emphasis is placed on allowing the user to associate each test case with some specific requirement in the standard. Test output consists of a set of formatted messages that enable the user to assess test results rapidly and accurately.

000,727

PB90-271024

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.

CHAOS: A SUN-Based Program for Analyzing Chaotic Systems.

Final rept.

J. W. Aronson. 1990, 10p

Pub. in Computers in Physics, p408-417 Jul/Aug 90.

Keywords: *Computer graphics, Power spectra, Reprints, CHAOS computer program, C programming language, Mathematical manifolds, Bifurcation(Mathematics), Fractal dimensions, Poincare maps, Nonlinear analysis.

CHAOS is a C-based program on SUN workstations, designed for studying nonlinear dynamics. It furnishes easy access to graphical and numerical procedures through the SUN windowing system. Among the graphical tools of CHAOS are the drawing of basins, basin boundaries, bifurcation diagrams, unstable manifolds, and point sets. The program can plot in 2D and 3D as well as on the surface of a cylinder, sphere, or torus. On the numerical side, CHAOS can compute fractal and correlation dimensions, Lyapunov exponents, Poincare maps, power spectra, and periodic orbits. The program allows for the quick and easy addition of new systems of equations.

000,728

PB90-500919

CP T99

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

NIST-PCTS: National Institute of Standards and Technology-POSIX Conformance Test Suite.

Software.

J. A. Hall. 1989, mag tape NIST/SW/MT-90/011

Supersedes PB88-176185.

Source tape is in the ASCII character set. This restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. For price at 6250 bpi density, call NTIS Computer Products.

Keywords: *Software, *Conformity, *Tests, Validity, Operating systems(Computers), Magnetic tapes, *POSIX, *Federal information processing standards, L=C, H=DEC VAX 11/750.

The NIST-PCTS is a POSIX Conformance Test Suite (PCTS) written by the National Institute of Standards and Technology (NIST) based on AT&T'S SVVS3.0. The NIST-PCTS tests system implementations for conformance to FIPS 151-1 (POSIX). FIPS 151-1 is based on the IEEE STD 1003.1-1988 and adheres to the testing guidelines of IEEE 1003.3 Draft 10.0...Software Description: The system is written in the C programming language for implementation on a POSIX implementation ie a DEC VAX 11/750 computer using the 4.2 BSD operating system.

000,729

PB91-101188

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.

Computing Factors for Exact Two-Sided Tolerance Limits for a Normal Distribution.

Final rept.

K. R. Eberhardt, R. W. Mee, and C. P. Reeve. 1989,

17p

Grant NSF-DMS85-03735

Sponsored by National Science Foundation, Washington, DC.

Pub. in Commun. Statist.-Simula. 18, n1 p397-413 1989.

Keywords: Confidence limits, Degrees of freedom, Sampling, Error analysis, Computer programs, Reprints, *Computer calculations, *Tolerance limits.

A self-contained FORTRAN subroutine is provided which computes factors for Wald-Wolfowitz type tolerance limits allowing arbitrary combinations of sample size n and degrees of freedom nu . The exact calculations from our program reveal inadequacies of two existing approximations, especially when $nu \gg n$. Numerous applications where nu does not = $n - 1$ are cited; two of these are discussed and illustrated.

000,730

PB91-101345

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.

Use of Rootfinding ODE (Ordinary Differential Equations) Software for the Solution of a Common Problem in Nonlinear Dynamical Systems.

Final rept.

D. K. Kahner, W. F. Lawkins, and S. Thompson.

1989, 13p

Pub. in Jnl. of Computational and Applied Mathematics 28, p219-230 1989.

Keywords: *Ordinary differential equations, Nonlinear systems, Reprints, *Computer applications, *Dynamical systems, Interactive systems, Computer software, Poincare problem.

The authors discuss how rootfinding, which is built into some ordinary differential equations (ODE) software, can be used to generate Poincare sections. An interactive program is also described.

000,731

PB91-112433

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.

Program Generator for Efficient Evaluation of Fourier Series.

Final rept.

B. R. Miller. 1989, 8p

Pub. in Proceedings of ACM-SIGSAM International Symposium on Symbolic and Algebraic Computation, Portland, OR., July 17-19, 1989, p199-206.

Keywords: *Fourier series, Computer programming, Algorithms, Fortran, Reprints, *Automatic programming, Numerical solution.

Many fields require the evaluation of large multi-variate Fourier series, but the naive method of calling sine and cosine for each term can be prohibitive where computing resources are constrained or the series are extremely large (30,000 terms). Although the number of such calls can be reduced by using trigonometric identities, such a reduction is usually not possible by hand. Indeed, even when it is carried out by computer, care must be taken to generate compact programs and avoid generating large numbers of intermediate terms. The author describes an algorithm for automatically generating very efficient Fortran programs directly from the mathematical descriptions of the series to be evaluated. The resulting Fortran programs are 5-7 times faster than the naive version and sometimes significantly more compact.

000,732
PB91-112789 PC A05/MF A01
National Inst. of Standards and Technology (NCSL),
Gaithersburg, MD.
Message Handling Systems Interoperability Tests.
G. Lotridge. Oct 90, 86p NISTIR-4452

Keywords: *Computer networks, *Message processing, Open systems interconnections, Interoperability tests, Protocols.

The document contains the X.400 Interoperability test suite that was originally developed by the OSINET Technical Committee. OSINET is a regional Open Systems Interconnection (OSI) network that was established to promote OSI through activities related to interoperation testing. This interoperability test suite has been coordinated internationally through OSINET's participation in OSI sup one, an association of regional OSI networks. The tests are organized into seven sections. Each test in a section has a name, test purpose, test procedure and expected results.

000,733
PB91-118141 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Scientific Computing Div.
Residual Hermite Normal Form Computations.
Final rept.
P. D. Domich. 1989, 12p
Sponsored by Universite Catholique de Louvain, Louvain-la-Neuve (Belgium).
Pub. in ACM Transactions on Mathematical Software
15, n3 p275-286 Sep 89.

Keywords: *Algorithms, Computation, Congruences, Chinese remainder theorem, Reprints, *Foreign technology, *Hermitian polynomial, *Computer calculations, Hermite normal form.

The paper extends the class of Hermite normal form solution procedures that use modulo determinant arithmetic. Given any relatively prime factorization of the determinant value, integral congruence relations are used to compute the Hermite normal form. A polynomial-time complexity bound that is a function of the length of the input string exists for this class of procedures. Computational results for this new approach are given.

000,734
PB91-118265 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Scientific Computing Div.
Optimizing Precompiler for Finite-Difference Computations on a Vector Computer.
Final rept.
J. Gary, and L. Fosdick. 1989, 14p
Pub. in Parallel Computing 10, n1 p51-64 Mar 89.

Keywords: Optimization, Finite difference theory, Reprints, *Precompilers, *Vector processing, Fortran 8X programming language, CYBER 205 computers.

The paper is concerned with techniques for translating array expressions, as found in FORTRAN 8X, into very efficient vector expressions on a machine in which long vectors are needed for high performance. It describes the application of these techniques in a precompiler for the CYBER 205 which requires a vector length of 1000 to achieve 90% of the asymptotic speed. The precompiler does not vectorize FORTRAN 77 DO loops, instead it vectorizes and optimizes programs written in the explicit array syntax of the proposed FORTRAN standard (FORTRAN 8X). The opti-

mization of the vector code is intended to be most effective for algorithms commonly used in finite-difference approximations of partial differential equations. Finite-difference schemes frequently evaluate the same expression over the interior of a multidimensional rectangular array. In these computations the precompiler is able to vectorize arithmetic operations over the entire array, rather than over individual dimensions, thus generating relatively long vectors. This vectorization is done, whenever possible, without using expensive gather operations. When gather operations must be used the precompiler attempts to minimize them by making one gather serve for several operands through the use of masks and offsets.

000,735
PB91-120188 PC A04/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Computing and Applied Mathematics.
SNMPLIB: A Simple Network Management Protocol Function Library for IBM PC Compatible Computers.
R. Crosson. Nov 90, 72p NISTIR-4467

Keywords: *Computer networks, *Data base management systems, *Input output routines, Protocols, Compatibility, *Simple Network Management Protocol library, Software tools, Microsoft C programming language, IBM PC, Personal computers, Ethernet interfaces, Network interconnections, Cost engineering.

Many Simple Network Management Protocol applications exist, but few general purpose packages run on a personal computer. SNMPLIB is a library of function calls written in Microsoft C version 5.0 for IBM PCs and compatibles. Its data structures and functions are described. With SNMPLIB a user can write a program to dynamically monitor operational variables of compatible networked devices and take action when those variables cross threshold values. The network input/output routines work with any Ethernet interface for a PC or a compatible for which a packet driver has been installed, making the application somewhat independent of the Ethernet interface used in the computer. A sample application program, SNMPPMON, is supplied which monitors user specified variables in user specified devices and writes their values to the PC's display. The SNMPLIB and SNMPPMON have been compiled on a Sun Microsystems workstation and successfully used there with a similar, but Sun Ethernet interface specific, set of input/output functions.

Control Systems & Control Theory

000,736
PB90-209586 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Factory Automation Systems Div.
Voila: A System for Looking at Processes.
S. Ressler, and S. N. Clark. Oct 89, 16p NISTIR-89/
4196

Keywords: *Computer graphics, *Control systems, Visualization, Man computer interface, Smalltalk-80 programming language, Finite state machines.

The ability to visualize data is becoming an increasingly important research field in its own right. The paper presents one approach to the problems of visualization in the context of illustrating and observing a control system. Specifically, the application domain is a real-time control system developed at NBS primarily for the control of factory floor applications. The user interacts with the system via multiple levels of detail selection only those portions of the system the user wishes to view. The implementation environment for the system was primarily Smalltalk-80 which provided a high degree of extensibility and flexibility. Integration of existing control system development tools into a visualization environment was a key goal of the project.

000,737
PB90-225947 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Mfg. Engineering.
Cell as Part of a Manufacturing System.
A. Jones, and A. Saleh. May 90, 33p NISTIR-4308

Keywords: *Process control, *Automatic control, *Manufacturing, Fabrication, Equipment, Data proc-

essing, Production control, Planning, Feedback control, Research projects, *Computer aided manufacturing, Robotics, Cell control, US NBS.

A new approach to the design, implementation, and integration of cell controllers in a manufacturing system is described. (Workstations are managed by the cell controller). It combines techniques from control theory, operations research, and computer science. The cell controller can be (1) modified to fit both the physical definition of a cell and the capabilities of other controllers in the system, and (2) easily integrated into any shop floor control system which meets the interface requirements.

000,738
PB90-269473 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Intelligent Controls Group.
System Factors in Real-Time Hierarchical Control.
J. Michaloski, and T. Wheatley. Aug 90, 21p NISTIR-4386

Keywords: *Robots, Hierarchies, *Multiprocessors, *Real time, *Control systems, *Concurrent processing, Architecture(Computers).

Robot control needs multi-processor architectures to satisfy timing constraints. The paper outlines hierarchical control as a concurrent real-time design methodology that provides system partitioning across multiple processors. The paper then studies specific multi-processor architectural factors affecting the concurrent hierarchical model. As a part of the concurrent real-time control methodology, the paper will present design principles to manage problems such as real-time constraints, interprocessor communication and synchronization. The paper is organized as follows. The first section discusses task decomposition in conjunction with the theory of concurrent hierarchical control. The second section analyzes the effect of real-time requirements on concurrent hierarchical control. The third section discusses the effect of architectural factors on concurrent hierarchical control especially communication and synchronization. The final section analyzes the transition from design to implementation with a look at work at NIST and elsewhere.

Information Processing Standards

000,739
FIPS PUB 127-1 PC E18
National Inst. of Standards and Technology (NCSL),
Gaithersburg, MD.
Database Language SQL. Category: Software Standard. Subcategory: Database.
Final rept.
L. J. Gallagher. 2 Feb 90, 166p
Available from Supt. of Docs. Supersedes FIPS PUB 127.
Three ring vinyl binder also available; North American Continent price \$7.00; all others write for quote.

Keywords: Data processing, *Federal information processing standards, *Structured Query Language, *SQL database language, Computer software.

The publication announces adoption of American National Standard Database Language SQL with Integrity Enhancement, ANSI X3.135-1989, and American National Standard Database Language Embedded SQL, ANSI X3.168-1989, as the Federal Information Processing Standard for Database Language SQL (FIPS SQL). The Publication is a revision of FIPS PUB 127 that offers new conformance alternatives, new programming language interfaces, a new integrity enhancement option, clarification and correction of existing specifications, and additional considerations for use in procurements. The revision supersedes FIPS PUB 127. The purpose of FIPS SQL is to promote portability of database application programs and programmers among different installations. The standard is used by implementors as the reference authority in developing a FIPS conforming relational model database management system and by application programmers to help write SQL conforming applications.

000,740
FIPS PUB 151-1 PC E12

COMPUTERS, CONTROL & INFORMATION THEORY

Information Processing Standards

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

POSIX: Portable Operating System Interface for Computer Environments. Category: Software Standard; Subcategory: Operating Systems.

Final rept.

R. J. Martin. 28 Mar 90, 324p ISBN-1-55937-003-3
Also available from Supt. of Docs. Supersedes FIPS PUB 151. Library of Congress catalog card no. 88-082605. Prepared in cooperation with Institute of Electrical and Electronics Engineers, Inc., New York. Three ring vinyl binder also available; North American Continent price \$7.00; all others write for quote.

Keywords: *Standards, *Operating systems(Computers), Interfaces, Computer systems programs, *Federal information processing standards, C programming language, Computer program portability, Application programs (Computers), FIPS PUB 151-1.

The publication announces the adoption of IEEE Std 1003.1-1988 of the Institute of Electrical and Electronics Engineers (IEEE) Standard for Portable Operating System Interface for Computer Environments as a Federal Information Processing Standard (FIPS). IEEE Std 1003.1-1988 defines a C language source interface to an operating system environment. The standard is for use by computing professionals involved in system and application software development and implementation. The standard is the first component of a series of specifications needed for application portability. The Appendix to the standard discusses the elements needed in an Applications Portability Profile. The revision supersedes FIPS PUB 151 in its entirety.

000,741

FIPS PUB 157 PC E18
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Guideline for Quality Control of Image Scanners; Category: Hardware Standard; Subcategory: Calibration, Validation, and Testing. Recommended Practice for Quality Control of Image Scanners: Standard.

Final rept.

L. A. Welsch, J. Baronas, and T. Bagg. c13 Sep 89, 32p
Also available from Supt. of Docs. Prepared in cooperation with Association for Information and Image Management, Silver Spring, MD. Three ring vinyl binder also available; North American Continent price \$7.00; all others write for quote.

Keywords: *Quality control, *Image scanners, Guidelines, Standards, Calibration, Validation, Testing, American National Standard for Information and Image Management, Federal Information Processing Standards Publication 157, Digital image scanners, Monochrome image scanners, *Document processing.

The Guideline announces the adoption of the American National Standard for Information and Image Management-Recommended Practice for Quality Control of Image Scanners, ANSI/AIIM MS44-1988, as a Federal Information Processing Standards Publication Guideline. MS44 provides procedures and physical test objects that can be used by document processing system analysts, designers, and operators for calibrating monochrome, digital image scanners. In addition, MS44 procedures and test objects are designed to be used to maintain an acceptable image quality level through periodic testing of scanners and other system components, i.e., displays, typesetters, laser printers, accompanying software systems, etc. MS44 procedures and test objects can also be used to set scanner parameters to match specific characteristics of documents being scanned so that the system produces optimum image quality. The test objects that are included with this Guideline are recommended for use when implementing the Guideline. Using reproductions of these test objects will not provide meaningful results. The Guideline includes MS44 Appendices A through F which cover producing custom test objects, scanning low contrast materials, preparing continuous tone images for scanning, issues of using line/space resolution test targets on digital systems, and thresholding/enhancement scanning characteristics.

000,742

FIPS PUB 158 PC E14
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

User Interface Component of the Applications Portability Profile. Category: Software Standard. Subcategory: Application Program Interface.

Federal information processing standards.

D. R. Kuhn. 29 May 90, 630p

Also available from Supt. of Docs.

Three ring vinyl binder also available, North America Continent price \$7.00; all others write for quote.

Keywords: *Standards, *Windowing, Interfaces, Computer graphics, *Federal information processing standards, *Man computer interface, *Application programs(Computers), *Software engineering, Portable Operating System Interface(POSIX), Computer program portability, Application program interface, Open systems interconnections.

The publication announces the adoption of the X Protocol, Xlib Interface, Xt Intrinsic and Bitmap Distribution Format specifications of the X Window System, Version 11, Release 3 (X Window System is a trademark of the Massachusetts Institute of Technology (MIT)) as a Federal Information Processing Standard. This standard is for use by computing professionals involved in system and application software development and implementation. This standard is a part of a series of specifications needed for application portability. The Appendix to the standard contains a reference model for network-based bit-mapped graphic user interface standards. The standard covers the Data Stream Encoding, Data Stream Interface, and Subroutine Foundation layers of the reference model. It is the intention of NIST to provide standards for other layers of the reference model as consensus develops within industry. The standard addresses the user interface functional area of the Applications Portability Profile that was announced in FIPS 151, POSIX: Portable Operating System Interface for Computer Environments.

000,743

FIPS PUB 21-3 PC E19
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

COBOL. Category: Software Standard. Subcategory: Programming Language.

Final rept.

K. A. Miles. 12 Jan 90, 910p

Also available from Supt. of Docs. Supersedes FIPS PUB 21-2.

Three ring vinyl FIPS binder also available, \$7.00 N.A.C. Others write for quote.

Keywords: Data processing, *Federal information processing standards, *Cobol programming language, Information processing, Computer software.

The standard announces the adoption of American National Standard Programming Language, COBOL, ANSI X3.23-1985 and X3.23A-1989, as amplified herein, as a Federal Information Processing Standard (FIPS). The revision supersedes FIPS PUB 21-2 and reflects the addition of an Intrinsic Function facility to the COBOL specifications. The American National Standards define the elements of the COBOL programming language and the rules for their use. The purpose of the standards is to promote portability of COBOL programs for use on a variety of data processing systems. The standards are used by implementors as the reference authority in developing processors and by users who need to know the precise syntactic and semantic rules of the standard language.

000,744

FIPS PUB 6-4 PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Counties and Equivalent Entities of the United States, Its Possessions, and Associated Areas. Category: Federal General Data Standard, Representations and Codes.

Final rept.

H. Tom. 31 Aug 90, 37p

Also available from Supt. of Docs. Supersedes FIPS PUB 6-3.

Three ring vinyl binder also available; North American Continent price \$7.00; all others write for quote.

Keywords: *Data processing, *Standards, Coding, States(United States), Counties, Statistical data, Information systems, Geography, *Federal information processing standards.

The standard implements ANSI X3.31-1988, Information Systems -- Codes -- Structure for the Identification of the Counties and County Equivalents of the United States and Its Outlying and Associated Areas for Infor-

mation Interchange. The publication, which supersedes FIPS PUB 6-3, provides the names and three-digit codes that represent the counties and statistically equivalent entities of the 50 States, the District of Columbia, and the possessions and associated areas of the United States, for use in the interchange of formatted machine-sensible data.

000,745

PB90-197948 PC A16/MF A02
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Working Implementation Agreements for Open Systems Interconnection Protocols.

T. Boland. Feb 90, 355p NISTIR-90/4247

Proceedings of the NIST (National Institute of Standards and Technology) workshop for Implementors of OSI Plenary Assembly, Gaithersburg, MD., December 15, 1989.

Keywords: *Workshops, *Standards, Implementation, Protocols, Specifications, Agreements, *Open systems interconnections, GOSIP(Government OSI Profile).

The document records current agreements on implementation details of Open Systems Interconnection Protocols among the organizations participating in the NIST/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. The document is a standing document that is updated after each workshop (about 4 times a year).

000,746

PB90-206855 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO, Time and Frequency Div.

Station-to-Station.

Final rept.

D. B. Sullivan. 1989, 3p

Pub. in Broadcast Engineering, p112, 114, and 116 Nov 89.

Keywords: *Synchronism, *Modems, *Computers, Time measurement, Reprints, Computer applications.

The paper describes the new National Institute of Standards and Technology (NIST) Automated Computer Time Service (ACTS) which is designed to provide computers with telephone access to NIST time at accuracies approaching one millisecond.

000,747

PB90-207358 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Proposed Integration Framework for Step Standard for the Exchange of Product Model Data).

W. F. Danner. Apr 90, 29p NISTIR-90-4295

Keywords: *Product development, *Standards, Specifications, Standardization, Mathematical models, Product data exchange specification, Standard for the exchange of product model data, Protocols.

The paper presents a proposed integration framework for product data modeling. The framework provides for the representation of functional, programmatic, and physical product data across all phases of a product's life cycle. It provides a single coherent approach to product data modeling for the specification of application views. Most importantly, it creates an open system that encourages the innovative use of information. The framework has as its major feature an integrated product information model with four conceptual levels. A generic product data model is the key element of the framework. It is composed of application-independent facts common to all products. The generic product data model meets the requirements of multiple application areas by providing for the interpretation of generic facts in specific contexts. It also provides a logical structure for the integrated product information model which is used by application models to fulfill user requirements.

000,748

PB90-207788 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST (National Institute of Standards and Technology) STEP (Standard for the Exchange of Product Model Data) Documents Configuration Management System User's Guide.

S. Katz, G. Rinaudot, and S. Ressler. Apr 90, 21p
NISTIR-90/4303

Keywords: *Documents, *Records management, Information retrieval, *Standard for the exchange of product model data, *Configuration management, Control systems, On line systems, Product data exchange specification.

The brief User's Guide is intended to help ISO members access NIST's on-line version of the STEP documents. The STEP documents are now under a preliminary configuration control system on the TANDEM computer at NIST. The User's Guide explains how to access the TANDEM from a PC and how to use the Configuration Management System's commands to read, edit and re-enter the portions of the STEP documents under control.

000,749

PB90-218066

Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Systems and Network Architecture Div.

Measurements of a Transport Implementation Running Over an IEEE 802.3 Local Area Network. Final rept.

S. Heatley, and D. Stokesberry. 1988, 10p
Pub. in Proceedings of Computer Networking Symposium, Washington, DC., April 11-13, 1988, p34-43.

Keywords: Performance evaluation, Standardization, Measurement, Implementation, Reprints, *Local area networks(LAN), *Open system interconnection(OSI) standards, *Transport(Computers), Throughput, Protocols, Computer software, Computer networks.

In the recent past, there has been a great deal of effort to develop Open System Interconnection (OSI) standards, to implement the standards, to test conformance of implementations to the standards, and to demonstrate interoperability between products. Now, as users procure systems that implement the OSI protocols, there is increasing interest in their performance. The paper assesses the performance of a typical commercially available implementation of the lower four OSI layers (transport, network, data link and physical). One-way delay and throughput measurements are reported for the Intel 310 microcomputer system running the iNA960 implementation of OSI Transport over an IEEE 802.3 CSMA/CD local area network. The minimum one-way delay versus message size for various combinations of the lower four OSI layers is shown. The results show the tradeoff between delay and the services offered by the protocols. The maximum throughput for the Transport Class 4 service is reported and the main factors affecting maximum throughput are discussed. The discussion is not specific to this implementation; it is also applicable to other implementations.

000,750

PB90-241654

Not available NTIS
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

More Effective Federal Computer Systems: The Role of NIST (National Institute of Standards and Technology) and Standards.

Final rept.
S. M. Radack. 1990, 13p
Pub. in Government Information Quarterly 7, n1 p37-49 1990.

Keywords: *Standards, *Guidelines, *National government, Telecommunication, Compatibility, Information centers, Computer systems hardware, Reprints, *Computer communications, *National Institute of Standards and Technology, Computer software, Computer security, Interfaces(Computers), Federal information processing standards.

Since the mid-1960s, standards have been important tools for improving the Federal government's use of computer and related telecommunications systems. The National Institute of Standards and Technology (NIST) has been charged with developing standards, guidelines, and technical methods that are needed by Federal government organizations. The merging of computer and telecommunications technologies and the increasing complexity of systems will make standards for the interconnectivity of systems, portability of computer software, and the protection of computer information important NIST initiatives for the future.

000,751

PB90-250085

PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

QDES User's Guide. National PDES Testbed Report Series.

S. N. Clark. Jul 90, 41p NISTIR-4361

Keywords: *Standards, *Editing, *Manufacturing, Product management, Specifications, Testbeds, Windowing techniques, *PDES(Product Data Exchange Specification), *Computer aided manufacturing, User manuals(Computer programs), *STEP, Smalltalk, Product models, Geometric modeling, QDES(Quick and Dirty Editor for STEP).

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. The neutral exchange medium for PDES product models is the STEP physical file format. The National PDES Testbed at NIST has developed QDES, a window-based editor for STEP product models. The editor, written in Smalltalk-80, is schema-driven; in the Testbed context, an Express information model is used to describe the objects to be manipulated; QDES itself thus has no a priori knowledge of its domain. The document describes the operation of the editor. A tutorial is included.

000,752

PB90-250119

PC A07/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Naming Forum: Proceedings of the IRDS Workshop on Data Entity Naming Conventions.

J. J. Newton. Jul 90, 138p NISTIR-4374

Keywords: *Meetings, Guidelines, Standardization, *Federal information processing standards, *Data management, Naming conventions, National Institute of Standards and Technology.

As part of the Federal Information Processing Standard (FIPS) Information Resource Dictionary System (IRDS) project, NIST has sponsored a series of workshops intended to produce guidance to the developers and users of the IRDS standard. The publication summarizes the major points discussed during speaker's presentations and general discussions at the IRDS Workshop - Naming Convention Forum held at NIST on 16-17 November, 1989. The purposes of the workshop were to bring together data administrators concerned with naming conventions for a networking and discussion session, and to provide guidance to the X3H4.4 Task Group in the development of requirements for a Naming Convention Verification Module for the X3H4 IRDS standard. After presentations by NIST X3H4 representatives, nine speakers described their implementations of naming conventions. In addition, a demonstration of the WIS/DIM system's automated assistance for naming was presented.

000,753

PB90-256868

PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST SQL Database Loader: STEP Working Form to SQL. National PDES Testbed Report Series.

D. A. Nickerson. Jul 90, 12p NISTIR-4337
See also PB89-215198 and FIPS PUB 127-1.

Keywords: *Standards, Manufacturing, Test beds, *STEP standard, *Product data exchange, SQL database language, Software tools, Computer aided design.

The Standard for the Exchange of Product Model Data (STEP) is an emerging standard for the exchange of product information among various manufacturing applications. A SQL database containing product data definitions has been provided as a facility for testing STEP. The National PDES Testbed at NIST has developed software to load a SQL database with instances of a product data definition.

000,754

PB90-257585

PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Framework for Developing a CALS Data Dictionary.

D. K. Jefferson. Jul 90, 25p NISTIR-4377

Keywords: Guidelines, *CALS, *Computer Aided Acquisition and Logistic Support, *Data dictionaries Computer architecture, Computer systems design.

The paper provides guidance for the development of data dictionaries for the Computer-aided Acquisition and Logistic Support (CALS) Program. The objective is to present the costs and benefits of alternative architectures; five levels of service are analyzed. A brief tutorial on data dictionaries is included. Six steps are recommended for data dictionary development.

000,755

PB90-257627

PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Stable Implementation Agreements for Open Systems Interconnection Protocols: Version 3, Edition 1, December 1989 Change Page Index.

Special pub. (Final).
Mar 90, 163p NIST/SP-500/177-SUPPL-1
Also available from Supt. of Docs. as SN903-015-00000-4. See also PB90-212192.

Keywords: Computer networks, Protocols, Workshops, *Open systems interconnections, Local area networks, Pocket switching, Testing protocols, Stable agreements.

These are the change pages to the document that records current Stable Agreements for Open Systems Interconnection Protocols among the organizations participating in the NIST/OSI Workshop Series for Implementors of OSI.

000,756

PB90-257759

PC A15/MF A02
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Graphics Standards in the Computer-Aided Acquisition and Logistic Support (CALS) Program, Fiscal Year 1989. Volume 1. Test Requirements Document, Extended CGM (CGEM).

Rept. for Oct 88-Sep 89.
D. R. Benigni. May 90, 340p NISTIR-4329
See also PB90-228016. Sponsored by Office of the Secretary of Defense, Washington, DC.

Keywords: *Computer graphics, *Standards, Tests, Military procurement, Conformity, Logistics, Computer programming, *CALS(Computer Aided Acquisition and Logistic Support), CGEM(Extended Computer Graphics Metafile), Department of Defense.

The computer-aided Acquisition and Logistic Support (CALS) Program is a Department of Defense (DoD) Industry strategy to transition from paper-intensive acquisition and logistic processes to a highly automated and integrated mode of operation for the weapon systems of the 1990s. The volumes document the accomplishments of the Graphics Software Group of the National Institute of Standards and Technology (NIST) in support of computer graphics standards for CALS in FY89. They provide a progress report on continuing graphics standards efforts related to the Computer Graphics Metafile (CGM) standard. The reports are divided into two volumes: 1, Test Requirements Document and Extended CGM (CGEM); and 2, MIL-D-28003 Revisions and CGM Registration. Volume 1. Completion of the first milestone toward the establishment of a comprehensive CGM (and MIL-D-28003) Test Method and ultimately a Testing Service, namely the creation of a Test Requirements Document, is detailed. The Test Requirements Document will provide the basis for developing conformance tests to determine compliance both with CGM and MIL-D-28003. Progress to inject CALS requirements into the Extended CGM (CGEM) is also detailed.

000,757

PB90-259763

PC A19/MF A03
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Working Implementation Agreements for Open Systems Interconnection Protocols (1990).

Final rept.
T. Boland. Sep 90, 432p NISTIR-4382
See also PB90-197948. Proceedings of NIST Workshop for Implementors of OSI Plenary Assembly, Gaithersburg, MD., June 22, 1990.

Information Processing Standards

Keywords: *Standards, Computer networks, Agreements, Protocols, *Open systems interconnections, Local area networks, Network protocols.

The document records Working Agreements on Implementation details of Open Systems Interconnection Protocols among the organizations participating in the NIST/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. This is a standing document that is updated after each workshop (about 4 times a year).

000,758
PB90-264094 PC A03/MF A01
 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Design Issues for Conformance Testing of the PHIGS Standard.
 J. Cugini, and L. S. Rosenthal. Aug 90, 16p NISTIR-4384

Keywords: *Standards, *Computer graphics, Tests, *Programmers Hierarchical Interactive Graphics System, *PHIGS standard.

Conformance testing for the Programmer's Hierarchical Interactive Graphics System (PHIGS) standard presents certain novel difficulties, especially the indirect effect of many functions, and the inaccessibility to the program of visual effects. The model of logical inference offers a way to organize a system of the complexity needed to overcome these problems. This complexity makes the use of certain database concepts quite valuable in allowing users to comprehend the system. The problem of inaccessible effects can be addressed only by careful design of the user interface, so as to minimize the operational difficulty and subjectivity inherent in testing such features.

000,759
PB90-265216 PC A06/MF A01
 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
User's Guide for the PHIGS Validation Tests (Version 1.0).
 Final rept.
 J. Cugini, M. T. Gunn, and L. S. Rosenthal. Aug 90, 104p NISTIR-4349

Keywords: *Standards, *Computer graphics, Validation, Tests, *Programmers Hierarchical Interactive Graphics System, *PHIGS system, Interactive graphics, User manuals(Computer programs).

The PHIGS Validation Tests (PVT), developed by NIST, consist of a large set of Fortran programs which may be used to test how well implementations of PHIGS conform to the standard. The tests are organized into a hierarchical structure of modules which corresponds to the conceptual overview of the standard. The tests are associated with the standard via a set of semantic requirements which are derived directly from the standard. Cross-reference tables allow the user to find tests relating to specific PHIGS functions and data structures. Directions for installation and operation of the tests are included.

000,760
PB90-269507 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Fed-X: The NIST Express Translator.
 S. N. Clark. Aug 90, 18p NISTIR-4371REV

Keywords: *Translator, Parsing, Manufacturing, Standards, Test beds, *Product data exchange specification, PDES, EXPRESS computer language, Software tools.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. PDES includes an information model written in the Express language; other PDES-related information models are also written in Express. The National PDES Testbed at NIST has developed software to manipulate and translate Express models. The software consists of an in-memory working form and an associated Express language parser, FED-X. The design and capabilities of FED-X and the Express Working Form are discussed.

000,761
PB90-269531 PC A04/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.
NIST Express Working Form Programmer's Reference. National PDES Testbed Report Series.
 S. N. Clark. 5 Sep 90, 56p NISTIR-4407

Keywords: Standards, Programming manuals, Translators, Parsers, Manufacturing, Test beds, *Product Data Exchange Specifications, EXPRESS computer language, PDES system, Computer aided design, Software tools.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. PDES includes an information model written in the Express language; other PDES-related information models are also written in Express. The National PDES Testbed at NIST has developed software to manipulate and translate Express models. This software consists of an in-memory working form and an associated Express language parser, Fed-X. The internal operation of the Fed-X parser is described. The implementation of the data abstractions which make up the Express Working Form is discussed, and specifications are given for the Working Form access functions. The creation of Express language translators using Fed-X is discussed.

000,762
PB91-107177 PC A05/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
National PDES Testbed Strategic Plan 1990. National PDES Testbed Report Series.
 C. R. McLean. Oct 90, 83p NISTIR-4438
 Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Standards, *Strategy, *Test beds, Products, Specifications, Manufacturing, Programs, *National Institute of Standards and Technology, *Standard for the Exchange of Product Model data, *Product data exchange, *Product data exchange specifications, Computer aided acquisition and logistics support, Product data sharing, Computer aided manufacturing.

The document presents a long range strategic plan for the National PDES Testbed project at the National Institute of Standards and Technology (NIST). The Testbed was initiated in 1988 under the sponsorship of the U.S. Department of Defense Computer-aided Acquisition and Logistic Support (CALS) program. A major goal of the Testbed is to provide technical leadership in a national effort to implement a complete and useful specification for the exchange of Product Model Data (STEP). The STEP efforts is led by the International Organization for Standardization (ISO) TC184/SC4. The plan also outlines a number of supporting project threads that have been established for the Testbed: initiation of the Testbed, development of configuration management systems and services, development of testing systems to validate the proposed standard, specification and testing of application protocols, construction of a prototype STEP-based manufacturing cell, establishment of a product data exchange network, development of conformance testing systems, and management/technical support activities.

000,763
PB91-107227 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Development Plan: Product Data Exchange Network. National PDES Testbed Report Series.
 S. Frechette, and K. Jurens. Sep 90, 29p NISTIR-4431
 Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Standards, *Manufacturing, Project planning, Validation, Test beds, Test facilities, Networks, Development, Planning, *Standard for the Exchange of Product model data, *Product data exchange, *STEP, Computer aided acquisition and logistic support, Computer aided manufacturing, National Institute of Standards and Technology.

The National PDES Testbed (NPT) project of the National Institute of Standards and Technology in Gaithersburg, MD was established to support development and validation of the emerging Standard for the Exchange of Product Model Data (STEP). National PDES

Testbed staff have begun the development, of a Product Data Exchange Network (PDEN) which will help accelerate the development, testing, and validation of STEP and help ensure that STEP will function as intended in actual manufacturing environments. The document outlines a plan for the development of such a Product Data Exchange Network. The Product Data Exchange Network will consist of manufacturing facilities and research centers from industry, academia, and government linked electronically via modems or computer networks. The intent of this network is to accelerate the development, validation, and implementation of the STEP standard by distributing development, testing, and validation activities throughout a broad spectrum of manufacturing enterprises. The National PDES Testbed at NIST will serve as headquarters for the Product Data Exchange Network.

000,764
PB91-107235 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Mfg. Engineering.
NIST Step Class Library (Step into the Future).
 M. J. McLay, and K. C. Morris. Sep 90, 24p NISTIR-4411

Keywords: *Standards, *Input output routines, *Software libraries, Implementation, Manufacturing, Validation, Test beds, Prototypes, *Product data exchange, *Standard for the Exchange of Product Model Data, EXPRESS programming language, Software tools, Computer aided design, Computer aided manufacturing.

The paper describes a C++ class library that implements the Standard for the Exchange of Product Model Data (STEP). The STEP class Library (SCL) is under development at the National Institute of Standards and Technology as part of the National PDES Testbed and provide the core set of STEP functions for tools that are used to validate the STEP information models and for STEP based application prototypes. The library also lowers the economic barrier to developing STEP based applications. The current version of the library provides a STEP compliant file exchange mechanism, consequently, users of the class library will not have to create an input/output mechanism for STEP. The paper provides an introduction to STEP and the specification language, Express, in which it is written. The supporting classes that provide the STEP compliant input/output mechanism and the mapping between the Express specification and the C++ classes are described. The paper concludes with descriptions of some applications that use the class library and a discussion of future directions for the class library.

000,765
PB91-107243 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Development Plan: Step Production Cell. National PDES Testbed Report Series.
 J. E. Fowler. Sep 90, 33p NISTIR-4421
 Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: *Standards, *Machining, *Manufacturing, *Controllers, Components, Validation, Test beds, Development, Project planning, *Standard for the Exchange of Product model data, *Product data exchange, *Computer integrated manufacturing, Production cells.

The Standard for The Exchange of Product model data (STEP) is an emerging international standard addressing the problems of data exchange for a variety of manufacturing enterprises. NIST has established the National PDES Testbed specifically to address the development and testing of STEP, and to serve U.S. industry in their use of the standard. The STEP Production Cell is a machining system based on STEP data exchange. The system uses STEP data as the primary source for controlling part manufacturing. The STEP Production Cell demonstrates how STEP is used in a typical, small batch manufacturing system. The system serves to validate STEP technology in a manufacturing scenario. The plan for developing the STEP Production Cell over the next four years is described in the document.

000,766
PB91-107581 PC A03/MF A01

Information Processing Standards

National Inst. of Standards and Technology, Gaithersburg, MD.

Development Plan Validation Testing System. National PDES Testbed Report Series.

M. J. Mitchell. Sep 90, 39p NISTIR-4417
Sponsored by Assistant Secretary of Defense (Production and Logistics), Washington, DC. Computer-aided Acquisition and Logistic Support Program.

Keywords: Standards, *Validation, Test beds, *Standard for the Exchange of Product model data, *Validation Testing System, *Software tools, Application protocol, STEP, PDES, Product Data Exchange, Computer aided acquisition and logistics support.

The paper describes the plan for the development of the Validation Testing System (VTS) which will provide techniques and systems to engineers for validating and ensuring the internal consistency of the STEP specification. Unlike most standards activities which start from baselines with proven feasibility, Product Data Exchange using STEP (PDES) is a development activity, containing a dynamic set of concepts which have not stabilized. Major portions of STEP are yet to be completed and in some cases haven't been started. Given this dynamic nature it becomes critical to create quality assurance mechanisms that can provide technical feedback to standards activities. The major goal of the Standards Testing Center of the National PDES Testbed is to ensure that the quality of the specification is high and that PDES will indeed work. The VTS will be an integrated computing environment for evaluating the quality of the specification.

000,767
PB91-112888 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Status of PDES-Related Activities (Standards and Testing). National PDES Testbed Report Series.
C. Furlani, J. Wellington, and S. Kemmerer. Oct 90, 22p NISTIR-4432

Keywords: *Standards, *Computer integrated manufacturing, Tests, Organizations, International programs, *STEP(Standard for the Exchange of Product Model Data), *PDES(Product Data Exchange Specification), IGES(Initial Graphics Exchange Specification), CALS(Computer Aided Acquisition and Logistics Support), SGML(Standard General Markup Language).

The report describes the current national and international standards and testing activities that relate to PDES (Product Data Exchange using STEP). PDES is the name given to the United States organizational activity that supports the development and implementation of the international standard, STEP (Standard for the Exchange of Product Model Data). The definition of PDES was made more explicit in March 1990 by altering the meaning of the acronym from its earlier one, 'Product Data Exchange Specification'.

000,768
PB91-119701 PC A03/MF A03
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
NIST-PCTS: National Institute of Standards and Technology-POSIX Conformance Test Suite. NIST-PCTS:151-1(Version 1.1). Installation Guide.
28 Sep 90, 39p NIST/SW/MT-90/011A
For system on magnetic tape, see PB90-500919.

Keywords: *Tests, *Operating systems(Computers), Installing, Manuals, *Federal Information Processing Standards, C programming language, National Institute of Standards and Technology.

The NIST-PCTS:151-1, is a POSIX conformance test suite (PCTS) written by the National Institute of Standards and Technology (NIST) based on AT&T's SVVS 3.0. It tests system implementations for conformance to FIPS 151-1 for POSIX.1(3/28/1990). The FIPS 151-1 for POSIX.1 is based on the IEEE Std 1003.1-1988 (Portable Operating Systems Interface for Computer Environments) and the additional requirements specified in Appendix A. The NIST-PCTS:151-1 adheres to the guidelines of the IEEE 1003.3 Draft 10.0 (Standard for Tests Methods for Measuring Conformance to POSIX) and may be configured to accept the prototypes from P1003.1a Draft 5.20 February 1990. The Installation Guide specifies the implementation resources needed and documents the procedures to be followed to install and execute this PCTS.

000,769
PB91-120113 PC A20/MF A03

National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Working Implementation Agreements for Open Systems Interconnection Protocols, March 1990.

T. Boland. Mar 90, 458p NISTIR-4302
See also PB90-259763. Proceedings of NIST Workshop for Implementors of OSI Plenary Assembly, Gaithersburg, MD., March 16, 1990.

Keywords: *Standards, Computer networks, Data processing security, *Protocols, *OSI(Open Systems Interconnection), Message processing, File management systems.

The document records Working Agreements on Implementation details of Open Systems Interconnection (OSI) Protocols among the organizations participating in the National Institute of Standards and Technology (NIST)/OSI Workshop Series for Implementors of OSI Protocols. These decisions are documented to facilitate organizations in their understanding of the status of agreements. The document is updated after each workshop (about 4 times a year).

000,770
PB91-134858 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg, MD. Systems and Software Technology Div.
Verifying and Validating for Maintainability.
Final rept.
D. R. Wallace, and T. Daughtrey. 1988, 6p
Pub. in Proceedings of Computer Standards Conference 1988 - Computer Standards Evolution: Impact and Imperatives, Washington, DC., March 21-23, 1988, p41-46.

Keywords: *Standards, Validity, Proving, Reprints, *Computer program verification, *Computer software maintenance, Computer software management.

An IEEE standard for software verification and validation plans may improve the maintainability of software. The standard specifies the format and content of software verification and validation plans for both new and existing software. It requires that planning for software verification and validation include the software verification and validation tasks to be performed during software maintenance, regardless of when the plan is written. The paper contains descriptions of the standard, of software maintenance from a software verification and validation perspective, and two examples of improved software maintainability from application of the standard.

Information Theory

000,771
PB91-112870 PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.
State Occupancy Information for Performance Comparisons.
G. E. Lyon. Oct 90, 17p NISTIR-4418
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.

Keywords: *State estimation, *Multiprocessing, Algorithms, Comparisons, Time sharing, *Distributed processing, *Memory devices, *Hypercubes, *Computer systems design, *Computer performance evaluation, *Concurrent processing, Parallel processing, Application programs(Computers).

A state occupancy view of performance removes time as an overwhelming concern. While transient behavior not incorporated explicitly into a state is lost, occupancies still capture general performance details. Emphasis is upon comprehensive results that are nonetheless simply compared. Summaries are defined by the resolution of the chosen state-space, rather than the amount of collected data. The hypercube and other distributed-memory systems bring both opportunities and challenges to a state-based approach. Certainly processor and communication activities are more easily identified and more independent with distributed-memory than with shared-memory. But isolated nodes also entail problems in capturing global observation states. However, many hypercube application codes are homogeneous across nodes, a fact that makes partial states quite useful. Three paradigms illustrate homogeneous applications with communication dependencies that are strong (global), moderate

(local), or weak (uninhibiting and random). The three performance summaries are compact and accurate.

Pattern Recognition & Image Processing

000,772
PB90-136995 PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Advanced Systems Div.
Decoding Bar Codes from Image Data.
M. D. Garris, and C. L. Wilson. Sep 89, 29p NISTIR-89/4177
Sponsored by Bureau of the Census, Suitland, MD.

Keywords: *Decoding, Algorithms, Scanning, Histograms, Average, Computer programs, *Bar codes, *Image processing.

Image storage technology using direct decoding of bar codes in scanned images can simplify paper handling and improve the transmission and storage of forms. Software was developed to provide portable 'C' programs which demonstrate the feasibility to directly decode bar codes from raster images. Three distinct decoding algorithms were developed and tested: A scan method was developed which decodes a single scan line without any prior image processing or enhancements. The method minimizes the processing time necessary to decode a bar code, but is susceptible to noise within the scan line; A global histogram averaging method was developed to ensure reliability. The method takes into account information from the entire image maximizing reliability at the expense of processing time; A hybrid method was designed which samples the original bar code into a collection of representative scan lines. The scan lines are then averaged together providing noise reduction while maintaining efficiency. These methods are fully portable and can be incorporated in a wide range of image applications.

000,773
PB90-152745 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Calibration of a Structured Light Vision System.
Final rept.
Y. Hung, P. Yeh, and P. Mansbach. 1983, 28p
Grant N00014-83-K-0236
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in CAR-TR-29, CS-TR-1137, 28p 1983.

Keywords: *Mathematical models, Range finding, Calibrating, Algorithms, Optimization, Reprints, *Computer vision, National Institute of Standards and Technology.

The structured light vision system and its mathematical model developed at the National Bureau of Standards are described. A nonlinear optimization route based on Marquardt's algorithm is implemented to find the best fit of the parameters identified in the vision system.

000,774
PB90-218215 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Framework for Representing and Reasoning about Three-Dimensional Objects for Vision.
Final rept.
E. L. Walker, M. Herman, and T. Kanade. 1987, 13p
Sponsored by Defense Advanced Research Projects Agency, Arlington, VA.
Pub. in Proceedings of Workshop on Spatial Reasoning and Multi-Sensor Fusion, St. Charles, IL., October 5-7, 1987, p21-33.

Keywords: Reasoning, Models, Geometry, Pattern recognition, Reprints, *Computer vision, *Three dimensional bodies, *Knowledge bases(Artificial intelligence), Object-oriented programming, Robotics.

The capabilities for representing and reasoning about three-dimensional objects are essential for knowledge-based, 3D photo-interpretation systems that combine domain knowledge with image processing, as demonstrated by such systems as 3D Mosaic and Acronym. Three-dimensional representation of objects is necessary for many additional applications such as robot navigation and 3D change detection. Geometric reasoning is especially important, since geometric re-

Pattern Recognition & Image Processing

relationships between object parts are a rich source of domain knowledge. A practical framework for geometric representation and reasoning must incorporate projections between a 2D image and a 3D scene, shape and surface properties of objects, and geometric and topological relationships between objects. In addition, it should allow easy modification and extension of the system's domain knowledge and be flexible enough to organize its reasoning efficiently to take advantage of the current available knowledge. The authors are developing such a framework, called the 3D FORM (Frame-based Object Recognition and Modelling) System. The system uses frames to represent objects such as buildings and walls, geometric features such as lines and planes, and geometric relationships such as parallel lines.

000,775

PB90-254665

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD, Robot Systems Div.

Merging 3-D Symbolic Descriptions Obtained from Multiple Views of a Scene.

Final rept.

M. Herman, 1987, 8p

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Intelligent Robots and Computer Vision, v726 p292-298 1987.

Keywords: Algorithms, Reprints, *Scene analysis, Image reconstruction, Computer vision, Geometric modeling, Polyhedrons, Three dimensional.

An algorithm is presented for merging three-dimensional symbolic descriptions of static polyhedral scenes obtained from multiple viewpoints. The 3-D descriptions are assumed to be partial because of occlusions. The merging algorithm treats the topology of the descriptions (i.e., connections between vertices, edges, and faces) separately from the geometry (i.e., physical dimensions and relative locations). The paper describes one part of a larger project whose goal is to obtain an integrated symbolic description of a scene from range data obtained from multiple viewpoints.

000,776

PB90-271479

Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD, Precision Engineering Div.

Processing of 2-D Digital Images by Integral Holography.

Final rept.

T. R. Lettieri, J. C. Boudreaux, O. Manuar, H. Bandy, and J. Parker, 1987, 7p

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Applications of Digital Image Processing X, v829 p144-149 1987.

Keywords: Depth finding, Stereoscopy, Holography, Reprints, *Image processing, Imaging techniques, Three dimensional, Two dimensional.

The use of integral holography for recovering depth information from a series of two-dimensional digital images is discussed.

000,777

PB91-101279

Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO, Electromagnetic Technology Div.

Spatial Light Modulator for Texture Classification.

Final rept.

J. Haggerty, and M. Young, 1989, 4p

Pub. in Applied Optics 28, n23 p4992-4995, 1 Dec 89.

Keywords: *Pattern recognition devices, Fourier transformation, Hybrid computers, Remote sensing, Power spectra, Texture, Reprints, Light modulators, Optical processing, Light valves, Robot vision.

The paper describes a hybrid computer-optical processor devoted to the analysis of texture. Textures are displayed on a spatial light modulator and their power spectra are calculated optically by a Fourier optical technique. A video camera and a computer with a frame digitizer process the power spectra. The authors define a multidimensional feature space and associate each texture with a point in this feature space. After a training set, the system can distinguish several textures. This hybrid computer is a step toward real time texture classification because of the nearly instantaneous optical Fourier transformation.

000,778

PB91-112805

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD, Robot Systems Div.

Closed-Form Massively-Parallel Range-from-Image-Flow Algorithm.

D. Raviv, and J. S. Albus, Oct 90, 15p NISTIR-4450
Prepared in cooperation with Florida Atlantic Univ., Boca Raton.

Keywords: Algorithms, Motion, Space perception, *Computer vision, *Image processing, Parallel processing.

The authors provide a closed-form solution for obtaining 3D structure of a scene for a given six degree of freedom motion of a camera. The solution is massively parallel, i.e., the range that corresponds to each pixel is dependent on the spatial and temporal changes in intensities of that pixel, and on the motion parameters of the camera. The measurements of the intensities are done in a priori known directions. The solution is for the general case of camera motion. The derivation is based upon representing the image in the spherical coordinate system, although a similar approach could be taken for other image domains, e.g., the planar coordinate system. They comment on the amount of computations, errors and singular points of the solutions. They also suggest a practical way to significantly reduce and implement them.

General

000,779

AD-A221 717/2

PC A11/MF A02
National Bureau of Standards, Washington, DC, Inst. for Computer Sciences and Technology.

Proceedings of National Computer Security Conference Held in Washington, DC on 15-18 September 1986 (Computer Security - for Today and for Tomorrow).

18 Sep 86, 249p

Keywords: Ada programming language, Auditing, Automation, Computer programs, Computers, Data bases, *Symposia, *Data processing security, Intercommunication systems, Networks, Security, Targets.

Partial Contents: A Brief Summary of a Verification Assessment Study; A Network Security Perspective; Smart Terminals for Trusted Computer Systems; Database Systems and the Criteria: Do They Relate; Integrity in Trusted Database Systems; A Verified Labeler for the Secure Ada Target; Limitations of Dial-Up Security Devices; Automated Analysis of Computer System Audit Trails for Security Purposes; Managing Exposure to Potentially Malicious Programs; Towards a Discipline for Developing Verified Software; Using Software Analysis Tools to Analyze the Security Characteristics of HOL Programs. (kr)

000,780

PB90-145095

PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Management Guide to the Protection of Information Resources.

Special pub. (Final).

C. Helsing, M. Swanson, and M. A. Todd, Oct 89,

24p NIST/SP-500/170

Also available from Supt. of Docs. as SN003-003-02968-8. Library of Congress catalog card no. 89-600763.

Keywords: *Information systems, *Computer information security, Instructions, Computer programs, Data management systems, User manuals(Computer programs), Risk, Personnel management, Education.

The primary responsibility for data security rests with the managers of the functional areas supported by the data. The booklet introduces information system security concerns, and describes the essential components of an effective information resource protection process.

000,781

PB90-147489

PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Computer User's Guide to the Protection of Information Resources.

Special pub. (Final).

C. Helsing, M. Swanson, and M. A. Todd, Oct 89,

21p NIST/SP-500/171

Also available from Supt. of Docs. as SN003-003-02970-0. Library of Congress catalog card no. 89-600764.

Keywords: *Computer information security, *Information sources, Instruction, Data processing security, Responsibilities.

Computers have changed the way information resources are handled. Large amounts of information are stored in one central place with the ability to be accessed from remote locations. Users have a personal responsibility for the security of the system and the data stored in it. The document outlines the user's responsibilities and provides security and control guidelines to be implemented.

000,782

PB90-148123

PC A17/MF A02
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Report of the Invitational Workshop on Data Integrity.

Special pub. (Final).

Z. G. Ruthberg, and W. T. Polk, Sep 89, 377p NIST/SP-500/168

Also available from Supt. of Docs. as SN003-003-02966. Library of Congress catalog card no. 89-600756. Proceedings of the Workshop on Data Integrity (2nd), Gaithersburg, MD., January 25-27, 1989.

Keywords: *Computer systems, *Meeting, *Data integrity, Data processing security, Computer communications, Operating systems(Computers), Data base management systems, Computer information security, Integrity framework.

The report contains the proceedings of the second invitational workshop on computer integrity issues and is the second response to the Clark/Wilson paper entitled 'A Comparison of Military and Commercial Data Integrity Policy.' The NIST Computer and Telecommunications Security Council established a Working Group on Data Integrity as the subject of the second workshop. The Planning Committee outlined the scope of the workshop as discussions of (1) Integrity Framework Elements, (2) Implementation Requirements and Approaches, and (3) Implementation/Models in the light of the agreed upon integrity framework. The five discussion groups covered: Operating Systems and Systems, Telecommunications, System Services, Applications, and Implementations/Models. No consensus was reached on the definition of data integrity but consensus was reached on quality oriented (1) Policy and Objectives and (2) Mechanisms.

000,783

PB90-148750

PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Executive Guide to the Protection of Information Resources.

Special pub. (Final).

C. Helsing, M. Swanson, and M. A. Todd, Oct 89,

20p NIST/SP-500/169

Also available from Supt. of Docs. as SN003-003-02969-6. Library of Congress catalog card no. 89-600762. Prepared in cooperation with Deloitte, Haskins and Sells, Washington, DC.

Keywords: *Computer information security, Information systems, Information sources, Government policies, Federal agencies, Education, Responsibility.

The Executive Guide outlines the areas that the policy makers must address regarding the protection of computer systems and the information processed within them. The key to a successful policy on information resource protection is for top management to understand all the issues involved. The document explains what should be addressed in agency policy and where it best fits within an organization.

000,784

PB90-148784

PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD, Computer Security Div.

Guide for Selecting Automated Risk Analysis Tools.

Special pub. (Final).

I. E. Gilbert. Oct 89, 35p NIST/SP-500/174

Also available from Supt. of Docs. as SN003-003-02971-8. Library of Congress catalog card no. LCCCN-89-600769.

Keywords: *Computer software, *Computer security, Computer systems, Data collection, Risk analysis, Risk management.

The publication is intended to assist in the selection of appropriate automated risk analysis tools. It contains information that will be helpful in developing requirements evaluation criteria.

000,785

PB90-159609 PC A03/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Computer Security Div.**Prototyping SP4: A Secure Data Network System Transport Protocol Interoperability Demonstration Project.**

C. Dinkel, N. Nazario, and R. Rosenthal. Jan 90, 40p NISTIR-90/4228

Sponsored by National Security Agency/Central Security Service, Fort George G. Meade, MD.

Keywords: *Computer networks, Prototypes, Data transmission, Standards, Tests, *Computer security, *Protocols, Computer communications, Secure communications, Computer architecture, Open systems interconnection.

The Secure Data Network System (SDNS) project implements computer to computer communications security for distributed applications. The internationally accepted Open Systems Interconnection (OSI) computer networking architecture provides the framework for SDNS. SDNS utilizes the layering principles of OSI to implement secure data transfers between computer nodes of local area and wide area networks. SDNS implements SP4, a security protocol at the OSI Transport layer that provides end-to-end reliable transparent data communications with confidentiality and integrity security services. Laboratory prototypes of SP4 formed the basis of proposed voluntary national standards and will form the basis for future security enhancements to existing Government OSI Profiles.

000,786

PB90-171257 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.**GRAMPS (General Real-Time Asynchronous Multiprocessor System) Multiprocessor Operating System.**

P. Mansbach. Jan 90, 15p NISTIR-89/4190

Keywords: *Multiprocessors, *Communication, Multiprocessing, Operating systems(Computers), Real time, GRAMPS, Robot vision, Optical disks, Memory(Computers).

GRAMPS is an operating system designed for use by a number of independent functionally-divided processors which communicate via common (shared) memory. It achieves high speed, simplicity, and ready adaptability to users' individual needs by being primarily a single-tasking system, and adding processor boards when concurrent operation of processes is required. It thus trades software cost for known hardware cost. Three mechanisms of asynchronous data communication between processors are provided. These include a set of Unix-compatible calls, so a program can be debugged in a Unix environment and simply re-linked to run on a target board. GRAMPS allows individual processors to be stopped and restarted, without interrupting the other processors, and allows single processors to be run in isolation. The operating system includes a fast downloader, a monitor (in PROM), and an array of debugging tools. GRAMPS provides an extremely fast system for single-tasking multiple-processor applications, and some multi-tasking capability as well. It is currently running on Motorola 680x0 microprocessors, and has also run on Intel 8086's.

000,787

PB90-188061 PC A08/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.**Secure Data Network System (SDNS) Access Control Documents.**

C. Dinkel. Mar 90, 162p NISTIR-90-4259

Sponsored by National Security Agency/Central Security Service, Fort George G. Meade, MD.

Keywords: *Computer networks, Data processing security, Specifications, *Computer security, *Access control, Protocols.

The Secure Data Network System (SDNS) implements computer to computer communications security for distributed applications. The internationally accepted Open Systems Interconnection (OSI) computer networking architecture provides the framework for SDNS. SDNS uses the layering principles of OSI to implement secure data transfers between computer nodes of local area and wide area networks. The publication includes three access control documents developed by the National Security Agency as output from the SDNS project. SDN.801 describes the principles and functions underlying the SDNS access control and authentication security services. SDN.802 provides specifications which form a common basis from which devices implementing the access control service will be able to achieve interoperability. The third document in the set, SDN.801 Addendum 1, is an extension of access control information specifications provided in section 5 of SDN.802.

000,788

PB90-188079 PC A05/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.**Secure Data Network System (SDNS) Key Management Documents.**

C. Dinkel. Mar 90, 100p NISTIR-90/4262

Sponsored by National Security Agency/Central Security Service, Fort George G. Meade, MD.

Keywords: *Computer networks, Data processing security, *Computer security, Computer communications, Protocols, Data encryption, Distributed computer systems.

The Secure Data Network System (SDNS) implements computer to computer communications security for distributed applications. The internationally accepted Open Systems Interconnection (OSI) computer networking architecture provides the framework for SDNS. SDNS uses the layering principles of OSI to implement secure data transfers between computer nodes of local area and wide area networks. The publication includes four key management documents developed by the National Security Agency as output from the SDNS project. SDN.601 supplies a profile for the implementation of SDNS Key Management services in Open Systems. The definition of services provided by the Key Management Application Service Element (KMASE) is provided by SDN.902. The protocol specified in SDN.903 describes the KMASE services provided to the Key Management Application Process to support applications in a distributed open system environment. The framework of the SDNS security attribute negotiation service is described in SDN.906.

000,789

PB90-244484 PC A09/MF A02
National Inst. of Standards and Technology (NEL), Gaithersburg, MD.**U.S. Department of Energy Risk Assessment Methodology. Volume 1. DOE Risk Assessment Guideline Instructions, Resource Table, and Completed Sample. Volume 2. DOE Risk Assessment Worksheets.**

E. Roback. May 90, 195p NISTIR-4325, DOE/MA-365

Sponsored by Department of Energy, Washington, DC.

Keywords: *Security, *Information systems, Information retrieval, Vulnerability, Internal security, Data processing, Guidelines, Reprints, *Risk assessment, *US DOE, *Computer information security.

The publication reprints two volumes of a risk assessment guideline developed by the Department of Energy. Volume I: The DOE Risk Assessment Instructions, Resource Tables, and Completed Sample -- A Structured Approach, and Volume II: DOE Risk Assessment Worksheets, are the result of a joint program sponsored by the Department of Energy's (DOE) Office of ADP Management and the Computer and Technical Security Branch. It was developed for DOE under contract by Booz, Allen & Hamilton, Inc. The guideline was developed to allow ADP Managers and end users to quickly understand and accomplish risk

assessments in a more effective and expeditious fashion. The Guideline is organized into two separate volumes. (Both Volume I and II are included in the publication.) Volume I, the main body of the Guideline includes general instructions and references. Volume II also consists of instructions for Steps 1 through 6. Also included are a glossary and bibliography, which follow Volume II. Volume II consists of the worksheets for each step for completing the Guideline.

000,790

PB90-247446 PC A11/MF A02
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.**Security Labels for Open Systems: An Invitational Workshop.**

N. Nazario. Jun 90, 234p NISTIR-4362

Held in Gaithersburg, MD on May 30-31, 1990.

Keywords: *Meetings, Cryptology, Communications intelligence, Data processing, Computer networks, Secure communication, *Computer information security, *Security labels, Computer program integrity.

On May 30 and 31, 1990 the Protocol Security Group at NIST held a Workshop on Security Labels. Thirty-Five representatives from the U.S. Government, industry, and the United Kingdom gathered for two days to discuss Security Labels for open systems. The discussion went from the generalities of labels in 'end systems' to the more specific issue of labels in secure Open Systems Interconnection (OSI). The information shared during the two days discussion is documented in these proceedings.

000,791

PB90-261256 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.**NIST (National Institute of Standards and Technology) Digital Time Service.**Final rept.
J. Levine, M. Weiss, D. D. Davis, D. W. Allan, and D. B. Sullivan. 1989, 11p

Pub. in Proceedings of Annual Precise Time and Time Interval Applications and Planning Meeting (21st), Redondo Beach, CA., November 28-30, 1989, p181-190.

Keywords: *Time, Automation, Computers, Synchronization, Digital systems, Time lag, Reprints, *NIST Digital Time Service, Telephones.

The NIST Digital Time Service is designed to provide computers with telephone access to time generated by the National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards) at accuracies approaching 1 ms. Features of the service include automated estimation by the transmitter of the telephone-line delay, advanced alert for changes to and from daylight saving time and advanced notice of insertion of leap seconds. The ASCII-character time code operates with most standard modems and computer systems. The system can be used to set computer clocks and simple hardware can also be developed to set non-computer clock systems.

000,792

PB90-264102 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.**Automated Information System Security Accreditation Guidelines.**

Aug 90, 49p NISTIR-4378

Sponsored by Federal Aviation Administration, Washington, DC.

Keywords: *Information systems, *Security, Guidelines, *Computer information security, *Data processing security, Risk assessment, Contingency plans, Accreditation, US FAA.

The Federal Aviation Administration's publication, 'Automated Information System Security Accreditation Guidelines,' provides procedures for the preparation of documentation required for security accreditation of automated information systems. It has been designed to make the accreditation process as straightforward as possible for any system, whatever its purpose or level of complexity. The accreditation process requires the identification of the data processing activities in the data processing installation and the completion of the forms in this guideline to develop a security profile of the system, conduct a risk assessment and document contingency plans. A Designated Approving Authority

General

then signs the accreditation statements that formally accept the risks to each data processing activity.

000,793
PB90-265224 PC A03/MF A01
 National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Robot Systems Div.
Range from Triangulation Using an Inverse Perspective Method to Determine Relative Camera Pose.
 K. Chaconas. Aug 90, 22p NISTIR-4385

Keywords: *Range finding, Stereophotography, Triangulation, Inverse perspective method, Scene analysis, Charge coupled devices, Three dimensional, Robot vision.

The document describes a technique to obtain three-dimensional range from two arbitrarily-placed, stationary cameras. The method uses an inverse perspective algorithm to determine the position of each of the cameras with respect to a set of four coplanar points. Using the two transformations obtained, the relationship between the two cameras is determined. Subsequently, the range to a corresponding feature point that appears in both of the camera images can be calculated using triangulation.

000,794
PB90-265240 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Domestic Disaster Recovery Plan for PCs, OIS, and Small VS Systems.
 E. Roback. Aug 90, 37p NISTIR-4359
 Sponsored by Department of State, Washington, DC.

Keywords: *Information systems, *Disasters, Recoverability, Contingency, Planning, Personnel, Methodology, Backups, Failure, *Management information systems, *Data processing, Strategy, *Small computer systems, *Computer security, Personal computers.

The report provides a methodology for developing a disaster recovery plan for small computer systems. It describes how a plan is to be developed, including, specifically: determination of the criticality of processing requirements, backup strategy, data backup, and interim processing. The assignment of responsibilities for key computer personnel are also discussed. Finally, the model Disaster Recovery Plan is presented. It is organized into six chapters: (1) Overview, (2) Emergency Response, (3) Backup Operations, (4) Recovery, (5) Maintenance, and (6) Testing.

000,795
PB90-265257 PC A04/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Department of Justice Simplified Risk Analysis Guidelines.
 E. Roback. Aug 90, 61p NISTIR-4387
 Sponsored by Department of Justice, Washington, DC. Justice Management Div.

Keywords: Guidelines, Information systems, Automation, Data processing security, *Risk assessment, *Department of Justice, *Computer security.

The intent of the Simplified Risk Analysis Guidelines (SRAG) is to simplify the risk analysis process. The SRAG expedites the risk analysis process for the system under evaluation by initially determining if minimum security requirements applicable to the Department of Justice (DOJ) are met, which eliminates a number of threats and losses from evaluation. The SRAG is based on Automated Information System (AIS) security policies, regulations, circulars, and guidelines applicable to the DOJ as well as a review of a number of risk analysis methodologies developed by Government agencies and contractors. The SRAG approach divides systems requiring risk analyses into three categories: PCs; mainframes, minicomputers, and other remotely accessed AISs; and application systems. Each of these categories is further divided depending on whether nonsensitive, sensitive, or classified information is processed, or whether an application is nonsensitive or sensitive. The Appendix includes detailed information required to conduct a risk analysis, and a number of tables and work forms for use in conducting and documenting the risk analysis.

000,796
PB91-107540 PC A09/MF A01
 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.

Computer Security and Privacy Plans (CSPP) Review Project: A First-Year Federal Response to the Computer Security Act of 1987 (Final Report), 1989.

D. M. Gilbert. Sep 90, 191p NISTIR-4409
 Portions of this document are not fully legible. Prepared in cooperation with National Computer Security Center, Fort George G. Meade, MD.

Keywords: *Data processing security, Information systems, Guidelines, Implementation, Planning, Reviewing, *Computer security, *Computer Security Act of 1987, *Federal agencies, National Institute of Standards and Technology, National Security Agency, Computer privacy, Unclassified sensitive information.

The goal of the Computer Security Act of 1987 (Public Law 100-235) (the Act) is to prompt federal agencies to take measures to improve the security and privacy of sensitive information in federal computer systems. The Act requires federal agencies to prepare and submit for review security plans for all computer systems that contain sensitive information. The Act provides that the plans be submitted to the National Institute of Standards and Technology (NIST) and the National Security Agency (NSA) for review and comment. The report describes the Computer Security and Privacy Plan (CSPP) review effort that was conducted in response to the Act by a joint team from NIST and NSA in 1989. The report also discusses future directions for implementing the Act.

000,797
PB91-120121 PC A04/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
SRI International: Improving the Security of Your UNIX System.
 Final rept.
 E. Roback, and D. A. Curry. Nov 90, 57p NISTIR-4453

Also pub. as SRI International, Menlo Park, CA. Information and Telecommunications Sciences and Technology Div., rept. no. ITSTD-721-FR-90-21. Prepared in cooperation with SRI International, Menlo Park, CA.

Keywords: *Data processing security, *Operating systems(Computers), Computer networks, File management systems, *Computer security, *UNIX operating systems, *Account security, *Network security, *File system security, Computer software, Data base administrators.

The report provides various suggestions for improving the security of those systems operating under the UNIX operating system. Following an introduction explaining the rising concern for security, specific techniques are discussed for protecting account security, network security, and file system security. User responsibilities are included. Mechanisms available to system operators to monitor security are then presented. Following that is an overview of the wealth of software that has been developed to improve UNIX systems, much of which is freely available. Sources for obtaining this software are included. Finally, the document includes reference sources, such as where to obtain the latest information about security problems, suggested reading, and a security checklist.

DETECTION & COUNTERMEASURES

Infrared & Ultraviolet Detection

000,798
PB90-149287 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Phosphor Film Characterization Measurements in the Vacuum U.V. Using a Multichannel Detector.
 Final rept.
 A. Fahr, A. H. Laufer, and W. Braun. 1987, 6p
 Pub. in Applied Optics 26, n16 p3428-3433, 15 Aug 87.

Keywords: *Phosphors, *Ultraviolet detectors, Resolution, Spectroscopy, Optical coatings, Ultraviolet radi-

ation, Arrays, Linear systems, Sensitivity, Fluorescence, Reprints.

A linear microchannel plate-reticon array detector is used to characterize phosphor films. The films up-convert vacuum u.v. radiation into the detector's sensitive spectral range, wavelengths 350 nm. The objective is to optimize the resolution and sensitivity for vacuum u.v. spectrographic detection. The methodology for measuring the sensitivity as well as the angular dependence of fluorescence of films is described and absolute as well as relative efficiencies for several phosphors is given.

Optical Detection

000,799
AD-A225 222/9 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Calibration Technique for Heat Flux Sensors Used in Fire Experiments and Standard Fire Tests.
 Final rept.
 K. Steckler, K. Tu, and W. Twilley. Apr 90, 33p DOT/FAA/CT-89/26
 Contract DTF A03-88-A-00020

Keywords: *Calorimeter, Heat flux, Calibration, Radiometer, Accuracy, Alignment, *Detectors, *Fires, Flux density.

A means for calibrating total heat flux gauges using a comparative (substitution) technique has been established. An apparatus consisting of a reference radiometer, a stable infrared radiant heater capable of producing flux levels up to 3.7 W/cm², and a precision alignment mechanism has been constructed. The reference radiometer was characterized by the Radiometric Physics Division of The National Institute of Standards and Technology at flux levels in the range 0.8 mW/cm² to 0.9 W/cm². Its accuracy was found to be within 3 percent over this range which spans 3 orders of magnitude. As the radiometer is a highly linear thermocouple-based device having a self-calibration feature, this accuracy is expected to hold up to 4.2 W/cm², the upper limit of this device. Although the overall accuracy of calibrations performed in the new apparatus must still be established, it is expected to be within 3 to 5 percent.

Seismic Detection

000,800
PB90-170382 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Iterative Seismic Inversion.
 Final rept.
 S. J. Norton. 1988, 12p
 Pub. in Geophysical Jnl. 94, n3 p457-468 Sep 88.

Keywords: *Seismic detection, *Algorithms, *Iteration, Scattering, Least squares method, Reprints, *Image processing, Conjugate gradient method.

Two well-known iterative algorithms, steepest descent and conjugate-gradient descent, are used to solve the nonlinear seismic inversion problem from reflection data by minimizing the mean-square error between the measured data and data generated by the estimated model. The approach offers great flexibility, both in incorporating a priori information and in its ability to weight the measurements in an optimal fashion based on error statistics, which serves to regularize an otherwise ill-conditioned inversion. The descent algorithms have superior global convergence properties and avoid the need to invert a large matrix containing second-derivative information. For the special case of monochromatic plane-wave illumination and far-field detection, Weston has obtained an exact expression for the gradient, correct to all orders in the perturbation. Weston's result is generalized to the time domain and to point sources and receivers. The exact gradient improves both the rate and stability of the conjugate-gradient descent algorithm, as illustrated here in a one-dimensional example of the nonlinear inverse-scattering problem.

ELECTROTECHNOLOGY

Antennas

000,801
PB90-155839 PC A04/MF A01
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
Planar Near-Field Codes for Personal Computers.
 L. A. Muth, and R. L. Lewis. Oct 89, 52p NISTIR-89/
 3929
 Sponsored by Aerospace Guidance and Metrology
 Center, Newark AFB, OH.

Keywords: *Computer programs, *Antennas, *Metrology,
 Data management, Computer applications,
 Modules(Electronics), Computer software, *Planar
 Near-Field codes.

The author developed planar near-field codes, written
 in Fortran, to serve as a research tool in antenna me-
 trology. The author describes some of the inner work-
 ings of the codes, the data management schemes,
 and the structure of the input/output sections to
 enable scientists and programmers to use these codes
 effectively. The structure of the codes is seen to be
 open, so that a user can incorporate a new application
 into the package for future use with relative ease. The
 large number of subroutines currently in existence are
 briefly described, and a table showing the interdepend-
 ence among these subroutines is constructed. Some
 basic research problems, such as transformation of a
 near field to the far field and probe position error cor-
 rection, are carried out from start to finish, to illustrate
 use and effectiveness of these codes. Sample outputs
 are shown.

000,802
PB90-155854 PC A03/MF A01
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Near-Field Gain of Pyramidal Horns from 18 to 40
 GHz.**
 D. A. Hill, and R. L. Ehret. Nov 89, 19p NISTIR-89/
 3924

Keywords: *Horn antennas, *Electromagnetic fields,
 Field strength, Electromagnetic radiation, Anechoic
 chamber, Directional antennas, Microwave equipment,
 Field emission, *Near fields, *Pyramidal bodies, An-
 tenna radiation patterns.

Generating a standard electromagnetic field requires
 knowledge of the gain of the transmitting antenna.
 Using the two-antenna method, the near-field gain of
 pyramidal horns has been measured at frequencies
 from 18 to 40 GHz. The discrepancy between the
 measured and theoretical near-field gain is typically
 within +/- 0.3 dB for distances from 0.5 to 4 m from
 the horn aperture. An accurate laser alignment of the
 horns was necessary to obtain this level of agreement.

000,803
PB90-187626 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Antenna Far-Field Pattern Accuracies at Millimeter
 Wave Frequencies Using the Planar Near-Field
 Technique.**
 Final rept.
 M. H. Francis. 1989, 6p
 Pub. in Proceedings of Annual Meeting and Symposi-
 um of the Antenna Measurement Techniques Associa-
 tion (11th), Monterey, CA., October 9-13, 1989, p11-
 16-11-21.

Keywords: *Antenna radiation patterns, Electrical
 measurement, Millimeter waves, Far field, Accuracy,
 Reprints, Planar near field technique, Extremely high
 frequency.

In recent years there has been an increasing demand
 for antenna calibrations at millimeter wave frequen-
 cies. Because of this the National Institute of Stand-
 ards and Technology (NIST) has been developing
 measurement capabilities at millimeter wave frequen-
 cies. The development of gain and polarization meas-

urement capabilities have been previously reported.
 The paper reports on the development of the capability
 to measure an antenna pattern which has been
 achieved during the last year. Measurement accura-
 cies of better than 4 dB have been achieved for side-
 lobes which are 40 dB below the mainbeam peak.
 NIST is now providing a new measurement service for
 antenna patterns in the 30-50 GHz frequency range.

000,804
PB90-187683 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Automated Multi-Axis Motor Controller and Data
 Acquisition System for Near-Field Scanners.**
 Final rept.
 J. R. Guerrieri, and D. P. Kremer. 1989, 5p
 Pub. in Proceedings of Annual Meeting and Symposi-
 um of the Antenna Measurement Techniques Associa-
 tion (11th), Monterey, CA., October 9-13, 1989, p12-
 24-12-28.

Keywords: *Antenna scanners, *Electric controllers,
 Data acquisition, Millimeter waves, Far field, Control
 circuits, Logic circuits, Electrical measurement, Re-
 prints, Planar near field technique.

The National Institute of Standards and Technology
 (NIST) has developed a multi-axis controller and soft-
 ware data acquisition system that has improved probe
 position accuracies in near-field scanning. This ex-
 tends the usefulness of the NIST planar near-field
 scanner to higher frequencies. The system integrates
 programmable power supplies into an existing planar
 measurement system with new software that controls
 the power supplies and the data acquisition. It provides
 the higher positioning accuracy required for millimeter
 wave measurements at a reasonable cost.

000,805
PB90-187915 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Iterative Technique to Correct Probe Position
 Errors in Planar Near-Field to Far-Field Transfor-
 mations.**
 Final rept.
 L. A. Muth, and R. L. Lewis. 1989, 4p
 Pub. in Proceedings of International Symposium on
 Antennas and Propagation, Tokyo, Japan, August 22-
 25, 1989, p901-904.

Keywords: *Antenna radiation patterns, Integral equa-
 tions, Taylors series, Far field, Position(Location),
 Errors, Correction, Tests, Reprints,
 Probes(Electromagnetic), Iterative methods, Succes-
 sive approximation method, Near field.

A general theoretical procedure was developed to take
 into account probe position errors when planar near-
 field data are transformed to the far field. If the probe
 position errors are known, one can represent the
 measured data as a Taylor series, whose terms con-
 tain the error function and the ideal spectrum of the
 antenna. Then one can solve for the ideal spectrum in
 terms of the measured data and the measured position
 errors by inverting the Taylor series. A more general
 solution can also be written by formulating the problem
 as an integral equation and using the method of suc-
 cessive approximations to obtain a general solution.
 An important criterion that emerges from the condition
 of convergence of the solution to the integral equation
 is that the total averaged position error must be less
 than some fraction of the Nyquist rate for the antenna
 under test.

000,806
PB90-187923 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Improvements in Polarization Measurements of
 Circularly Polarized Antennas.**
 Final rept.
 A. C. Newell, D. P. Kremer, and J. R. Guerrieri. 1989,
 7p
 Pub. in Proceedings of Annual Meeting and Symposi-
 um of the Antenna Measurement Techniques Associa-
 tion (11th), Monterey, CA., October 9-13, 1989, p1-30-
 1-36.

Keywords: *Antennas, *Circular polarization, Electrical
 measurement, Reprints.

A new measurement technique that is used to meas-
 ure the polarization properties of dual port, circularly
 polarized antennas is described. A three antenna tech-

nique is used, and high accuracy results are obtained
 for all three antennas without assuming ideal or identi-
 cal properties. The technique eliminates the need for a
 rotating linear antenna, reduces the setup time when
 gain measurements are also performed, and reduces
 errors for antennas with low axial ratios.

000,807
PB90-187931 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Comparison of Antenna Bore-sight Measurements
 between Near-Field and Far-Field Ranges.**
 Final rept.
 A. C. Newell, J. R. Guerrieri, R. R. Persinger, J. A.
 Stiles, and E. McFarlane. 1989, 6p
 Pub. in Proceedings of Annual Meeting and Symposi-
 um on Antenna Measurement Techniques Association
 (11th), Monterey, CA., October 9-13, 1989, p1-24-1-
 29.

Keywords: *Antennas, Electrical measurement, Bore-
 sights, Alignment, Error analysis, Tests, Reprints, Near
 field, Uncertainty.

The paper describes the results of electrical bore-sight
 measurement comparisons between the far-field and
 two near-field ranges. Details are given about the near-
 field alignment procedures and the near-field error
 analysis. Details of the far-field measurements and its
 associated errors are not described here, as the near-
 field technique is of primary interest. Results demon-
 strated a maximum uncertainty between the different
 ranges of 0.018 deg. An analytical error analysis that
 predicted a similar level of uncertainty was also per-
 formed. The error analysis can serve as the basis for
 estimating uncertainty in other near-field measure-
 ments of antenna bore-sight.

000,808
PB90-205998 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Advanced System Characterizes Antennas to 65
 GHz.**
 Final rept.
 M. H. Francis, D. P. Kremer, and A. G. Repjar. 1990,
 7p
 Pub. in Microwaves and RF 29, n3, 77, 78, 80, 82, 84,
 86 and 88 Mar 90.

Keywords: *Microwave antennas, *Metrology, Antenna
 radiation pattern, Extrapolation,
 Polarization(Waves), Amplification, Transmitters, Re-
 ceivers, Accuracy, Reprints.

In the past, few antenna measurements above 30 GHz
 have been done by the National Institute of Standards
 and Technology (NIST). Recently, NIST has devel-
 oped the capability to do antenna measurements at
 frequencies from 30-65 GHz. The extrapolation tech-
 nique is used to determine the gain and polarization
 properties of antennas and probes with gains up to
 about 30 dB. The planar near-field technique is used
 for antennas with higher gains as well as for determin-
 ing far-field antenna patterns for frequencies up to 50
 GHz. The report describes the problems and the solu-
 tions for providing measurement capability at these
 frequencies. The problems that arise are primarily due
 to the small wavelengths at these frequencies requir-
 ing: much better accuracies in the manufacture of
 flanges, an improved technique for making insertion
 loss measurements, and improved probe positioning
 accuracy.

000,809
PB90-206038 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Fields Div.
**Microstrip Patch Antenna as a Standard Transmit-
 ting and Receiving Antenna.**
 Final rept.
 M. Kanda. 1990, 4p
 Pub. in IEEE (Institute of Electrical and Electronics En-
 gineers) Transactions on Electromagnetic Compatibil-
 ity 32, n1 p5-8 Feb 90.

Keywords: *Microwave antennas, Antenna radiation
 pattern, Engineering standards, Experimental design,
 Impedance matching, Reprints, *Microstrip transmis-
 sion lines, *Antenna design.

The paper discusses the possibility of employing a mi-
 crostrip patch antenna as a standard transmitting or
 receiving antenna. The intrinsic properties of the sub-

Antennas

strate used for the antenna are determined by careful impedance measurements. Experimental results indicate that the transmitting characteristics of a microstrip antenna can be theoretically determined from its geometry. The microstrip patch antenna discussed is physically small (20-cm square for 450 MHz) and can be well matched to a 50-ohm power delivery system (SWR = 1.17).

000,810

PB90-218108 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Mobile Antennas.

Final rept.
R. G. FitzGerrell, and M. J. Treado. 1989, 16p
Sponsored by National Inst. of Justice, Washington,
DC.
Pub. in NIJ (National Institute of Justice) Standard
0205.01, 16p 1989.

Keywords: *Antennas, *Mobile equipment, *Law enforcement, Performance standards, Performance tests, Vehicles, Radio frequencies, Reprints.

The document establishes minimum performance requirements and methods of test for mobile antennas mounted on vehicles used by law enforcement agencies, and deals with antenna characteristics that determine the suitability and effectiveness of antennas for law enforcement use. The following four law enforcement frequency bands are considered: 25-50 MHz, 150-174 MHz, 400-512 MHz, and 806-866 MHz. The standard supersedes NILECJ-STD-0205.00, Mobile Antennas dated May 1974.

000,811

PB90-218439 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Calibration and Meaning of Antenna Factor and Gain for EMI Antennas.

Final rept.
E. B. Larsen. 1986, 8p
Pub. in Item 1986 (Interference Technology Engineers' Master), p114-120 1986.

Keywords: *Metrology, *Antennas, *Amplification, Electromagnetic fields, Calibrating, Methodology, Reprints, *Antenna factor, Electromagnetic measurement.

The gain of an antenna is most commonly measured by comparing its output in a locally generated field to that of a 'standard' receiving antenna, whose gain is accurately known. This approach is called a 'relative' gain measurement. If the gain is determined without using another antenna having known gain, the procedure is called an 'absolute' gain measurement. The three techniques for determining absolute gain and antenna factor are described.

000,812

PB91-107391 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Fields Div.
Standard Linear Antennas, 30 to 1000 MHz.

Final rept.
R. G. FitzGerrell. 1986, 5p
See also PB87-172722.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Antennas and Propagation AP-34, n12 p1425-1429 Dec 86.

Keywords: *Antennas, *Insertion loss, Linear systems, Dipoles, Computation, Reprints, Monopoles.

It is demonstrated that the insertion loss between pairs of thin, linear antennas may be calculated using fairly simple equations that are generally considered to be good engineering approximations. Although the insertion loss calculation does not involve antenna gain directly (some measurements are actually made in the near-field where gain is not defined), the result is precisely the quantity obtained using the antenna gains in Friis's transmission formula, assuming the mismatch losses are zero. Therefore, the antenna gain product is implicit in the more general insertion loss equations. The particular measurement of insertion loss used here yields a quantity called site attenuation by electromagnetic compatibility engineers. A close agreement between measured and calculated data provides confidence in the site attenuation calculations when the site is essentially perfect, and provides confidence in the gain product of the antenna pair calculated using basically the same equations as those used for insertion loss.

Circuits

000,813

PATENT-4 968 908 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Method and Apparatus for Wide Band Phase Modulation.

Patent.
F. L. Walls. Filed 6 Mar 89, patented 6 Nov 90, 12p
PB91-110429, PAT-APPL-7-319 197
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Phase modulation, Telecommunication, Navigation, Frequency measurement, Time measurement, Oscillators, *Phase noise, *Noise measurement, PAT-CL-307-529.

A phase modulator for use in a two-oscillator phase noise measurement system is placed in the line from either the reference oscillator or the device under test. The phase modulator couples a small portion of the input signal to an amplitude modulator and phase shifter to shift the small signal by exactly 90 degrees. The small signal portion is then coupled back into the input signal such that small variations in the coupled signal result in phase modulation and not amplitude modulation which would undermine the calibration of the instrument. The phase modulator described can also be used with known devices of many types to correct the added phase noise of components, e.g., power amplifiers.

000,814

PB90-145160 PC A04/MF A01
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Systematic Errors in Power Measurements Made with a Dual Six-Port ANA.

Technical note.
C. A. Hoer. Jul 89, 55p NIST/TN-1332
Also available from Supt. of Docs. as SN003-003-02963-7.

Keywords: *Network analyzers, *Bolometers, *Error analysis, Electronic test equipment, Telecommunication, Electric analyzers, Numerical analysis, Efficiency, Microwave equipment, Power measurement.

The purpose of the report is to determine the systematic error in measuring power with a dual 6-port Automatic Network Analyzer. Most of the report concentrates on developing equations for estimating systematic errors due to imperfections in the test port connector, imperfections in the connector on the power standard, and imperfections in the impedance standards used to calibrate the 6-port for measuring reflection coefficient. These are the largest sources of error associated with the 6-port. For 7 mm connectors, all systematic errors which are associated with the 6-port add up to a worst-case uncertainty of +/- 0.00084 in measuring the ratio of the effective efficiency of a bolometric power sensor relative to that of a standard power sensor.

000,815

PB90-155367 PC A16/MF A02
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Electrical Performance Tests for Storage Oscilloscopes.

H. K. Schoenwetter, T. F. Leedy, and O. B. Laug.
Dec 89, 356p NISTIR-89/4220
Sponsored by Army Communications-Electronics Command, Fort Monmouth, NJ.

Keywords: *Oscilloscopes, *Performance tests, Electric analyzers, Electric measuring instruments, Electronic test equipment, Checkout, Performance evaluation, Specifications.

Electrical performance test procedures for a dc to 100 MHz storage oscilloscope were developed for the purpose of evaluating samples submitted by electronic instrument manufacturers in response to specifications issued by the U.S. Army Communications-Electronics Command. The detailed, step-by-step test procedures are based on the specifications supplied by the Army and include sample data sheets and tables for the recording of interim data and final test results. The report discusses the measurement principles and techniques

underlying the more significant procedures. In addition, the sources of measurement uncertainty are discussed.

000,816

PB90-155797 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Coaxial Intrinsic Impedance Standards.

Technical note.
R. T. Adair, and E. M. Livingston. Oct 89, 31p NIST/TN-1333
Also available from Supt. of Docs. as SN003-003-02987-4.

Keywords: *Impedance, *Network analyzers, *Calibrating, Electric analyzers, Electronic test equipment, Transmission lines, Microwaves, Standards, Scattering parameters.

The paper discusses how impedance standards are derived from the basic definition of impedance, constructed and used in metrology with coaxial air-line systems. Basic transmission line equations are reviewed with emphasis given to intrinsic or derived standards for obtaining the impedance in low-loss transmission line systems. A brief description is given of how impedance standards are used to calibrate the vector automatic network analyzer, and specifically, the six-port system automatic network analyzer used at the National Institute of Standards and Technology for calibration services in the radio frequency, microwave, and millimeter wave areas. Measurement uncertainties are given for 7 mm coaxial devices measured with the National Institute of Standards and Technology six-port system. The resolution of the six-port system is several orders more precise than that of the present impedance standards from which it is calibrated. Required improvements in the physical dimensions of air-line standards which permit the automatic network analyzer's capability to be more fully utilized are given.

000,817

PB90-170911 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Electromagnetic Technology Div.
Accurate Experimental and Theoretical Comparisons between SIS Mixers Showing Weak and Strong Quantum Effects.

Final rept.
W. R. McGrath, P. L. Richards, D. W. Face, D. E. Prober, and F. L. Lloyd. 1988, 13p
Pub. in Jnl. of Applied Physics 63, n8 p2479-2491 1988.

Keywords: Josephson junctions, Electromagnetic noise, Reprints, *Mixers (Electronics), Superconducting junctions, Quantum effects, Gain.

The authors have made a systematic study of the gain and noise in SIS mixers employing Ta-based, Nb-based and Pb-alloy-based tunnel junctions. These junctions displayed both weak and strong quantum effects at a signal frequency of 33 GHz. The effects of energy gap sharpness and subgap current were investigated and are quantitatively related to mixer performance. Detailed comparisons are made of the mixing results with the predictions of the Tucker theory. Mixer performance was with a novel test apparatus which is accurate enough to allow for the first detailed tests of theoretical noise predictions. It was found that the Tucker theory underestimates the mixer noise temperature by a factor of about 2 for all of the mixers.

000,818

PB90-187808 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. ElectroSystems Div.

High-Current Very Wide-Band Transconductance Amplifier.

Final rept.
O. B. Laug. 1990, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n1 p42-47 Feb 90.

Keywords: *Broadband amplifiers, *Transconductance, Resistors, Bandwidth, Voltage amplifiers, Circuits, Electric potential, Broadband, Electric current.

A new design approach for a high-current, very wide-band transconductance amplifier is described. The approach is based on paralleling the input and output of complementary unipolar current-mirror cells. Each cell

has a fixed current gain determined by the ratio of two resistors. A differential input voltage-to-current circuit drives the cell array. The design has the advantage of avoiding the need for a single low-resistance current-sensing resistor and the attendant problems inherent in such resistors. Although the concept is still under development, a prototype of the cell-based transconductance amplifier was implemented with ten positive and ten negative current cells to gain some experimental familiarity with the approach in addition to providing verification of computer simulation results. The prototype transconductance amplifier is dc coupled, has a 3-dB bandwidth of about 750 kHz, and can deliver up to 35-A rms at 100 kHz with an output compliance voltage of 5-V rms. Other important characteristics such as output-load regulation and dc offsets are discussed.

000,819
PB90-190729 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.

Time-Domain Testing Strategies and Fault Diagnosis for Analog Systems.

Final rept.
H. Dai, and T. M. Souders. 1990, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n1 p157-162 Feb 90.

Keywords: *Tests, Electrical fault location, Analog systems, Reprints, *Analog circuits, *Parameter identification.

An efficient approach is presented for functional testing and parameter estimation of analog circuits in the time domain. The test equations are based on the sensitivity matrix, which can be obtained simultaneously with the nominal solution vector. An example is given, with results based on actual measurement data. Practical considerations, including the effects of ambiguity groups, measurement errors, and time skew are covered. The approach can be directly extended to nonlinear circuits.

000,820
PB90-192329 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.

Monitoring Power Quality.

Final rept.
F. D. Martzloff, and T. M. Gruzs. 1990, 5p
Pub. in Powertech 6, n2 p22-26 Feb 90.

Keywords: *Power supply circuits, *Surges, *Monitors, *Quality, Voltage regulation, Voltage regulators, Electrical equipment, Electrical measurement.

The quality of the power supplied to sensitive electronic equipment is an important issue. Monitoring disturbances of the power supply has been the objective of various site surveys, but results often appear to be instrument-dependent or site-dependent, making comparisons difficult.

000,821
PB90-192337 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.

Glimpse at Long-Term Effects of Momentary Overvoltages on Zinc Oxide Varistors.

Final rept.
F. D. Martzloff, and T. F. Leedy. 1989, 6p
Pub. in Ceramic Transactions 3, p306-311 1989.

Keywords: *Overvoltage, *Surges, *Varistors, Reliability, Circuit protection, Power supply circuits, Voltage regulation, Voltage regulators, Variable resistors, Life(Durability), Zinc oxides.

Because the prime function of varistors is the diversion of high energy surges, most of the attention is directed toward selecting the appropriate device rating to ensure long life under surge conditions. Some attention is also given to matching steady-state rating of the device to the power system voltage. However, during abnormal (and not well defined) power system conditions, the line voltage can reach values that will cause substantial current in the varistor. Until the effects of these momentary overvoltages are better identified and understood, there will be risk of near-term failure at worst and accelerated aging at best.

000,822
PB90-207010 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.

Characterizing Transient Measurements by Use of the Step Response and the Convolution Integral.

Final rept.
R. H. McKnight, J. Lagnese, and Y. Zhang. 1990, 7p
Sponsored by Department of Energy, Washington, DC.
Div. of Electric Energy Systems.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n2 p346-352 Apr 90.

Keywords: *Mathematical models, *Voltage dividers, *Surges, *Measurement, Convolution integrals, Numerical analysis, Graphs(tables), Reprints.

A method to determine the suitability of a divider system for making measurements of high voltage transients is described. The method involves the convolution of the experimentally determined step response of the divider with various analytic waveforms which represent ideal waveforms expected in the experimental arrangement. The result of the convolution is compared, both graphically and in terms of relevant parameters such as peak amplitude and front time, with the original waveform. The procedure allows the distortion introduced by the convolution calculation to be seen clearly. The numerical implementation of the method is easily run on a personal computer.

000,823
PB90-207309 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Center for Electronics and Electrical Engineering Technical Publication Announcements. Covering Center Programs, April-June 1989, with 1990 CEEE Events Calendar.

E. J. Walters. Dec 89, 21p NISTIR-89/4218
See also PB89-228308.

Keywords: *Semiconductor devices, *Semiconductors(Materials), *Metrology, *Electromagnetic interference, *Signals, Abstracts, Superconductors, Cryogenics, Microelectronics, Electrooptics, Standards, Power equipment, Accuracy, Insulators.

The twenty-first issue of a quarterly publication provides information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the second quarter of calendar year 1989. Abstracts are provided by technical area for papers published this quarter.

000,824
PB90-254947 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Technology Div.

Superconducting Tunnel Junction Receiver for 345 GHz.

Final rept.
E. C. Sutton, W. C. Danchi, P. A. Jaminet, and R. H. Ono. 1990, 18p
Sponsored by Army Research Office, Research Triangle Park, NC., National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.
Pub. in International Jnl. of Infrared and Millimeter Waves 11, n2 p133-150 1990.

Keywords: *Receivers, Electron tunneling, Far infrared radiation, Reprints, Superconducting junctions, Mixers(Electronics), Tunneling(Electronics), Noise temperature.

The authors discuss the design, fabrication, and testing of a quasi-particle tunnel junction receiver for use at 345 GHz. The design employs small area Nb/Nb-oxide/PbInAu edge junctions in order to keep the device capacitance small and maintain a modest value for omega (R sub N) C. For optimum noise performance and beam properties, the mixer is contained in a waveguide mounting structure. The best sensitivity was obtained at 312 GHz where a double sideband (DSB) noise temperature of 275 K was measured. Noise temperatures of 400 K (DSB) or better were obtained out to 350 GHz.

000,825
PB90-261280 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

Protecting Computer Systems against Power Transients.

Final rept.
F. D. Martzloff. 1990, 5p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Spectrum 27, n4 p37-40 Apr 90.

Keywords: *Power supply circuits, *Computers, *Surges, Overvoltage, Overcurrent, Electromagnetic interference, Transient response, Circuit protection, Reprints.

Computers have emigrated from the sheltered life of computer rooms to the tougher environment of offices, factories, and homes where they encounter interfering or damaging transients. The article outlines general causes and remedies, and how to deal with surges and maintain the integrity of a small computer system. Small computer systems, especially the stand-alone type, can be protected in a do-it-yourself mode. More complex systems may need the help of a specialist. Two case histories illustrate the problems and solutions; steps required to determine protection needs are described, with generic guidance on selecting an appropriate protective device.

000,826
PB90-261298 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.

Power Quality Site Surveys: Facts, Fiction, and Fallacies.

Final rept.
F. D. Martzloff, and T. M. Gruzs. 1989, 15p
See also PB89-171656.
Pub. in Proceedings of International Power Quality Conference (1st), Long Beach, CA., October 15-20, 1989, p492-505.

Keywords: *Power supply circuits, *Surges, *Quality, *Site surveys, Overcurrent, Overvoltage, Circuit protection, Reprints, *Electronic equipment.

The quality of the power supplied to sensitive electronic equipment is an important issue. Monitoring disturbances of the power supply has been the objective of various site surveys, but results often appear to be instrument-dependent or site-dependent, making comparisons difficult. After a review of the origins and types of disturbances, the types of monitoring instruments are described. A summary of nine published surveys reported in the last 20 years is presented, and a close examination of underlying assumptions allows meaningful comparisons which can reconcile some of the differences. Finally, the paper makes an appeal for improved definitions and applications in the use of monitoring investments.

000,827
PB90-261306 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.

Power Quality Site Surveys: Facts, Fiction, and Fallacies.

Final rept.
F. D. Martzloff, and T. M. Gruzs. 1990, 15p
See also PB90-261298.
Pub. in Proceedings of National Conference Power Quality for End-Use Applications 'Selected Readings' (2nd), San Francisco, CA., March 21-23, 1990, p1005-1018.

Keywords: *Power supply circuits, *Surges, *Quality, *Site surveys, Overcurrent, Overvoltage, Circuit protection, Reprints, *Electronic equipment.

The quality of the power supplied to sensitive electronic equipment is an important issue. Monitoring disturbances of the power supply has been the objective of various site surveys, but results often appear to be instrument-dependent or site-dependent, making comparisons difficult. After a review of the origins and types of disturbances, the types of monitoring instruments are described. A summary of nine published surveys reported in the last 20 years is presented, and a close examination of underlying assumptions allows meaningful comparisons which can reconcile some of the differences. Finally, the paper makes an appeal for improved definitions and applications in the use of monitoring investments.

000,828
PB91-101196 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

Circuits

Digital Source for a New Impedance Bridge.

Final rept.
B. F. Field, and N. M. Oldham. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p24-25.

Keywords: *Impedance bridges, *Frequency synthesizers, Accuracy, Phase shift, Periodic functions, Reprints.

A digitally-synthesized source has been designed to provide two sinewave outputs with an accurately known adjustable phase shift in the second channel for use with a proposed new impedance bridge.

000,829

PB91-101634 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Performance Evaluation of a New Audio-Frequency Power Bridge.

Final rept.
B. C. Waltrip, and N. M. Oldham. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p142-143.

Keywords: *Electrical measurement, *Electric bridges, *Audio frequencies, Electric power, Electric potential, Electrical impedance, Alternating current, Performance evaluation, Impedance bridges, Wattmeter, Reprints.

Several techniques for measuring active and reactive power in the 50 Hz to 20 kHz frequency range are described. These approaches were developed to evaluate a new high-accuracy, audio-frequency power bridge that is based on ac voltage and impedance measurements.

000,830

PB91-107417 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Precision Power Amplifier for Power/Energy Calibration Applications.

Final rept.
O. B. Laug, 1987, 7p
See also PB87-201687.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n4 p994-1000 Dec 87.

Keywords: *Power amplifiers, Precision, Design, Reprints, Calibration, MOSFET, High voltage.

A precision power amplifier for use in power/energy calibration applications is described. The amplifier was primarily designed to boost the output amplitude of a digital generator to provide the nominal 120- or 240-rms voltage component of a 'phantom' calibration power source. The amplifier has a fixed gain of 40 and can provide a maximum output voltage swing of 970 V peak-to-peak or 340-V rms at 100-mA rms. The bandwidth is from dc to 150 kHz and at 60 Hz the observed no-load short-term amplitude and phase instabilities are + or - 5 ppm and + or - 5 micro rad, respectively. The amplifier design uses high-voltage N-channel MOSFET's in the output driver stage together with a unique circuit topology of opto-isolators between the low-level input stage and the high-level output stage.

000,831

PB91-107474 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electronic Instrumentation and Metrology Group.

NIST (National Institute of Standards and Technology) Digitally Synthesized Power Calibration Source.

Technical note (Final).
N. M. Oldham, O. B. Laug, B. C. Waltrip, and R. H. Palm. Aug 90, 64p NIST/TN-1281
Also available from Supt. of Docs. as SN003-003-03033-3.

Keywords: *Power supply circuits, *Electric power meters, *Wattmeters, *Watt hour meters, Waveform generators, Voltage amplifiers, Power measurement, *Calibration, Transconductance amplifiers, Circuit diagrams, Computerized control systems.

A digitally-synthesized source of 'phantom' power for calibrating electrical power and energy meters is described. Independent sources of voltage, current, and

phase angle are programmable between 0-240 volts, 0-5 amperes, and 0-360 degrees, respectively. The uncertainty of the active and reactive power is estimated to be within + or - 100 ppm of the full scale apparent power (volt-amperes).

000,832

PB91-107664 (Order as PB91-107656, PC A06)
National Inst. of Standards and Technology, Gaithersburg, MD.

Standards for Waveform Metrology Based on Digital Techniques.

B. A. Bell. 1990, 28p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n4 p377-405 Jul-Aug 90.

Keywords: *Standards, Analog to digital converters, Digital to analog converters, Electrical measurement, Waveform generators, Digital techniques, Sampling, *Waveform metrology, Calibration.

Over the last decade the use of digital synthesis and sampling techniques for generating and measuring electrical waveforms has increased dramatically with the availability of improved digital-to-analog (D/A) and analog-to-digital (A/D) converters and related devices. With this evaluation has come the need for physical laboratory standards and test methods to support the performance specifications of digital devices and the instruments in which they are used. The article describes the research and development at NIST of several laboratory standards and test systems that use 'digital technology' for characterizing data converters and for implementing various waveform synthesis and sampling instruments.

000,833

PB91-112599 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

100 GHz SIS Quasiparticle Mixer with 10 dB Coupled Gain.

Final rept.
A. V. Raisanen, D. G. Crete, P. L. Richards, and F. L. Lloyd. 1987, 2p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) MTT-S International Microwave Symposium, Las Vegas, NV., June 9-11, 1987, p929-930.

Keywords: Extremely high frequencies, Josephson junctions, Microwave equipment, Reprints, *Mixers(Electronics), Superconducting devices, Quasi particles, SIS (Superconductors).

The authors have tested a superconducting quasiparticle mixer for 85-110 GHz which gives much larger coupled gain than has been previously observed. When operated with a negative dynamic resistance of about 2000 ohms, the maximum coupled gain was $(G \text{ sub } M)(\text{DSB}) = 12.5 \pm \text{or} - 2.5 \text{ dB}$ ($G \text{ sub } M(\text{SSB}) = 9.5 \pm \text{or} - 2.5 \text{ dB}$). The associated mixer noise temperature was 15.9 K (DSB). Large gain was also observed with large positive dynamic resistance, giving the lowest mixer noise temperature of 12.4 K (DSB).

Electron Tubes

000,834

PATENT-4 965 529 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.

High Current, Very Wide Band Transconductance Amplifier.

Patent.
O. B. Lang. Filed 21 Sep 89, patented 23 Oct 90, 10p PB91-100784, PAT-APPL-7-410 387
Supersedes PB90-238627.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Transconductance, *Amplifiers, *Patents, Broadband amplifiers, Electron tube amplifiers, Resistors, *High current, PAT-CL-330-255.

A high-current, very-wide-band transconductance amplifier includes a differential voltage to current converter and a plurality of complementary unipolar current

mirror cells. The differential voltage to current converter isolates the input voltage terminal from the common side of the output load current terminal. A plurality of positive current mirror cells are connected in parallel and a plurality of negative current mirror cells are connected in parallel to avoid the need for a single low resistance current sensing resistor and the fabrication problems inherent in such resistors.

Optoelectronic Devices & Systems

000,835

PB90-169590 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Quantum Efficiency Stability of Photodiodes.

Final rept.
R. Korde, and J. Geist. 1987, 7p
Pub. in Applied Optics 26, n24 p5284-5290 1987.

Keywords: *Photodiodes, *Quantum efficiency, Ultraviolet radiation, Stability, Moisture, Reprints.

The stability of the quantum efficiency of inversion layer, phosphorus diffused (n on p) and boron diffused (p on n) photodiodes has been investigated. Unsatisfactory silicon-silicon dioxide interfaces, latent recombination centers in the diffused layers and moisture absorption by the device were identified as possible causes of instability. The major result of this work is the demonstration that n on p photodiodes are inherently more stable than p on n types in the ultraviolet and blue spectral regions, but that stable p on n devices can also be produced with sufficient care.

000,836

PB90-170978 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Gallium Arsenide (GaAs)-Based Photoconductive Switches for Pulse Generation and Sampling Applications in the Nanosecond Regime.

Final rept.
B. A. Bell, A. G. Perrey, and R. A. Sadler. 1989, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 38, n1 p92-97, 1 Feb 89.

Keywords: *Photoconductors, *Electric switches, *Pulse generators, Photoconductivity, Signal generators, Gallium arsenides, Electrooptics, Switching circuits, Optical communication, Reprints.

The paper describes the design of a set of optoelectronic switches having an interdigitated electrode structure and implemented with high resistivity GaAs photoconductive substrates. A theoretical analysis is developed for determining the pulsed light ON state resistance (peak conductance), OFF state (dark) resistance, and the associated capacitances for the various designed gap geometries. Data are provided on the processing steps used in successfully fabricating a working set of switches based on the theoretical design. A test apparatus is used to make measurements of the pulsed light conductance of these devices having nominal gap spacings of 5, 10, 20, and 40 micrometers.

000,837

PB90-187667 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Current Status of, and Future Directions in, Silicon Photodiode Self-Calibration.

Final rept.
J. Geist. 1989, 11p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers)-Optical Radiation Measurements II, v1109 p246-256 1989.

Keywords: *Photodiodes, Silicon, Accuracy, Reviews, Reprints, *Self calibration, Intercomparison.

The current status of silicon self-calibration and its applications are reviewed, including the results of a number of intercomparisons that establish the suitability of self-calibration for high accuracy applications. Some current research directions known to the author are described, and possible future directions are considered.

000,838
PB90-193376 Not available NTIS
 National Bureau of Standards (NEL), Boulder, CO.
 Electromagnetic Technology Div.

Fiber Optic Sensing of Pulsed Currents.

Final rept.

L. R. Veaser, G. I. Chandler, and G. W. Day. 1987,
 16p

Pub. in Proceedings of SPIE (Society of Photo-Optical
 Instrumentation Engineers)-Photonics: High Band-
 width Analog Applications, v648 p197-212 1987.

Keywords: *Electric current meters, *Optical measur-
 ing instruments, *Fiber optics, Faraday effect, Magne-
 tooptics, Reprints, *Optical fibers, Electric pulses.

The manuscript reviews work at Los Alamos National
 Laboratory on the use of optical fiber sensors for the
 measurement of pulsed electric currents. It is based on
 a presentation at the SPIE Advanced Study Institute
 Series on Broadband Photonic Sensors held in
 Howey-in-the-Hills, Florida, in April, 1986.

000,839
PB90-218009 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Technology Div.

**Polarimetric Magnetic Field Sensors Based on Yt-
 trium Iron Garnet.**

Final rept.

M. N. Deeter, A. H. Rose, and G. W. Day. 1989, 1p
 Pub. in Proceedings of IEEE (Institute of Electrical and
 Electronics Engineers) Lasers and Electro-Optics So-
 ciety Annual Meeting, Orlando, FL., October 17-20,
 1989, p110.

Keywords: *Magnetic measurement, *Yttrium iron gar-
 nets, Faraday effect, Magneto-optics, Ferrimagnetic
 materials, Magnetic fields, Sensitivity, Magnetometers,
 Reprints, Optical fibers, Sensors, Cylindrical configura-
 tion.

The authors describe the performance characteristics of
 polarimetric Faraday-effect magnetic field sensors
 employing ferrimagnetic sensing elements, such as yt-
 trium iron garnet (YIG). Experimental results of sensor
 sensitivity, linearity, and directionality are presented for
 three cylindrical YIG samples, each having a different
 length to width ratio.

000,840
PB90-254582 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Semiconductor Electronics Div.

Planar Silicon Photosensors: An Overview.

Final rept.

J. Geist, and A. R. Schaefer. 1990, 8p
 Pub. in Proceedings of International Forum on ASIC
 and Transducer Technology (3rd), Banff, Alberta,
 Canada, May 20-23, 1990, p32-38.

Keywords: *Photodetectors, *Semiconductor devices,
 *Technology assessment, Silicon, Accuracy, Preci-
 sion, Integrators, Complexity, Structural design, Re-
 prints.

Planar silicon photosensor technology, which is suit-
 able for integrating photosensors and circuits, is ad-
 vancing in four roughly orthogonal directions. These
 are (1) the accuracy with which the photosensor output
 signal can be related to the incident radiation, (2) the
 level of integration as measured by the number of pho-
 toensors in a system, (3) the level of integration as
 measured by the complexity of the processing of the
 photosensor output signals before presentation to a
 human observer or another system, and (4) the com-
 plexity of the photosensor structure. A brief overview
 of each of these areas accompanied by illustrative re-
 sults is presented.

000,841
PB90-254590 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Technology Div.

**Mean Lifetime Calculations of Quantum Well Struc-
 tures: A Rigorous Analysis.**

Final rept.

A. K. Ghatak, I. C. Goyal, and R. L. Gallawa. 1990,
 7p

Pub. in IEEE (Institute of Electrical and Electronics En-
 gineers) Jnl. of Quantum Electronics 26, n2 p305-310,
 Feb 90.

Keywords: Matrix methods, Electric fields, Reprints,
 *Quantum wells, Lifetime, Bound state.

A matrix method which is applicable to an arbitrary po-
 tential variation represented by a set of linear functions
 such as multiple quantum well structures in the pres-
 ence of a static electric field is described. An analytical
 expression for the mean lifetime of the quasi-bound
 state of a single quantum well in the presence of a
 static electric field is obtained.

000,842
PB90-261041 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Technology Div.

**Measurement Standards to Support Photonics
 Technology.**

Final rept.

D. Franzen. 1990, 4p

Pub. in Proceedings of IEEE (Institute of Electrical and
 Electronics Engineers) Instrumentation and Measure-
 ment Technology Conference, San Jose, CA., Febru-
 ary 13-15, 1990, p326-328.

Keywords: *Standards, Primary standards, Optical
 measurement, Fiber optics, Reprints, *Photonics, Op-
 tical detectors, Optical fibers, US NIST.

Standards to support the emerging photonics/
 lightwave technology industry can be classified into
 two groups: physical primary standards maintained by
 national standards laboratories and standard meas-
 urement procedures agreed upon by domestic and
 international voluntary standards bodies. The meas-
 urement of absolute optical power leads the prioritized
 list of primary standards needs. The progress at NIST
 toward the development and distribution of optical
 power and other primary standards is reviewed. Stand-
 ard measurement procedures to characterize fiber,
 cables, sources, detectors, and lightwave systems
 have been the focus of domestic and international
 standards bodies for the past decade. The interaction
 between NIST and these standards groups to evaluate
 the precision and accuracy of several test methods will
 be reported.

000,843
PB90-261058 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Semiconductor Electronics Div.

**Surface-Field-Induced Feature in the Quantum
 Yield of Silicon Near 3.5 eV.**

Final rept.

J. Geist, J. L. Gardner, and F. J. Wilkinson. 1990, 6p
 Pub. in Physical Review B 42, n2 p1262-1267, 15 Jul
 90.

Keywords: *Photodiodes, *Silicon, Quantum efficien-
 cy, Energy gap, Ionization, Reprints, EV range 1-10.

A broad feature near 3.5 eV was observed in the inter-
 nal quantum-efficiency spectra of various silicon pho-
 todiodes. This appears to be the first time this feature
 has been reported. The feature was clearly resolved in
 spectra from photodiodes with strong surface fields at
 the oxide-silicon interface, but was small enough to
 preclude observation in a previously published spec-
 trum of field-free silicon. The feature is attributed to a
 local maximum in the quantum yield for electron-hole
 pair production that is expected at direct transitions in
 the vicinity of the Gamma point in the silicon Brillouin
 zone. Qualitative arguments suggest that the magni-
 tude of the feature increases with increasing surface
 field due to field-assisted impact ionization, and in the
 case of depleted surfaces, also due to band-gap nar-
 rowing in the surface-depletion region.

000,844
PB90-261207 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Semiconductor Electronics Div.

**Reflectometer for Measurements of Scattering
 from Photodiodes and Other Low Scattering Sur-
 faces.**

Final rept.

R. Kohler, J. L. Luther, and J. Geist. 1990, 6p
 Pub. in Applied Optics 29, n21 p3130-3134, 20 Jul 90.

Keywords: *Photodiodes, *Reflectometers, Reflec-
 tance, Surfaces, Reprints, *Semiconductor detectors,
 Silicon diodes, Scatterometers.

The authors have designed and tested a simple instru-
 ment to measure the diffuse reflectance of good qual-
 ity optical surfaces such as the surfaces of semicon-
 ductor detectors with uncertainties of about 3%.
 Measurements have been performed on Si pho-
 todiodes and on a sample of known reflectance at two
 different wavelengths.

000,845
PB90-261223 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Precision Engineering Div.

**Holographic Stereogram Displays from Computer-
 Generated Polygonal Models.**

Final rept.

T. R. Lettieri, J. C. Boudreaux, O. Manuar, H. Bandy,
 and C. Carew. 1987, 8p

Pub. in Proceedings of SPIE (Society of Photo-Optical
 Instrumentation Engineers) Display System Optics,
 v778 p61-67 1987.

Keywords: *Stereoscopy, *Holography, *Three dimen-
 sional display systems, Reprints, Geometric modeling,
 Computer aided design, Computer aided manufactur-
 ing, AMPLE system.

Holographic stereograms, which have potential use as
 3-D optical displays, have been made from stereo
 pairs of computer-generated, shaded, polygonal-solid
 models. The reconstructed virtual images from this
 type of hologram are more realistic than those from
 similar holograms made using simple wire-frame com-
 puter models. To generate the shaded polygonal
 models, the Automated Manufacturing Programming
 Language Environment (AMPLE) system, developed
 at NBS, was used. The computer images from AMPLE
 were photographed directly from a CRT screen onto
 35 mm slide film, with the CRT image rotated by 10
 deg about a vertical axis between adjacent photos in
 order to make the stereo pairs. A focused-image, white
 light hologram system was then used to convert the
 stereo 35 mm slide pairs into the final stereograms.

000,846
PB91-112102 Not available NTIS
 National Bureau of Standards (NEL), Boulder, CO.
 Electromagnetic Technology Div.

**Progress in the Design of Optical Fiber Sensors for
 the Measurement of Pulsed Electric Currents.**

Final rept.

G. W. Day, L. R. Veaser, G. I. Chandler, and R. W.
 Cernosek. 1986, 6p

See also DE86007831. Sponsored by Bonneville
 Power Administration, Portland, OR.

Pub. in Conference Record of the Workshop on Meas-
 urement of Electrical Quantities in Pulse Power Sys-
 tems II, Gaithersburg, MD., March 5-7, 1986, p58-63.

Keywords: *Electric current, *Optical measuring instru-
 ments, *Fiber optics, Birefringence, Faraday effect,
 Polarization, Reprints, *Optical fibers, Sensors.

The state of the art in the design of fiber sensors for
 pulsed electric currents is reviewed. Some of the more
 useful configurations are described and compared.
 Transfer functions are computed and used to illustrate
 the effect of linear birefringence and twisting on the
 characteristics of the sensors. The technique of an-
 nealing bend-induced birefringence is described and
 its present capabilities indicated. An analysis of the ul-
 timate limits to noise equivalent current is given, sug-
 gesting that several orders of magnitude improvement
 should be obtainable.

000,847
PB91-118471 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Technology Div.

**Photorefractive Instabilities in Proton-Exchanged
 Waveguides: Two-Wave Coupling and Chaos.**

Final rept.

N. A. Sanford, R. K. Hickernell, and R. M. Craig.
 1990, 2p

Pub. in Proceedings of Integrated Photonics Research
 Conference, Hilton Head, SC., March 26-28, 1990,
 p91-92.

Keywords: Near infrared radiation, Reprints, *Photore-
 fraction, Optical waveguides, Two wave coupling, In-
 stability, Chaos.

Forward and self-seeded backward waves in proton-
 exchanged waveguides exhibit repetitive transient
 coupling with a threshold of 10's mW at 1064 nm. A
 time series of the quasi-periodic coupling suggests in-
 termittency as a route to chaos.

000,848
PB91-133934 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Electromagnetic Technology Div.

Optoelectronic Devices & Systems

Recent Advances in Faraday Effect Sensors.

Final rept.
G. W. Day. 1989, 5p
Pub. in Optical Fiber Sensors, Springer Proceedings in Physics, v44 p250-254 1989.

Keywords: *Optical measuring instruments, *Faraday effect, *Electric currents, *Magnetic fields, *Fiber optics, Measurement, Reprints, *Optical fibers, Sensors.

The paper reviews recent developments in the application of the Faraday effect to electric current and magnetic field sensing. The advantages and disadvantages of using the Faraday effect for magnetic field or electric current measurements are discussed. The principles and development of Faraday effect sensors have recently been reviewed. In the paper, more recent results are emphasized.

000,849
PB91-167437

(Order as PB91-167411, PC A05/MF A01)
National Inst. of Standards and Technology, Gaithersburg, MD.

Low-Contrast Thermal Resolution Test Targets: A New Approach.

J. Geist, and D. B. Novotny. 1990, 16p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n6 p631-646, Nov/Dec 90.

Keywords: *Infrared imagery, *Infrared photometry, *Radiometry, Image resolution, Thermal radiation, Computer programs, *Thermal resolution targets, Thermal imaging.

A new type of thermal resolution test target optimized to minimize the effects of lateral thermal gradients at low thermal contrast is described. This target consists of thin-film inconel heater strips over an etched silica substrate bonded to an aluminum heat sink. A simple, finite-difference model is used to study how variations in target construction and materials affect the generated thermal resolution test pattern. The construction, testing, and use of this type of target to extend the lower end of the contrast range of a conventional target are described.

Power & Signal Transmission Devices

000,850
PB90-149204

Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Analysis of Circular Bends in Planar Optical Waveguides.

Final rept.
R. L. Gallawa, and Y. Tu. 1989, 11p
Pub. in Fiber and Integrated Optics 8, p87-97 1989.

Keywords: *Optical communication, *Waveguide bends, Telecommunication, Planar devices, Bend properties, Pipe bends, Transmission lines, Communication cables, Fiber optics, Reprints.

Waveguide with circular bends are analyzed by means of a conformal transformation in conjunction with the WKB method of dealing with the nonuniform refractive index that results from the transformation. The result is a prediction of the operational parameters of the bent guide, including the loss. The transformation makes possible an intuitive understanding of the cause of the loss.

000,851
PB90-169350

Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Calibrated Optical Fiber Power Meters: Errors Due to Variations in Connectors.

Final rept.
X. Li, and R. L. Gallawa. 1988, 8p
Pub. in Fiber and Integrated Optics 7, n3 p241-248 1988.

Keywords: *Fiber optics, *Power meters, *Errors, *Electric connectors, Optical communication, Calibrating, Measuring instruments, Power measurement, Error analysis, Adaptors, Reprints.

Potential errors in the measurement of optical fiber power when using a calibrated power meter with con-

nectors of various types and from different vendors is discussed. Data is given on the error and standard deviation due to biconic connectors from a limited number of vendors. The authors speculate that the error is due to reflecting surfaces on the connector end. To confirm the hypothesis, they tested two connectors whose reflective ends have noticeable differences. The data illustrates the differences seen among connectors. The data indicates that a user should expect measurement error in most cases. A call for caution based on the results was issued.

000,852
PB90-271289

Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

Measuring Adapter Efficiency Using a Sliding Short Circuit.

Final rept.
W. C. Daywitz, and G. J. Counas. 1990, 7p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques 38, n3 p231-237 Mar 90.

Keywords: *Microwave equipment, *Adaptors, Electrical measurement, Reflection, Efficiency, Reprints.

The paper describes a simple technique for measuring the efficiency of adapters with losses less than 2dB. The technique is useful in microwave applications where a moderate error in the measured loss is acceptable. This error is less than 10% of the loss for losses between 0.5 and 2dB, and is less than 0.05dB below 0.5dB. An expression for the error is given.

000,853
PB90-271529

Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Electrical Fast-Transient Tests: Applications and Limitations.

Final rept.
F. D. Martzloff, and T. F. Leedy. 1990, 10p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Industry Applications 26, n1 p151-159 Jan/Feb 90.

Keywords: *Transmission lines, *Power lines, *Transient response, *Electromagnetic pulses, Standards, Tests, Reprints.

According to a new standard of the International Electrotechnical Commission (IEC), a fast-transient test must be applied to the connecting cables of electronic equipment. The purpose of the test is to demonstrate equipment immunity to fast transients resulting from switching. Tests and simulations of the propagation and attenuation of these fast transients in typical connecting cables are described, placing the IEC requirements in perspective.

Resistive, Capacitive, & Inductive Components

000,854
PATENT-4 969 956

Not available NTIS
Department of Commerce, Washington, DC.

Transparent Thin Film Thermocouple.
Patent.
K. G. Kreider, and M. Yust. Filed 19 Dec 89, patented 13 Nov 90, 7p PB91-110635, PAT-APPL-7-452 439

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Thermocouples, *Patents, Temperature measuring instruments, Thermoelectricity, Thin films, Sputtering, Indium oxides, Indium tin oxides, PAT-CL-136-201.

A transparent thin film thermocouple, and a method of manufacturing, comprises a positive element of indium tin oxide (ITO) and a negative element of indium oxide (In₂O₃) formed on a surface by reactive sputtering with the elements being electrically joined to form a hot junction for conversion of heat into electricity.

000,855
PB90-136953

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Influence of Pressure and Humidity on the Medium and Long-Term Frequency Stability of Quartz Oscillators.

Final rept.
F. L. Walls. 1988, 5p
Pub. in Proceedings of Annual Symposium on Frequency Control (42nd), Philadelphia, PA., May 31-June 2, 1988, p279-283.

Keywords: *Humidity, *Frequency stability, *Pressure, *Crystal resonators, Oscillators, Frequency control, Environments, Atmospheric density, Moisture content, Precipitation (Meteorology), Quartz resonators, Reprints.

The medium- and long-term frequency stability of most quartz-crystal-controlled oscillators is degraded by various environmental effects. The most important of these are acceleration, temperature, load change, humidity and possibly pressure. The paper shows data which indicate that the medium- and long-term frequency stability of some oscillators can be improved by controlling the moisture and pressure around the oscillator. Measurements on four different quartz-crystal-controlled oscillators of three different designs yielded improvements of 2 to 5 in frequency stability for measurement times of 1 to 11 days. The frequency stability of one oscillator, with very low drift, improved to $3 +$ or $- 1 \times 10^{-13}$ for measurement times from 0.03 s to 21 days. Supplemental experiments indicate that the probable cause for these improvements is the stabilization of frequency changes due to moisture that corresponds to a fractional change in frequency of about 10^{-9} for a 100 percent change in the relative humidity at room temperature. If these improvements can be routinely obtained in other precision quartz-crystal-controlled oscillators, then they may become useful for some applications generally thought to require atomic standards.

000,856
PB90-152893

Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Numerical Modeling of Capacitive Array Sensors Using the Finite Element Method.

Final rept.
P. R. Heyliger, J. C. Moulder, P. J. Shull, M. Gimple, and B. A. Auld. 1988, 8p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7A, p501-508 1988.

Keywords: *Mathematical models, *Capacitors, *Detectors, Surface defects, Electric fields, Dielectrics, Electric conductors, Electron probes, Numerical analysis, Reprints, *Finite element method.

The electrostatic field equations governing the behavior of a capacitive array sensor are solved using a two-dimensional finite element method. The response of the probe to surface flaws in conductors and dielectrics is examined by calculating the change in the probe's admittance as it is scanned across the flaw. The change in admittance, ΔY , is obtained by evaluating a line integral involving the electrostatic potential and its normal derivative. Results of parametric studies are reported showing the relative effects of the specimen's dielectric constant and flaw size on probe signals.

000,857
PB90-170929

Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. ElectroSystems Div.

Book Review: The Current Comparator by W. J. M. Moore and P. N. Miljanic.

Final rept.
O. Petersons. 1989, 2p
Pub. in Metrologia 26, n1 p77-78 Mar 89.

Keywords: *Comparator circuits, *Books, *Evaluation, Calibrating, Magnetic modulators, Current transformers, Direct current, Capacitance bridges, High voltage, Comparators, Reprints.

The book entitled, 'The Current Comparator,' by W.J.M. Moore and P. N. Miljanic has been reviewed. The review material includes an overall assessment of the coverage of the subject, and addresses the clarity and effectiveness of the authors in reaching their intended audience. The book is concise, yet includes a comprehensive monograph covering the basic principles, construction, details, error sources and error re-

Resistive, Capacitive, & Inductive Components

duction techniques for magnetic current comparators. Alternating (power frequency) and direct current comparators are covered. Numerous applications and instruments utilizing current comparators are described. The book will serve both as tutorial material for the uninitiated and as a reference volume for the expert.

000,858
PB90-187535 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
**Stability of High Quality Quartz Crystal Oscillators:
An Update.**

Final rept.
M. B. Bloch, J. C. Ho, C. S. Stone, A. Syed, and F. L. Walls. 1989, 5p
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p80-84.

Keywords: *Quartz resonators, *Crystal oscillators, *Frequency stability, Random noise, Reprints, Allan variance, Flicker noise, Phase noise.

Recently, two specially modified low-level, high-quality 5 MHz quartz oscillators were tested for spectral purity and stability at the National Institute of Standards and Technology. Such oscillators can exhibit parts-in-10 to the 14th power flicker floor stability in high precision quartz, frequency-source applications. Extensive details of measurement methodology are given.

000,859
PB90-205816 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Technology Div.
Classical Phase Diffusion in Small Hysteretic Josephson Junctions.

Final rept.
J. M. Martinis, and R. L. Kautz. 1989, 4p
Grant N00014-88-F-0077
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Physical Review Letters 63, n14 p1507-1510, 2 Oct 89.

Keywords: *Josephson junctions, Microwave frequencies, Brownian movement, Simulation, Reprints, Phase diffusion, Critical current.

The existence of classical phase diffusion in hysteretic junctions is demonstrated by quantitative agreement between experimental and simulated I-V curves. The simulations are based on a circuit that accurately models both the junction and its external shunting impedance at microwave frequencies. It is shown that the bias current at which the junction switches from the phase-diffusion state to the voltage state is sensitive to dissipation at microwave frequencies.

000,860
PB90-205923 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Electricity Div.
Comparisons of the NML (National Measurement Laboratory) and NIST (National Institute of Standards and Technology) Representations of the Ohm Using Transportable 1 Omega, 10 k Omega, 10 pF, and Quantized-Hall-Resistance Standards.

Final rept.
P. C. Coogan, B. W. Ricketts, G. W. Small, M. E. Cage, R. F. Dziuba, and J. Q. Shields. 1989, 6p
Pub. in Metrologia 26, p229-234 1989.

Keywords: *Engineering standards, *Electrical resistivity, Comparison, Accuracy, Methodology, Capacitors, Resistors, Transport properties, Quantum electronics, Measurement, Reprints.

Ohm representations of the National Measurement Laboratory in Australia and the National Institute of Standards and Technology in the United States have been compared by four different methods. The methods involved the transport and intercomparison, over a fifteen-month time period, of three 1 ohm resistors on two occasions, one 10 k ohm resistor, three 10 pF capacitors on two occasions, and one quantized Hall device. The excellent agreement of the comparisons of the ohm representations omega(NML) and omega(NIST) obtained by the four methods provides rigorous tests of the accuracies of fifteen different measurement systems used at the two laboratories. The weighted mean of the difference between omega(NML) and omega(NIST) was found to be (1.3664 + and - 0.0081) ppm for 1 January 1986.

000,861
PB90-209578 PC A03/MF A01

National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electrosystems Div.
Special Test and Evaluation Methods Used for a Nine-Axis Accelerometer.
J. D. Ramboz. Oct 89, 39p NISTIR-89/4195
Contract DOT-HS-01709
Sponsored by National Highway Traffic Safety Administration, Washington, DC.

Keywords: *Accelerometers, *Miniaturization, Measuring instruments, Crash tests, Vibration, Transducers, Graphs(Charts), Sensitivity, Performance tests, Rotating bodies, Calibrating.

The test methods used to characterize and evaluate the performance of a miniature nine-axis accelerometer are discussed. A special transducer containing nine separate linear accelerometers were examined. The intended application for this type of device is to derive angular acceleration data for dynamic head motion measurements relating to automobile crash studies. The accelerometers, amplifiers, multiplexer, frequency modulation telemetry transmitter and power supply are all to be molded into an athletic orthodontic mouthpiece and data will be obtained from measurements taken from boxer's head motions. The transducer parameters tested include axial and transverse linear vibration sensitivities, equivalent acceleration noise, effects of power supply voltage variations, and mouthpiece vibration transmissibility. Special test apparatus described includes a dual centrifuge and a dual spin-axis rate-table. Test philosophy and some test results are used to illustrate how apparently conflicting test results can be used to explain transducer performance under test conditions of combined environments.

000,862
PB91-120147 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Calibration Procedures for Inductance Standards Using a Commercial Impedance Meter as a Comparator.
Y. M. Chang, and S. B. Tillett. Nov 90, 28p NISTIR-4466

Keywords: *Standards, Electrical measurement, Electrical impedance, Comparison, *Inductance standards, *Calibration, Maxwell-Wien bridges, Impedance measurement.

Procedures for calibrating customers' inductance standards using a commercial impedance meter to compare them with NIST inductance standards by a substitution method are reported. These procedures are based on a six-month evaluation of the meter by measuring a group of six NIST inductance standards of different values at a frequency of 1 kHz. For each inductance standard, the results of measurements with the meter and the Maxwell-Wien bridge, which is used to realize the henry at NIST, are analyzed to determine the stabilities of the standards and the impedance meter as well as to estimate the random transfer uncertainty of the meter measurements. Values of inductance obtained using the Maxwell-Wien bridge are compared with corresponding values of inductance obtained with the meter by substituting customers' inductance standards with the six NIST standards over a period of six months. The statistical analyses used to assure that measurements made using such procedures are in control are described, as well as future plans to expand the substitution technique to include other values of inductance standards at various frequencies.

000,863
PB91-134361 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Technology Div.
Fabrication of Ultrasmall Nb-AIOx-Nb Josephson Tunnel Junctions.
Final rept.
J. M. Martinis, and R. H. Ono. 1990, 3p
Contract N00014-88-F-0077
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Applied Physics Letters 57, n6 p629-631, 6 Aug 90.

Keywords: *Josephson junctions, Aluminum oxide, Niobium, Capacitance, Fabrication, Reprints.

The authors describe a fabrication process to make Nb-AIO(x)-Nb edge junctions with areas as small as 0.0022 square micrometers and with current densities from 10 to 24 000 A/sq cm. The junction conductance was low for voltages below the superconducting

energy gap which indicates good quality tunnel barriers. Coulomb gap measurements obtained when the junctions were in the normal state were used to find the junction capacitance. Junction capacitance as small as 0.18 fF has been measured.

Semiconductor Devices

000,864
AD-A169 652/5 PC A02/MF A01
Stanford Univ., CA.
Report on an Interlaboratory Electromigration Experiment.
H. Schafft, T. Grant, J. Mandel, and J. Shott. Jun 86, 12p

Keywords: *Integrated circuits, *Metallizing, Separation, Failure(Mechanics), Ionic current, Reproducibility, Chips(Electronics), Wafers, Profilmeters, *Electromigration, *Very large scale integration, Kelvin resistance.

Electromigration is a metallization failure mechanism that is of concern for Very Large Scale Integration reliability. Ambiguities exist in the electromigration characterization of metallizations. These ambiguities are, in general, due to the different test structures and measurement methods used and to the incomplete reporting of the results from such characterizations. An interlaboratory experiment has been organized to address this problem. The purpose of the experiment is to assess the reproducibility of electromigration characterizations and to establish the technical base needed to develop guidelines for the design of electromigration test structures, for methods to measure the median time to failure of metallizations, and for reporting characterization measurements.

000,865
PB90-132721 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, April to June 1989, with 1989 CEEE Events Calendar.
E. J. Walters. Oct 89, 33p NISTIR-89/4181
See also PB89-228308.

Keywords: *Electrical engineering, *Abstracts, Electromagnetic interference, Semiconductor devices, Antennas, Lasers, Microwaves, Fiber optics, Superconductors, Instruments, *Center for Electronics and Electrical Engineering, National Institute of Standards and Technology.

The report is the twenty-seventh issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue covers the following second quarter of calendar year 1989 events: Semiconductor technology program; Signals & systems metrology program; Fast signal acquisition, processing, & transmission; Electrical systems; and Electromagnetic interference.

000,866
PB90-136615 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Semiconductor Electronics Div.
Electrical Characterization of Beta Silicon Carbide MIS (Metal-Insulator-Semiconductor) Capacitors with Thermally Grown or Chemical-Vapor Deposited Oxides.
Final rept.
J. J. Kopanski, and D. B. Novotny. 1989, 2p
Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.
Pub. in Proceedings of Fall Meeting of the Electrochemical Society, Extended Abstracts, Hollywood, FL., October 15-20, 1989, p722-723.

Keywords: *Capacitors, *Silicon carbides, *Vapor deposition, Oxides, Oxide coatings, Silicon inorganic compounds, Semiconductor devices, Coating processes, *MIS(Semiconductors).

Metal-Insulator-Semiconductor capacitors were fabricated on beta silicon carbide single crystals. The insu-

lating layers were thermally grown oxides or chemical-vapor-deposited oxides. Various oxidation conditions and post-deposition densification treatments were investigated. Capacitors were characterized by capacitance-voltage measurements. The effects of measurement frequency, voltage sweep rate, illumination, and temperature (to 300C) on the C-V response were determined. Interface trap distributions were estimated from the high-frequency capacitance. Oxide fixed charges were 5 to 9 x 10 sup 11/sq cm and interface trapped charge density at mid-gap levels was 0.5 to 2.0 x 10 sup 11/sq cm/eV.

000,867

PB90-152513

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Selected-Area Channeling Pattern and Defect Etch Study of Silicon Implanted with Oxygen.

Final rept.

P. Roitman, and G. E. Davis. 1988, 3p

Sponsored by Defense Nuclear Agency, Washington, DC.

Pub. in Microbeam Analysis, p456-458 1988.

Keywords: *Silicon, *Oxygen, *Defects, *Chemical etching, Thin films, Silicon dioxide, Semiconducting films, Reprints, *Ion implantation, *SIMOX, *Electron channeling, Scanning electron microscopy.

Silicon films on buried oxide layers formed by oxygen implantation have been studied using selected area channeling patterns and chemical etching. Neither technique provides the detailed information on defect morphology available from cross sectional TEM, but both techniques appear capable of providing useful information on defect densities. Sample preparation is certainly easier for both than for TEM, and the channeling pattern approach is non-destructive. There is some promise that they can be extended to the case of lower defect densities, although it is not clear how far. The analysis of the channeling pattern data and the correlation of that analysis with film quality needs to be more firmly established.

000,868

PB90-170960

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Relationship between Accelerating Voltage and Electron Detection Modes to Linewidth Measurement in an SEM (Scanning Electron Microscope).

Final rept.

M. T. Postek, W. J. Keery, and R. D. Larrabee. 1988, 9p

Pub. in Scanning 10, n1 p10-18 Jan/Feb 88.

Keywords: *Integrated circuits, *Dimensional measurement, *Line width, *Metrology, Electron scattering, Backscattering, Reprints, *Scanning electron microscopy, *Very large scale integration, *VHSIC(Circuits), *Very high speed integrated circuits, Secondary electrons.

The basic premise underlying the use of the scanning electron microscope (SEM) for linewidth metrology in semiconductor research and production applications is that the video image acquired, displayed, analyzed, and ultimately measured accurately reflects the structure of interest. However, it has been clearly demonstrated that image distortions can be caused by the detected secondary electrons not originating at the point of impact of the primary electron beam and by the type and location of the secondary electron detector. These effects and their contributions to the actual image or linewidth measurement have not been fully evaluated. The basic intent of this work is to demonstrate the magnitude of the errors introduced by beam/specimen interactions and the mode of signal detection at a variety of beam acceleration voltages and to discuss their relationship to precise and accurate metrology.

000,869

PB90-187501

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Three Dimensional Modeling of Optical Microlithography for Positive Photoresists.

Final rept.

E. Barouch, B. Bradie, H. Fowler, and S. V. Babu.

1989, 14p

Sponsored by National Science Foundation, Washington, DC., and Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in Proceedings of KTI Microelectronics Seminar, San Diego, CA., November 6-7, 1989, p123-136.

Keywords: *Lithography, *Mathematical models, Integrated circuits, Microelectronics, Simulation, Algorithms, Reprints, *Microlithography, *Photoresists, Three-dimensional calculations.

A three dimensional planar substrate positive photoresist simulation process in optical microlithography is presented. The system includes components for the calculation of the aerial image, the exposure-bleaching of the resist material, and the dissolution process. Standard computational techniques are being employed for the aerial image. The exposure model uses a continuum approximation of the Berning's field equation in conjunction with a suitably chosen WKB approximation. The local mathematical equivalence of the solent diffusion system to the front propagation described by the eikonal system is employed by the dissolution algorithm. The algorithm does not produce shock waves or discontinuities in the developed profiles.

000,870

PB90-187642

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Small Signal Modeling of the MOSOS Capacitor.

Final rept.

M. Gaitan, and P. Roitman. 1989, 2p

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) SOS/SOI Technology Conference, Stateline, NV., October 3-5, 1989, p48-49.

Keywords: *Capacitors, Semiconductors(Materials), Semiconductor devices, Capacitance, Models, Reprints, *Metal oxide semiconductor.

The high frequency and quasi-static capacitance of an MOS capacitor on a layer of insulator (MOSOS) has been modeled using numerical solution by perturbation analysis of the basic semiconductor equations.

000,871

PB90-188525

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Interface Trap Effects on the Hot-Carrier Induced Degradation of MOSFETs (Metal Oxide Semiconductor Field Effect Transistors) during Dynamic Stress.

Final rept.

J. S. Suehle, T. J. Russell, and K. F. Galloway. 1987, 7p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-34, n6 p1359-1365 1987.

Keywords: *Dynamic hardness tests, *Static hardness tests, Degradation, Reprints, *MOSFET, Radiation hardening, Interface traps.

Foundry and hardened n-channel MOSFETs were stressed with dynamic AC pulses and with static DC voltages. The pre-rad hot-carrier induced degradation is much more severe in the dynamic case than in the static case for the hardened devices. The data suggest that the pre-radiation hot-carrier degradation is strongly influenced by the relative density of interface traps and by the pulse structure. The post-radiation hot-carrier degradation is mainly influenced by the amount of radiation induced fixed oxide charge.

000,872

PB90-192675

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Temperature Induced Rebound in Power MOSFETs.

Final rept.

G. Singh, K. F. Galloway, and T. J. Russell. 1987, 6p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Nuclear Science NS-34, n6 p1366-1371 Dec 87.

Keywords: Isothermal annealing, Radiation effects, Field effect transistors, Reprints, *MOSFET, *Threshold rebound.

Enhancement mode n-channel power MOSFETs were investigated for rebound. They received 300 krad(Si) gamma dose under positive gate bias with source and drain grounded. The irradiated transistors were thermally annealed with all terminals shorted or under positive gate bias with drain and source shorted, at

temperatures from 60 C to 150 C. Threshold voltage rebound was observed for some transistor types under certain experimental conditions.

000,873

PB90-218124

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Investigation of Photoconductive Picosecond Microstripline Switches on Self-Implanted Silicon on Sapphire (SOS).

Final rept.

P. Polak-Dingles, G. Burdge, C. H. Lee, A. C.

Seabaugh, R. T. Brundage, M. I. Bell, and J. Albers. 1987, 3p

Pub. in Proceedings of Topical Meeting on Picosecond Electronics and Optoelectronics Conference, Incline Village, NV., January 14-16, 1987, p79-81.

Keywords: Electrical resistivity, Radiation damage, Photoconductivity, Reprints, *SOS(Semiconductors), Amorphous silicon, Microstrip devices, Ion implantation, Picosecond time, Silicon ions, Raman effect.

Silicon and sapphire switches, damaged by implantation with 270 keV Si ions at fluence levels of 10 to the 12th power to 2 x 10 to the 15th power per sq cm, have been characterized by picosecond cross-correlation, Raman, and resistivity measurements. Response times as short as 9 ps were measured for an implant dose of 10 to the 14th power. Raman measurements indicate amorphous silicon is not formed until the dose reaches 2 x 10 to the 15th power per sq cm, but there is no further decrease in response time at the higher doses. The resistivity peaks at the same dose level the minimum response time is observed, and then decreases for higher dose. The mobility decreases monotonically with increasing implant dose. The authors found that the optimum implantation condition is one that produces heavy damage in the material without fully amorphizing the silicon. Amorphization decreases the on/off ratio of the device through reduction of both dark resistance and mobility, without increasing the speed of the device.

000,874

PB90-241399

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Test Structure Data Classification Using a Directed Graph Approach.

Final rept.

M. W. Cresswell, D. Khera, L. W. Linholm, and C. E. Schuster. 1990, 6p

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Microelectronic Test Structures, San Diego, CA., March 5-7, 1990, p193-198.

Keywords: *Classifying, *Semiconductor devices, *Graph theory, Wafers, Tests, Acceptability, Product development, Diagnostic routines, Reliability, Reprints, *Expert systems, Knowledge bases(Artificial intelligence).

The paper introduces directed graph techniques to serve as an expert system rule generator by classifying selections of tested wafers into groups based on similarities of the spatial distributions of their parametric test structure measurements. The rules can be used to supplement rules derived by other means for diagnostic process analysis, work-in-process wafer screening, and yield and reliability management.

000,875

PB90-257718

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

MIS Capacitor Studies on Silicon Carbide Single Crystals: Final Report for May 8, 1989 to November 8, 1989.

J. J. Kopanski. Jul 90, 43p NISTIR-4352

Contracts NASA-C-30018-M, NASA-C-30007-K

Sponsored by National Aeronautics and Space Administration, Cleveland, OH. Lewis Research Center.

Keywords: *Silicon carbides, Electrical properties, Capacitance, Single crystals, Cubic lattices, Semiconductor traps, *MIS capacitors, Deep level transient spectroscopy, Electrical conductivity, Voltage, High temperature.

In this continuation of previous work, cubic SiC metal-insulator-semiconductor (MIS) capacitors with thermally grown or chemical-vapor-deposited (CVD) insu-

lators were characterized by capacitance-voltage (C-V), conductance-voltage (G-V), and current-voltage (I-V) measurements. The purpose of these measurements was to determine the four charge densities commonly present in a MIS capacitor (oxide fixed charge, $N(f)$; interface trap level density, $D(it)$; oxide trapped charge, $N(ot)$; and mobile ionic charge, $N(m)$) and to determine the stability of the device properties with electric-field stress and temperature. The section headings in the report include the following: Capacitance-voltage and conductance-voltage measurements; Current-voltage measurements; Deep-level transient spectroscopy; Conclusions (Electrical characteristics of SiC MIS capacitors).

000,876

PB90-269564 PC A05/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Semiconductor Measurement Technology: Thermal Resistance Measurements.

Special pub. (Final).

F. F. Oettinger, and D. L. Blackburn. Jul 90, 79p

NIST/SP-400/86

Also available from Supt. of Docs. as SN003-003-03035-0.

Keywords: *Integrated circuits, *Field effect transistors, *Thermal resistance, Electrical measurement, Computerized simulation, Infrared radiation, *Bipolar transistors, *MOSFET, *Very large scale integration, Infrared inspection.

The Special Publication reviews the thermal properties of power transistors and integrated circuits and discusses methods for characterizing these properties. The discrete devices discussed include bipolar transistors and metal-oxide-semiconductor field-effect-transistors. Measurement problems common to these devices, such as deciding the reason for requiring a particular measurement, adequate reference temperature control, selection of a temperature-sensitive electrical parameter, and separation of electrical and thermal effects during measurement are addressed. Due to the inherent difficulties in measuring and analyzing the thermal properties of active integrated circuits, an approach using specifically designed thermal test chips for evaluation of new die-attachment and packaging schemes is finding wide acceptance in the industry. In this Special Publication, indirect (i.e., electrical) measurements, direct (e.g., infrared) measurements, and computer simulation techniques for thermally characterizing integrated circuits are discussed in terms of their usefulness in characterizing VLSI packages.

000,877

PB90-271107

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Physics for Numerical Simulation of Silicon and Gallium Arsenide Transistors.

Final rept.

H. S. Bennett, and J. R. Lowney. 1990, 17p

Pub. in Solid-State Electronics 33, n6 p675-691 1990.

Keywords: Computerized simulation, Semiconductor doping, Charge carriers, Energy bands, Gallium arsenides, Reprints, *Silicon transistors, *Gallium arsenide transistors, Bipolar transistors, Metal oxide semiconductors.

The motivation for using computers to simulate the electrical characteristics of transistors is discussed. The authors' work and that of others in the area of device physics and modeling is described. The authors compare conventional device physics with an alternative approach to device physics that is more directly traceable to quantum-mechanical concepts. The authors then apply this new approach to quasi-neutral regions, space-charge regions, and regions with high levels of carrier injection. The limits for using theoretical results from uniform media in numerical simulations of devices with large concentration gradients are discussed. New calculations of the effective intrinsic carrier concentrations for gallium arsenide and silicon are also given. The authors conclude with examples of applying quantum-mechanically-based device physics to energy band diagrams for heterojunction bipolar transistors, MOS capacitors, and homojunction bipolar transistors.

000,878

PB90-271446

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Not available NTIS

Fabrication of Thin, Freestanding, Single-Crystal, Semiconductor Membranes.

Final rept.

K. C. Lee. 1990, 10p

Pub. in Jnl. of the Electrochemical Society 137, n8 p2556-2574 Aug 90.

Keywords: *Membranes, Single crystals, Semiconductor films, Microwave equipment, Gallium arsenides, Silicon, Etching, Dissolving, Wafers, Reviews, Reprints.

Freestanding, single-crystal, semiconductor membranes with thicknesses in the range of a few tens of nanometers to tens of micrometers are of increasing technological interest today. Their applications range from high speed electronic devices to electromechanical devices and pressure sensors. The review paper identifies two general classes of techniques for producing such thin membranes: dissolution of single-crystal wafers, and direct growth of single-crystal membranes. Numerous specific techniques in each general class are discussed. The discussion of each technique includes a brief explanation of the reason why it works, a description of the actual experimental implementation, an analysis of the range of thickness that can be produced, and the crystalline and electrical quality of the membranes. Unusual difficulties with implementing a technique, or special advantages of a technique are also noted. Since this review is intended to aid in the selection of a technique for producing thin semiconductor membranes when one has a particular application in mind, note is made of those applications for which the membranes produced with each technique are particularly well suited.

000,879

PB91-101352

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

New Method of Extracting the Channel Length from the Gate Current of p-Channel MOSFETs.

Final rept.

J. S. Kim. 1990, 12p

Pub. in Solid-State Electronics 33, n8 p1097-1107 1990.

Keywords: *Metal oxide transistors, Electrical measurement, Electron tunneling, Carrier mobility, Field effect transistors, Capacitance, Resistance, Accuracy, Gates(Circuits), Experimental data, Semiconductors(Materials), Reprints, *MOSFET.

A new method for determining the channel length of p-channel MOSFETs is proposed and experimentally tested. The method is based on the relationship between the channel area and the body-to-gate current in the Fowler-Nordheim tunneling regime. The new method provides an alternative to conventionally used techniques, namely, the channel-conductance and the gate-capacitance methods, since it circumvents measurement interferences due to the parasitics encountered in these methods.

000,880

PB91-107193

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Semiconductor Technology for the Non-Technologist, Second Edition.

R. I. Scace. Sep 90, 39p NISTIR-4414

Keywords: *Semiconductor devices, Integrated circuits, Processing, Assembling, Process control, Transistors, Semiconductor diodes, Thyristors, Silicon, Reviews, *Semiconductors, Uses.

The properties of semiconductor materials, the methods of processing them, and the solid-state products made from them are described in terms intended to be understandable by the lay person. The semiconductor industry has grown at a rate of 21% per year compounded for the last twenty years, and its products have declined in unit cost by a factor of five in current dollars (a factor of ten in constant dollars) in the same period. This very satisfactory but anomalous behavior has attracted the interest of many who are not familiar with the technology of the industry, yet who need to have some understanding of it. The report is intended to help meet that need.

000,881

PB91-107201

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

PC A03/MF A01

Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, January-March 1990, with 1990 CEEE Events Calendar.

J. A. Gonzales. Sep 90, 24p NISTIR-4423

See also PB90-265232.

Keywords: *Semiconductor devices, *Metrology, *Research, Electronics, Electrical engineering, Electromagnetic interference, Integrated circuits, Antennas, Silicon, Waveforms, Electrooptics, Superconductors, National Institute of Standards and Technology.

The twenty-fourth issue of the quarterly publication provides information on the technical work of the National Institute of Standards and Technology (NIST) Center for Electronics and Electrical Engineering (CEEE). It covers the first quarter of calendar year 1990. Abstracts are provided by technical area for papers published during the quarter.

000,882

PE 91-07367

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Turn-Off Failure of Power MOSFET's.

Final rept.

D. L. Blackburn. 1987, 7p

See also PB86-132610.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Electronics PE-2, n2 p136-142 Apr 87.

Keywords: *Metal oxide transistors, *Field effect transistors, Failure, Reprints, *MOSFET, Bipolar transistors, Second breakdown, Turn-off.

Experimental results of the failure of power MOSFET's during inductive turn-off are discussed. The electrical characteristics of these devices during failure are shown to be identical to those of a bipolar transistor undergoing second breakdown. Other comparisons of the power MOSFET failure and bipolar second breakdown are made. A nondestructive measurement system is used that allows repeated measurements of the failure characteristics as a function of various parameters to be made on a single device. It is shown that commercially available power MOSFET's do not fail as a result of dV/dt currents. Drain voltage slew rates up to 22 V/ns were studied. Other measurements show that the drain voltage at which failure occurs increases with temperature, the critical current above which failure occurs decreases with temperature, and the magnitude of the load inductance has no effect on the failure. The results of the study are consistent with the theory that activation of the parasitic bipolar transistor initiates the power MOSFET failure during turn-off.

000,883

PB91-107409

National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Performance Trade-Off for the Insulated Gate Bipolar Transistor: Buffer Layer versus Base Lifetime Reduction.

Final rept.

A. R. Hefner, and D. L. Blackburn. 1987, 14p

See also PB87-134896.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Electronics PE-2, n3 p194-207 Jul 87.

Keywords: Mathematical models, Performance, Reprints, *Bipolar transistors, One-dimensional calculations, Tradeoffs, Lifetime.

A one-dimensional analytic model for the insulated gate bipolar transistor (IGBT), which includes a high-doped buffer layer in the low-doped bipolar transistor base, is developed. The model is used to perform a theoretical trade-off study between IGBT's with and without the buffer layer. The study is performed for devices of equal breakdown voltages, and the critical parameters chosen to 'trade-off' are turn-off switching energy loss (related to turn-off time) and on-state voltage, both at a given current. The results of the model predict that for equal breakdown voltages an optimized device with a buffer layer has less switching energy loss for a given on-state voltage than an optimized device with no buffer layer.

000,884

PB91-111963

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **High-Precision Optical Reflectometer for the Study of Semiconductor Materials and Structures.** Final rept.
M. I. Bell, and D. A. McKeown. 1990, 4p
Contract DNA-IACRO-88-800
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Review of Scientific Instruments 61, n10 p2542-2545 Oct 90.

Keywords: *Optical reflectometers, *Reflectometers, Silicon dioxide, Thin films, Performance, Design, Reprints, *Semiconductors, Ellipsometry, Multilayers, Silicon on insulator, Ion implantation.

The design and performance of a high-precision optical reflectometer are described. This instrument has been optimized for measuring the specular reflectivity of thin films and multilayer structures of interest in semiconductor technology. Its design emphasizes high spectral and spatial resolution, photometric accuracy, and stray light rejection. Use of a spectrometer drive linear in wavenumber (energy) and a flexible data acquisition system facilitates data analysis. The performance of the reflectometer is demonstrated using a set of specimens consisting of silicon-dioxide layers on silicon substrates for which the oxide thicknesses had been determined by ellipsometry. Excellent agreement is obtained between the thicknesses derived from the reflectivity spectra and those determined ellipsometrically.

000,885

PB91-112235 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **Investigation of the Threshold Voltage of MOS-FETs with Position- and Potential-Dependent Interface Trap Distributions Using a Fixed-Point Method.** Final rept.
M. Gaitan, I. D. Mayergoyz, and C. E. Korman. 1990, 8p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 37, n4 p1031-1038 Apr 90.

Keywords: *Metal oxide transistors, *Field effect transistors, Fixed points(Mathematics), Mathematical models, Reprints, *MOSFET, *Threshold voltage.

Simulation results are presented for a MOSFET with position and energy (potential) dependent interface trap distributions which may be typical for devices subjected to interface trap producing processes such as hot-electron degradation. The interface trap distribution is modeled as a Gaussian peak at a given position along the channel while the energy dependence is derived from C-V measurements from an MOS capacitor exposed to ionizing radiation. A novel fixed-point technique is used to solve the two-dimensional boundary-value problem. The technique is shown to be globally convergent for arbitrary distributions of interface traps. A comparison of the convergence properties of the Newton and fixed-point methods is presented, and it is shown that for some important cases the Newton technique fails to converge while the fixed-point technique converges with a geometric convergence rate.

000,886

PB91-112268 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **Materials Problems Affecting Reliability and Yield of Wire Bonding in VLSI (Very Large Scale Integration) Devices.** Final rept.
G. G. Harman, and C. L. Wilson. 1989, 13p
Pub. in Proceedings of MRS Symposium on Electronic Packaging Materials Science IV, San Diego, CA., April 24-28, 1989, v154 p401-413.

Keywords: *Integrated circuits, *Reliability(Electronics), Gold intermetallics, Microelectronics, Metal films, Failure, Yield, Reprints, *Very large scale integration, *Wire bonds, Aluminum intermetallics, Silver intermetallics.

Materials problems have always been a significant cause of wire bond failures in microelectronics. However, modern VLSI materials, processing, and packaging methods combined often result in new or masked versions of old failure mechanisms. The paper describes the classical Au-Al intermetallic compound

problem as described by a new two-dimensional finite element diffusion model, and demonstrates that diffusion in poor welds is more rapid than in bulk couples. Failures resulting from modern bonding material couples (e.g., Cu-Au, Al-Ag, etc.) can result in bond failures superficially resembling Au-Al type failures. Failures resulting from bonds made to contaminated gold electroplated films are described, and a new failure model resulting from hydrogen in these films is shown.

000,887

PB91-112276 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **Investigation of the Drive Circuit Requirements for the Power Insulated Gate Bipolar Transistor (IGBT).** Final rept.
A. R. Hefner. 1990, 12p
Pub. in Proceedings of the Annual Power Electronics Specialists Conference (PESC '90) (21st), San Antonio, TX., June 11-14, 1990 p126-137.

Keywords: Mathematical models, Reprints, *Bipolar transistors.

The drive circuit requirements of the Insulated Gate Bipolar Transistor (IGBT) are explained with the aid of an analytical model. It is shown that non-quasi-static effects limit the influence of the drive circuit on the time rate-of-change of anode voltage. Model results are compared with measured turn-on and turn-off waveforms for different drive, load, and feedback circuits and for different IGBT base lifetimes.

000,888

PB91-112409 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **Persistent Photoconductivity in SIMOX Film Structures.** Final rept.
S. Mayo, J. R. Lowney, P. Roitman, and D. B. Novotny. 1990, 5p
Contract DNA-IACRO-88-800
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Jnl. of Applied Physics 68, n7 p3456-3460, 1 Oct 90.

Keywords: *Photoconductivity, Film resistors, Thin films, Silicon dioxide, Reprints, Photoinduced transient spectroscopy, Silicon films.

Photoinduced transient spectroscopy (PITS) was used to measure the persistent photoconductive (PPC) response in n-type separation by implanted oxygen (SIMOX) film resistors. A broadband, single-shot, flashlamp-pumped dye laser pulse was used to photoexcite interband electrons in the film, and the excess carrier population decay was measured at temperatures in the 60-220-K range. The PPC signals exhibit nonexponential character and the conductivity transients are recorded as a function of temperature for variable periods up to 30 s. The photoconductive data are analyzed by using the Queisser and Theodorou potential barrier model, and a logarithmic time-decay dependence is confirmed for the first time in SIMOX material. The hole-trap density at the conductive-film-buried-silica interface is calculated to be in the high 10 to the 15 power/cc to low 10 to the 16 power/cc range. The sensitivity of PITS is demonstrated to be appropriate for characterization of the SIMOX interface structure and for material qualification.

000,889

PB91-112821 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **Semiconductor Measurement Technology: A Programmable Reverse-Bias Safe Operating Area Transistor Tester.** Special pub. (Final).
D. W. Berning. Aug 90, 62p NIST/SP-400/87
Also available from Supt. of Docs.

Keywords: *Transistors, *Test equipment, Schematic diagrams, Electrical measurement, Breakdown(Electronic threshold), Second breakdown.

The circuits and construction of a transistor turn-off breakdown tester are described. Principles of operation for various circuits in the tester are discussed, as well as those for the complete system. Construction notes are given with layout guidelines. Included are complete circuit schematics and details of construc-

tion of special parts used in the tester. Specifications and performance data are also given in the document.

000,890

PB91-133967 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Semiconductor Electronics Div. **Nondestructive Characterization of Oxygen-Ion-Implanted Silicon-on-Insulator Using Multiple-Angle Ellipsometry.** Final rept.
P. Dutta, G. A. Candela, D. Chandler-Horowitz, J. F. Marchiando, and M. C. Peckerar. 1988, 3p
Pub. in Jnl. of Applied Physics 64, n5 p2754-2756 1988.

Keywords: Annealing, Wafers, Reprints, *Silicon on insulator, Ion implantation, Oxygen ions, Ellipsometry.

Silicon-on-insulator formed by high-dose and high-energy oxygen ion implantation in silicon, SIMOX, has been characterized nondestructively by multiple-angle ellipsometry using a He-Ne laser at 632.8 nm. A multilayered model exhibiting two interlayers, one between the top silicon and the buried oxide and the other between the buried oxide and the substrate silicon, offers a good representation of SIMOX. The distinction between low-temperature furnace anneal (1150 C) and high-temperature rapid thermal anneal (1150 C + 1350 C) on as-implanted wafers is manifested in terms of the optical properties of these transition regions. It is shown that the agreement between the theoretical model and the experimental results improves for the high-temperature annealed SIMOX.

000,891

PB91-134346 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div. **Comments on 'Improved Calibration and Measurement of the Scattering Parameters of Microwave Integrated Circuits'.** Final rept.
R. Marks. 1990, 1p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Microwave Theory and Techniques 38, n4 p453 Apr 90.

Keywords: *Integrated circuits, Network analyzers, Electrical measurement, Electromagnetic scattering, Reprints, *Microwave circuits, Calibration.

The letter is a response to the paper 'Improved Calibration and Measurement of the Scattering Parameters of Microwave Integrated Circuits,' which proposes an 'improved' version of the earlier TRL and LRL schemes for network analyzer calibration. It argues that the proposal is not an improvement but in fact simply an alternative formulation of the earlier procedures.

000,892

PB91-134353 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div. **Wafer-Level ANA Calibrations at NIST (National Institute of Standards and Technology).** Final rept.
R. Marks, and K. Phillips. 1989, 14p
Pub. in Proceedings of ARFTG Conference Digest (34th), Ft. Lauderdale, FL., November 30-December 1, 1989, 14p.

Keywords: *Integrated circuits, *Wafers, Transmission lines, Network analyzers, Metrology, Algorithms, Reprints, *Calibration, US NIST.

The National Institute of Standards and Technology has begun a program supporting on-wafer scattering parameter measurements. In contrast to many previous NIST endeavors, the program seeks to transfer methodology into industrial measurement laboratories. The subject of the paper is the development of calibration techniques and algorithms, rather than physical standards, for the measurement of on-wafer scattering parameters. In particular, the authors discuss a TRL-based method which uses transmission lines as standards, but includes redundant measurements to improve calibration accuracy and bandwidth.

000,893

PB91-134965 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

On-Wafer Microwave Standards at NIST.

Final rept.
D. Williams. 1990, 6p
Pub. in Proceedings of ARFTG Conference Digest (34th), Ft. Lauderdale, FL., November 30-December 1, 1989, p5-10 1990.

Keywords: *Integrated circuits, *Standards, *Wafers, Transmission lines, Scattering, Reprints, Probes(Electromagnetic), Microwave circuits, Calibration, US NIST.

The National Institute of Standards and Technology has begun a program to develop standards and calibration services for microwave wafer-level probing systems. The standards will be based on planar transmission lines and are designed to support measurements between 1 and 40 GHz. The program objectives, organization, and plans are discussed.

General

000,894
PATENT-4 963 523 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.

High-Tc Superconducting Unit Having Low Contact Surface Resistivity and Method of Making.
Patent.

J. W. Ekin, A. J. Panson, and B. A. Blankenship.
Filed 6 Nov 87, patented 16 Oct 90, 5p PB91-100503, PAT-APPL-7-117 259
Supersedes PB88-167960.

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Electric contacts, *Superconductors, Electrical resistivity, Copper, Silver, Gold, *High temperature superconductors, Yttrium barium cuprates.

A low resistivity contact to a high-T(c) superconductor is made by forming a contact pad on the surface of an abraded or freshly prepared superconductor by depositing an inert metal on the surface so that a surface resistivity between the surface of the high-T(c) superconductor and the pad is established of less than about 1000 microhm-cm squared at high-T(c) superconductor operating temperatures.

000,895
PB90-136300 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.

Theory and Measurements of Unintentional Radiators.
Final rept.

M. T. Ma. 1988, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Tsukuba, Japan, June 7-10, 1988, p30-31.

Keywords: *Electromagnetic radiation, *Electrical faults, *Emission, Dipole moments, Electric moments, Magnetic moments, Measurement.

By characterizing an unknown emitter with equivalent vector electric- and magnetic-dipole moments, a theoretical basis to express the radiation properties of such an emitter in terms of these unknown dipole moments. Power and relative phase measurements from appropriate ports of a transverse electromagnetic (TEM) cell when the emitter is placed at the cell's center are proven to be sufficient to determine quantitatively the unknowns and therefore, the radiation characteristics.

000,896
PB90-163635 PC A06/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Bibliography of the NIST (National Institute of Standards and Technology) Electromagnetic Fields Division Publications.

R. M. Lyons, and K. A. Gibson. Sep 89, 119p
NISTIR-89/3920
Also available from Supt. of Docs. Supersedes PB89-189211.

Keywords: *Electromagnetic fields, *Bibliographies, Antennas, Dielectric properties, Electromagnetic inter-

ference, Microwaves, Metrology, Electromagnetic noise, Remote sensing, Waveforms, Radiation hazards, Time domain, National Institute of Standards and Technology.

The bibliography lists the publications by the staff of the Electromagnetic Fields Division of the National Institute of Standards and Technology for the period January 1970 through August 1989. It supersedes NISTIR 88-3900 which listed the publications of the Electromagnetic Fields Division from January 1970 through August 1988. Selected earlier publications from the Division's predecessor organizations are included. Topics discussed include Antennas, Dielectric measurements, Electromagnetic interference, Microwave metrology, Noise, Remote sensing, Time domain, Waveform metrology, and Miscellaneous.

000,897
PB90-169376 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

NIST (National Institute of Standards and Technology) Helps Navy Define Data Needed to Produce Hybrid Microcircuit Assemblies.

Final rept.
T. F. Leedy. 1990, 1p
Pub. in Inside ISHM 17, n1, 17, Jan/Feb 90.

Keywords: *Data, *Specifications, Microelectronics, Reprints, *Microcircuits, *Format, Computer aided design, Computer aided manufacturing, National Institute of Standards and Technology, Automated Manufacturing Research Facility, Microelectronic circuits.

The National Institute of Standards and Technology (NIST) Electrosystems Division of the Center for Electronics and Electrical Engineering and the NIST Automated Manufacturing Research Facility of the Center for Manufacturing Engineering have started a three-year program entitled, 'A Data Format Specification for Hybrid Microelectronic Assemblies' sponsored by the Naval Ocean Systems Center, San Diego. The project objective is to develop a specification for a neutral format to promote the exchange of design and manufacturing data for hybrid microcircuit assemblies. Comments from industry are being solicited at two special workshops.

000,898
PB90-169640 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Superconductivity: Challenge for the Future. Federal Conference on Commercial Applications of Superconductivity, Washington, DC., July 28-29, 1987.

Final rept.
R. A. Kamper, and A. F. Clark. 1987, 1p
Pub. in Cryogenics 27, n10 p594 1987.

Keywords: Superconductivity, Meetings, Reprints, *Superconducting devices, Uses.

The brief report is on the Federal Conference on Commercial Applications of Superconductivity, Washington, DC, July 28-29, 1987.

000,899
PB90-169947 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Josephson-Voltage Array Development at the NBS (National Bureau of Standards) In Boulder.

Final rept.
C. A. Hamilton, F. L. Lloyd, and C. Burroughs. 1987, 5p
Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p50-1-50-5.

Keywords: *Standards, *Superconductivity, Research, Automatic control systems, Reliability, Electric potential, Calibrating, Electronic laboratories, Design, Reprints, *National Institute for Standards and Technology, *Josephson arrays.

The paper will review the principles of Josephson array voltage standards and then discuss the four goals of array development at the NBS in Boulder. The goals are the fabrication of more reliable and stable devices, the development of larger arrays to achieve voltages approaching 10 volts, the development of an automated system to facilitate a wide variety of calibrations and the support of a rapidly growing list of standards laboratories using NBS array devices.

000,900
PB90-183344 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD.

Report on Interactions between the National Institute of Standards and Technology and the Institute of Electrical and Electronic Engineers.

Rept. for 1 Oct 87-31 Dec 89.
G. K. Ehrlich. Feb 90, 59p NISTIR-90/4254
See also PB90-130899.

Keywords: *Technology transfer, *Electrical engineering, Standards, Computers, Reliability, Robots, Ultrasonic frequencies, Interfaces, Electrical circuits, *National Institute of Standards and Technology, *Institute of Electrical and Electronic Engineers.

The report highlights examples of interactions between the National Institute of Standards and Technology (NIST) and the Institute of Electrical and Electronic Engineers (IEEE) since October 1, 1987. It is meant to be representative, not all-inclusive. The interactions are organized by IEEE Societies in the following categories: editors, committee memberships and contribution to standards, conferences and workshops, and publications. Recent NIST recipients of IEEE honors and awards are also provided. The report illustrates many activities which are designed to disseminate NIST's most recent technical advances and to learn of the technical challenges facing engineers in industry.

000,901
PB90-187691 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

10-V Josephson Voltage Standard.
Final rept.

C. A. Hamilton, F. L. Lloyd, K. Chieh, and W. C. Goeke. 1989, 3p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 38, n2 p314-316 Apr 89.

Keywords: *Josephson junctions, *Standards, Arrays, Design, Operations, Reprints, *Voltage standards.

The paper describes the design and operation of an 18 992 Josephson-junction array which can generate reference voltages up to 12 V. The device has applications for the direct calibration of Zener reference standards, calibrators, and digital voltmeters at the 10-V level, and for very accurate linearity and ratio measurements.

000,902
PB90-187709 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Standards and High-Speed Instrumentation.
Final rept.

C. A. Hamilton, D. G. McDonald, J. E. Sauvageau, and S. Whiteley. 1989, 9p
Pub. in Proceedings of the IEEE (Institute of Electrical and Electronics Engineers) 77, n8 p1224-1232 Aug 89.

Keywords: *Superconductivity, *Metrology, Josephson junctions, Comparators, Oscilloscopes, Bolometers, Arrays, Reprints, Voltage standards, Uses.

The paper reviews four applications of superconductivity which are of current interest in metrology. These applications are Josephson series-array voltage standards, cryogenic current comparators, a superconducting sampling oscilloscope, and a new bolometer based on a kinetic inductance thermometer.

000,903
PB90-187782 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

Absorber Characterization.
Final rept.

D. P. Kremer, A. C. Newell, and D. A. Agee. 1989, 5p
Pub. in Proceedings of Annual Meeting and Symposium of the Antenna Measurement Techniques Association (11th), Monterey, CA., October 9-13, 1989, p13-7-13-11.

Keywords: *Absorbers(Materials), *Microwave equipment, Electromagnetic scattering, Electrical measurement, Doppler effect, Sensitivity, Accuracy, Reprints.

The National Institute of Standards and Technology has devised an improved version of the Doppler shift

General

method to measure the scattering levels of different sizes and types of microwave absorber. The technique is useful as an inexpensive and simple method for measuring individual absorber pieces with good accuracy and sensitivity. The system does not require a large anechoic facility nor a sophisticated measurement system for gating out background scattering. Reflectivity levels on the order of -80 dB can be measured and relative changes of 1 dB can be detected. Sample results for absorber with and without fire retardant salts and different sizes are presented.

000,904
PB90-188087 PC A09/MF A02
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Emerging Technologies in Electronics and Their Measurement Needs. Second Edition.
Feb 90, 195p NISTIR-90/4260
Also available from Supt. of Docs. See also PB89-189245.

Keywords: *Electric equipment, *Technology innovation, *Measurement, Electrical engineering, Semiconductor devices, Superconductors, Magnets, Magnetic recording, Fiber optics, Telecommunication, Lasers, Microwaves, Sensors, Video equipment, National Institute of Standards and Technology.

The National Institute of Standards and Technology (NIST) is the nation's lead organization for the development of measurement capability and for the maintenance of national reference standards that assure the uniformity of that capability. Within NIST, the Center for Electronics and Electrical Engineering (CEEE) is responsible for measurements that support the U.S. electronics industry. As part of fulfilling this responsibility, CEEE assesses measurement needs that affect the competitiveness of the U.S. electronics industry in emerging technologies. The report is the second in a series that seeks to provide an increasingly comprehensive assessment of those needs.

000,905
PB90-188095 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, July to September 1989, with 1990 CEEE Events Calendar.
E. J. Walters. Feb 90, 42p NISTIR-90/4236
See also PB90-132721.

Keywords: *Semiconductors(Materials), *Signal processing, *Electromagnetic interference, Abstracts, Metrology, Semiconductor devices, Electrical engineering, Antennas, Lasers, Fiber optics, Superconductors, National Institute of Standards and Technology.

The issue contains abstracts for all Center papers released for publication by the National Institute of Standards and Technology in the quarter and citations and abstracts for Center papers published in the quarter. Technical topics addressed include: Semiconductor technology; Fast signal acquisition, processing, and transmission; Electrical systems; and Radiated electromagnetic interference.

000,906
PB90-193343 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.
Fundamental Processes of SF(sub 6) Decomposition and Oxidation in Glow and Corona Discharges.
Final rept.
R. J. Van Brunt, and J. T. Herron. 1990, 20p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation 25, n1 p75-94 Feb 90.

Keywords: *Electrical insulation, *Sulfur hexafluoride, *Glow discharges, *Decomposition reactions, *Oxidation, Reaction kinetics, Collision cross sections, Free radicals, Rates(Per time), Reprints, *Corona discharges, Chemical dissociation, Ion molecule interactions.

It is known that sulfur hexafluoride (SF6), used as an insulating gas in HV apparatus, will oxidize in electrical discharges in the presence of oxygen or water vapor to

form various reactive and stable by-products. In order to meaningfully interpret experimental data on rates of oxidation and by-product formation in discharges, it is necessary to apply theoretical chemical kinetics models that utilize rates for numerous gas-phase processes as functions of gas temperature and/or electric field-to-gas density ratio (E/N). Current knowledge about the fundamental collision processes involving electrons, ions, free radicals, and molecules needed to understand the gas-phase discharge chemistry in SF6 is reviewed. Implications of the fundamental rate data reviewed here to recently proposed chemical-kinetics models of corona and glow-type discharges in SF6 are discussed.

000,907
PB90-196536 PC A07/MF A01
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Development of Standards for Superconductors.
Final Report. January 1988-December 1989.
L. F. Goodrich, R. B. Goldfarb, and S. L. Bray. Jan 90, 137p NISTIR-90/3935
Sponsored by Department of Energy, Washington, DC.

Keywords: *Superconductors, *Standards, Electrical measurement, Power supplies, Magnetization, Hysteresis, Superconducting wires, AC losses, Critical current, Reference materials, Niobium stannides, Interlaboratory comparisons, Circuit diagrams, Ripples.

A cooperative program with the Department of Energy, the National Institute of Standards and Technology, other national laboratories, and private industry is in progress to develop standard measurement practices for use in large-scale applications of superconductivity. The report describes research for the period January 1988 through December 1989. It contains the results of critical current studies on a large conductor Reference Material (RM), the effect of power-supply current ripple, the measurements of large conductors, and an interlaboratory comparison (round robin) of Nb3Sn wires. Short-range variations in magnetic hysteresis loss in multifilamentary Nb3Sn were studied. The results of participation in several interlaboratory comparisons are described.

000,908
PB90-206491 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, July to September 1989, with 1990 CEEE Events Calendar.
Rept. for Jul-Sep 89.
E. J. Walters. Apr 90, 25p NISTIR-90/4296
See also PB89-189302.

Keywords: *Electrical engineering, *Research management, *Electronics, Semiconductor devices, Metrology, Signals, Systems analysis, Power equipment, Superconductors, Electromagnetic interference, Abstracts, *National Institute of Standards and Technology.

The article is the twenty-second issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue of the Center for Electronics and Electrical Engineering Technical Publication Announcements covers the third quarter of calendar year 1989. Abstracts are provided by technical area for papers published this quarter.

000,909
PB90-207754 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Center for Electronics and Electrical Engineering: 1990 Program Description.
R. M. Powell. Apr 90, 35p NISTIR-90/4281

Keywords: *Electrical engineering, *Research management, *Center for Electronics Electrical Engineering, Organizational structure, Programs.

The report describes selected projects of measurement development that Center for Electronics and Electrical Engineering (CEEE) is addressing during fiscal year 1990. The report indicates the directions that these projects will take in the next few years. The report also describes selected accomplishments

during fiscal year 1989. Because of the size of CEEE and the scope of its work, only a representative sampling of these projects and accomplishments can be described in a document of this length. The report also outlines new programs of measurement development that CEEE has defined for future years.

000,910
PB90-217951 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.
Pressure Effects on Partial Discharges in Hexane under DC Voltage.
Final rept.
M. O. Pace, A. L. Wintenberg, T. V. Blalock, E. F. Kelley, and G. J. FitzPatrick. 1989, 6p
Sponsored by Department of Energy, Washington, DC. Electric Energy Systems Program.
Pub. in Proceedings of Annual Report Conference on Electrical Insulation and Dielectric Phenomena, Leesburg, VA., October 29-November 1, 1989, p87-92.

Keywords: *Electric discharges, *Hexane, Dielectric breakdown, Experimental data, Life(Durability), Photographic techniques, Dielectric properties, Electrical potential, Direct current, Reprints, *Pressure effects.

The pressure dependence of partial discharges (PD) has been experimentally investigated at a needle electrode in hexane from subatmospheric pressure (near hexane vapor pressure) to several atmospheres. Each PD produces a phase transition in the liquid near the needle which is photographed in synchronism with a characteristic pattern of current pulses. An image preserving optical delay allows photography to commence just before or at inception of the discharge. Individual current pulses comprising a characteristic pattern are resolved. The cathode event consists of a short pressure-insensitive inception phase, a pressure-sensitive growth at a decreasing rate, and finally a detachment and dissipation, sometimes with noticeable contraction before detachment; increased pressure reduces the growth rate and lifetime. The accompanying characteristic current pulse pattern always ceases during the growth of the PD. For the anode event, less extensive data similarly show slowing of growth with increased pressure and a (different) characteristic current pulse pattern.

000,911
PB90-250101 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Automated Production Technology Div.
Need for Research in Electronics Assembly Technology.
H. T. Bandy. Jul 90, 32p NISTIR-4368
Sponsored by Harry Diamond Labs., Adelphi, MD.

Keywords: *Electronics, *Production engineering, *Assembling, Technology assessment, Standardization, Process control, Precision, Statistical quality control, Flexibility, Technology innovation.

The National Institute of Standards and Technology assisted the Harry Diamond Laboratories in an effort to develop plans for a new program of research in electronics assembly technology. The need for research was investigated in the domains of precision engineering, system integration, and process control. Rather than engineering design problems, the emphasis was on principles, techniques, and standards that could help eliminate obstacles to widespread adoption of state-of-the-art technology in assembly plants. Current popular assembly methods as well as emerging new trends were studied. Research projects are recommended in the areas of (1) flexibility of equipment, (2) precision handling of components, (3) equipment interfaces, (4) equipment programmability, and (5) statistical process control.

000,912
PB90-254673 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.
Electric and Magnetic Dipole Radiation in a Random Medium.
Final rept.
D. A. Hill. 1990, 15p
Pub. in Electromagnetics 10, p279-292 1990.

Keywords: *Electromagnetic radiation, Magnetic dipoles, Far field, Reprints, Electric dipoles, Born approximation.

Electric and magnetic dipole radiation are studied for a medium where random, small-scale inhomogeneities are confined to a spherical shell region. Numerical results are presented for both the far-field pattern and the total radiated power. When the random inhomogeneities are located in the near field of the source, an electric dipole radiates a larger incoherent field than a magnetic dipole because of the electric dipole's larger reactive electric field.

000,913

PB90-254681 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Magnetic Dipole Excitation of an Insulated Conductor of Finite Length.

Final rept.

D. A. Hill. 1990, 7p

See also PB89-171664.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Geoscience and Remote Sensing 28, n3 p289-294 May 90.

Keywords: Magnetic dipoles, Electric conductors, Characteristic impedance, Reprints, *Induced current.

Excitation of currents on an insulated conductor of finite length with arbitrary terminations is studied for a magnetic dipole source. For matched terminations, the results agree closely with previous results for an infinitely long conductor, but other terminations produce end reflections that cause standing waves. Specific calculations are presented for a vertical magnetic dipole source, because this source produces the appropriate horizontal electric field and could be used in a borehole-to-borehole configuration. Numerical results for the induced current and secondary magnetic field indicate that long conductors produce a strong anomaly over a broad frequency range for any type of termination.

000,914

PB90-254699 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.
Propagation along a Two-Wire Line Located at the Air-Earth Interface.

Final rept.

D. A. Hill, and L. R. Anderson. 1990, 4p

Sponsored by Army Belvoir Research Development and Engineering Center, Fort Belvoir, VA.
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Geoscience and Remote Sensing 28, n3 p400-402 May 90.

Keywords: *Transmission lines, Electromagnetic wave transmission, Characteristic impedance, Dielectric properties, Reprints.

A simple quasi-static expression has been derived for the propagation constant of a two-wire transmission line located at the air-earth interface. A numerical solution of the mode equation shows that the quasi-static approximation is valid when the wire separation is much less than a free-space wavelength. The quasi-static approximation can be used to determine the complex dielectric constant of the earth from measurements of either the propagation constant or the characteristic impedance of the transmission line.

000,915

PB90-255381 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Semiconductor Electronics Div.
Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, October to December 1989, with 1990 CEEE Events Calendar.

J. A. Gonzalez. Jun 90, 46p NISTIR-4323

See also PB90-188095.

Keywords: *Research projects, *Electrical engineering, *Electronics, Semiconductors, Metrology, Photodetectors, Antennas, Electrooptics, Superconductors, Electromagnetic interference, Abstracts.

This is the twenty-ninth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. The issue of the CEEE Technical Progress Bulletin covers the fourth quarter of calendar year 1989. Abstracts are provided by technical area for both published papers and papers approved by NIST for publication.

000,916

PB90-256801

(Order as PB90-256793, PC A08)

National Inst. of Standards and Technology, Boulder, CO.

Operation of NIST Josephson Array Voltage Standards.

C. A. Hamilton, C. Burroughs, and K. Chieh. 1990, 17p

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n3 p219-235 May-Jun 90.

Keywords: *Standards, Josephson junctions, Arrays, Design, *Voltage standards, Calibration, Operation.

The paper begins with a brief discussion of the physical principles and history of Josephson effect voltage standards. The main body of the paper deals with the practical details of the array design, cryoprobe construction, bias source requirements, adjustment of the system for optimum performance, calibration algorithms, and an assessment of error sources for the NIST-developed Josephson array standard.

000,917

PB90-256819

(Order as PB90-256793, PC A08)

National Inst. of Standards and Technology, Gaithersburg, MD.

Calibration of dc Voltage Standards at NIST.

B. F. Field. 1990, 17p

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n3 p237-253 May-Jun 90.

Keywords: *Standards, Avalanche diodes, *Voltage standards, *Calibration, Josephson effect, Standard cells.

The document describes the procedures used at NIST to calibrate dc voltage standards in terms of the NIST volt. Three calibration services are offered by the Electricity Division: Regular Calibration Service (RCS) of client standard cells at NIST; the Volt Transfer Program (VTP) a process to determine the difference between the NIST volt and the volt as maintained by a group of standard cells in a client laboratory; and the calibration of client solid-state dc voltage standards at NIST. The operational procedures used to compare these voltage standards to NIST voltage standards and to maintain the NIST volt via the ac Josephson effect are discussed.

000,918

PB90-257742

PC A06/MF A01

National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.**Dielectric Characterization and Reference Materials.**

Technical note (Final).

R. G. Geyer. Apr 90, 123p NIST/TN-1338

Also available from Supt. of Docs.

Keywords: *Dielectrics, Electrodynamics, Microwave frequencies, Metrology, Anisotropy, Losses, *Reference materials, Hilbert transformation, Temperature dependence, Permittivity, Relaxation.

Dielectric reference materials are analyzed with respect to fundamental requirements of linearity, homogeneity and isotropy. Generalized frequency- and temperature-dependent dispersion relations are presented which allow the prediction of broadband dielectric behavior from limited measurement data, determination of valid modal field structure in cavity or waveguide fixtures, and identification of discrepancies and errors in measurement data. An approach for examining the influence of deviations of sample homogeneity on a precisely specified electromagnetic field structure is outlined, and sufficient conditions for isotropic, uniaxial, or biaxial anisotropic dielectric behavior are reviewed in terms of a material's chemical lattice physics. These characteristics direct the choices of suitable reference materials useful for confirming or improving the accuracy of dielectric measurements.

000,919

PB90-261066

Not available NTIS

National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Fields Div.**Electrodynamics of Materials for Dielectric Measurement Standardization.**

Final rept.

R. G. Geyer. 1990, 7p

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference, San Jose, CA., February 13-15, 1990, p2-7.

Keywords: Relaxation time, Standardization, Electrodynamics, Measurement, Metrology, Reprints, *Dielectric materials, *Reference materials, Loss tangent.

Dielectric reference materials are analyzed in light of the fundamental requirements of linearity, homogeneity and isotropy. Generalized frequency- and temperature-dependent dispersion relations are presented which allow the prediction of broadband dielectric behavior from limited measurement data, determination of valid modal field structure in cavity or waveguide fixtures, and identification of discrepancies and errors in measurement data. An approach for examining the influence of deviations of sample homogeneity on a precisely specified electromagnetic field structure is outlined, and sufficient conditions for isotropic, uniaxial, or biaxial anisotropic dielectric behavior are examined in terms of a material's chemical lattice physics. These characteristics direct the choices of suitable reference materials useful in dielectric metrology.

000,920

PB90-265232

PC A03/MF A01

National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Electronics and Electrical Engineering.**Center for Electronics and Electrical Engineering Technical Publication Announcements Covering Center Programs, October-December 1989, with 1990 CEEE Events Calendar.**

J. A. Gonzalez. Aug 90, 33p NISTIR-4383

See also PB90-206491.

Keywords: *Electrical engineering, *Electronics, *Metrology, Photodetectors, Signal processing, Antennas, Electrooptics, Power equipment, Superconductors, Electromagnetic interference, Semiconductor devices, Microwaves, Millimeter waves, Abstracts, National Institute of Standards and Technology, US NIST, Semiconductors, Optical fibers.

This is the twenty-third issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. This issue of the 'Center for Electronics and Electrical Engineering Technical Publication Announcements' covers the fourth quarter of calendar year 1989. Abstracts are provided by technical area for papers published this quarter. Main topics include the following: Semiconductor technology program; Signals and systems metrology program; Fast signal acquisition, processing, and transmission; Electrical systems; Electromagnetic interference.

000,921

PB90-265265

PC A03/MF A01

National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Semiconductor Electronics Div.**Center for Electronics and Electrical Engineering Technical Progress Bulletin Covering Center Programs, January to March 1990, with 1990 CEEE Events Calendar.**

J. A. Gonzalez. Aug 90, 36p NISTIR-4381

See also PB90-255381.

Keywords: *Electrical engineering, *Electronics, *Metrology, Silicon, Photodetectors, Integrated circuits, Semiconductor devices, Electrical measurement, Laser beams, Magnetic measurement, Antennas, Microwaves, Millimeter waves, Electrooptics, Electromagnetic interference, Superconductors, Abstracts, National Institute of Standards and Technology, US NIST, Semiconductors.

This is the thirtieth issue of a quarterly publication providing information on the technical work of the National Institute of Standards and Technology (formerly the National Bureau of Standards) Center for Electronics and Electrical Engineering. This issue of the 'CEEE Technical Progress Bulletin' covers the first quarter of calendar year 1990. Abstracts are provided by technical area for both published papers and papers approved by NIST for publication. Main topics include the following: Semiconductor technology program; Signals

General

and systems metrology program; Fast signal acquisition, processing, and transmission; Electrical systems; Electromagnetic interference.

000,922

PB90-271545 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Thermophysics Div.
**Microsecond-Resolution Electrical Measurements
in High-Current Discharges.**
Final rept.

J. L. McClure, and A. Cezaırlıyan. 1990, 14p
Pub. in International Jnl. of Thermophysics 11, n4
p739-751 Jul 90.

Keywords: *Electric discharges, *Electrical measurement, Electric current, Transient response, Reprints, High voltage.

The instrumentation and operation of an accurate technique for electrical measurements in a capacitor discharge system are described. Capable of measuring currents up to about 50 kA at voltages up to 10 kV, the system uses commercially available current transformers to measure both current and voltage. The measurement system was evaluated by performing experiments on a calibrated Inconel resistor. The results indicate that electrical resistance and imparted electrical energy can be measured with an uncertainty of less than 1.5%.

000,923

PB91-101097 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**Investigating the Use of Multimeters to Measure
Quantized Hall Resistance Standards.**
Final rept.

M. E. Cage, D. Y. Yu, B. M. Jeckelmann, R. L. Steiner, and R. V. Duncan. 1990, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p332-333.

Keywords: *Multimeters, *Hall effect, *Electrical resistance, *Standards, Metrology, Accuracy, Calibrating, Resistors, Josephson functions, Arrays, Reprints, *Quantum Hall effect, *Resistance standards.

A new generation of digital multimeters was used to compare the ratios of the resistances of wire-wound reference resistors and quantized Hall resistances. The accuracies are better than 0.1 ppm for ratios as large as 4:1 if the multimeters are calibrated with a Josephson array.

000,924

PB91-101204 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**International Comparison of Low Audio Frequency
Power Meter Calibrations Conducted in 1989.**
Final rept.

P. S. Filipksi, W. J. M. Moore, R. B. D. Knight, P. Martin, and N. M. Oldham. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p158-159.

Keywords: *Calibrating, *Power meters, *Audio frequencies, Comparison, Standards, Electrical measurement, Electric converters, Wattmeters, Reprints, Interlaboratory comparisons.

The results of an intercomparison of audio frequency power meter calibrations conducted in 1989 between the National Research Council, Canada, the National Physical Laboratory, United Kingdom, and the National Institute of Standards and Technology, USA, are described. A time-division watt-converter, developed at the National Research Council, was used as the transfer standard. The measurements were made at 120 V, 5 A, power factors of 1, 0 lead and 0 lag and at frequencies up to 5 kHz.

000,925

PB91-101295 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

RF-DC Differences of Thermal Voltage Converters Arising from Input Connectors.

Final rept.
D. X. Huang, J. R. Kinard, and G. Rebudela. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p280-281.

Keywords: Electric connectors, Radio frequencies, Mathematical models, Direct current, Differences, Skin effect, Transmission lines, Experimental data, Reprints, *Thermal converters.

The RF-dc differences of thermal voltage converters (TVC's) caused by skin effect and transmission line effects of different length input structures have been previously studied. Discrepancies do exist, however, between simple mathematical models and measured results for commonly used input connectors. The paper reports a study of these discrepancies.

000,926

PB91-101360 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**Hybrid Construction of Multijunction Thermal
Converters.**
Final rept.

J. R. Kinard, and D. X. Huang. 1990, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p62-63.

Keywords: Thin films, Electric potential, Design, Electric current, Prototypes, Audio frequencies, Microwave frequencies, Reprints, *Thermal converters, Thick films.

Using thin-film and thick-film technologies, multijunction thermal converters have been designed for frequencies ranging from audio up to tens of megahertz and for heater currents from a few milliamperes up to hundreds of milliamperes. The paper describes the designs and the early production of prototype converters.

000,927

PB91-101378 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**AC-DC Difference Relationships for Current Shunt
and Thermal Converter Combinations.**
Final rept.

J. R. Kinard, T. E. Lipe, and C. B. Childers. 1990, 3p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p136-137.

Keywords: Alternating current, Direct current, Measurement, Experimental data, Mathematical models, Electric converters, Reprints, *Thermal converters.

The paper describes the relationship between the overall ac-dc difference of a thermal converter and current shunt combination and the characteristics of the separate thermal converter and current shunt. Predicted and measured results are given for shunts used with different thermal converters.

000,928

PB91-101493 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**New Low-Voltage Standards in the DC to 1 MHz
Frequency Range.**
Final rept.

N. M. Oldham, and R. M. Henderson. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p66-67.

Keywords: *Electrical measurement, *Standards, Electric potential, Audio frequencies, Radio frequencies, Accuracy, Reprints, *Voltage standards.

Several new techniques for measuring the rms value of 1 to 600-mV signals have been developed and compared to existing thermal transfer standards. Differences between the techniques at 100 mV are typically within + or - 20 ppm in the audio-frequency range and within + or - 100 ppm out to 1 MHz.

000,929

PB91-101501 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

Monitoring the Mass Standard: A Comparison of Mechanical to Electrical Power.

Final rept.
P. T. Olsen, W. L. Tew, R. E. Elmquist, and E. R. Williams. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p180-181.

Keywords: *Standards, *Mass, *Electrical measurement, Accuracy, Precision, Electric power, Experimentation, Fundamental constants, Reprints.

Except for the kilogram, all of the base units of the International System of Units (SI) are defined by invariant fundamental constants. The on-going NIST (formerly NBS) absolute watt experiment shows the promise of being able to monitor the stability of the mass standard to better than 0.05 ppm. The authors discuss the latest results and future possibilities.

000,930

PB91-101527 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**Qualifying Watthour Meters for Use as MAP
Transport Standards.**
Final rept.

J. D. Ramboz, C. Fenimore, and S. B. Schiller. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p329-330.

Keywords: *Power meters, *Calibrating, Transport properties, Standards, Statistical analysis, Correction, Electric potential, Electric current, Temperature, Accuracy, Reprints.

One of the National Institute of Standards and Technology Measurement Assurance Programs transfers the watthour using transport meters. A statistical design is employed to determine the linear and non-linear corrections for the response of each meter to varying conditions of voltage, current, temperature, and power factor. For applications requiring less accuracy, a heuristic for dropping correction terms is given.

000,931

PB91-101535 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
Watt Transfer Standard.
Final rept.

J. D. Ramboz, and J. L. West. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p160-161.

Keywords: *Power measurement, *Wattmeters, *Standards, Electric measuring instruments, Power meters, Electrical measurement, Electric power, Reprints.

The use of a time-division multiplier power meter as a watt transfer standard between the National Institute of Standards and Technology (NIST) and an industry standards laboratory is described. Measurements of power at 120 and 240 volts, 5 amperes, 50 and 62 Hz and at power factors of 1 and 0 lagging are described. After the unit of power was transferred to the industrial laboratory, a comparison of the laboratory and NIST calibrations indicated an agreement to within 14 parts per million (ppm).

000,932

PB91-101592 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.
**Improvements for Automating Voltage
Calibrations Using a 10-V Josephson Array.**
Final rept.

R. L. Steiner, and R. J. Astalos. 1990, 2p
Pub. in Proceedings of Conference on Precision Electromagnetic Measurements, Ottawa, Canada, June 11-14, 1990, p102-103.

Keywords: *Electrical measurement, *Standards, Calibrating, Josephson junctions, Voltmeters, Scanners, Stability, Attenuators, Electromagnetic noise, Automation, Reprints, *Josephson arrays, *Voltage standards.

With three novel improvements, a voltage standard system based on a 10-V Josephson array is totally automated. A commercial standard cell scanner con-

trois switching for calibrating either Zener references or digital voltmeters, a programmable attenuator helps in obtaining voltage steps, and measurements of Digital Voltmeter noise help in verifying array stability.

000,933
PB91-101667 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.
Comparison of Theoretical and Experimental Data for the Near Field of an Open-Ended Rectangular Waveguide.
Final rept.

D. I. Wu, and M. Kanda. 1989, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electromagnetic Compatibility 31, n4 p353-358 Nov 89.

Keywords: *Electromagnetic fields, Far field, Comparison, Reprints, Open ended waveguides, Rectangular waveguides, Near field.

A comparison between theoretical and experimental data on the radiating near field of an open-ended waveguide (OEG) is presented. Two theoretical methods are examined. The first one is an approximation based on simple plane wave equations with the electric field expressed in terms of the gain of the OEG. The gain equation is an empirical equation obtained from scaled measured data. The second approach is based on far-field-to-near field transformations. Its purpose is to provide an alternate method for computing the fields as well as to provide a means of assessing the accuracy of the first approach. Theoretical data computed using both methods are presented along with measured data obtained in the anechoic chamber. The discrepancy between the two theoretical approaches is typically less than 0.5 dB (while the discrepancy between the theoretical and experimental results is small) and increases with the distance between the OEG and the field point.

000,934
PB91-107375 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Fields Div.
Performing EM Susceptibility/Vulnerability Measurements Using a Reverberation Chamber.
Final rept.

M. L. Crawford, and G. H. Koepke. 1987, 6p
See also PB87-106027.
Pub. in Proc. 7th Int. Zurich Symp. and Technical Exhibition on Electromagnetic Compatibility, Zurich, Switzerland, March 3-5, 1987 pp. 121-126 (EMC 1987).

Keywords: *Electromagnetic compatibility, Performance evaluation, Electrical measurement, Design, Reprints, *Electromagnetic susceptibility, Reverberation chambers, Test methods.

The paper discusses the design, evaluation, and use of a reverberation chamber for performing electromagnetic susceptibility (EMS) measurements of electronic equipment. Included are brief descriptions of the test procedures, application advantages and limitations, some EMS test results, interpretation of test results relative to free-space test methods, and an estimate of measurement uncertainties.

000,935
PB91-107458 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.
Characterization of a Sampling Voltage Tracker for Measuring Fast, Repetitive Signals.
Final rept.

T. M. Souders, H. K. Schoenwetter, and P. S. Hetrick. 1987, 5p
See also PB87-201661.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n4 p956-960 Dec 87.

Keywords: Signal processing, Frequency response, Radio frequencies, Errors, Reprints, *Sampling voltage trackers, Test methods.

An equivalent time sampling and digitizing system is described, together with test methods for characterizing its dynamic performance. Time base errors, linearity errors, step response parameters, and frequency response are considered, and typical measurement results are included. The system is capable of state of the art measurements at rf frequencies.

000,936
PB91-107466 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Electrosystems Div.

Characterizing Square and Triangular Waveforms.
Final rept.

G. N. Stenbakken. 1987, 3p
See also PB87-201653.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement IM-36, n4 p961-963 Dec 87.

Keywords: *Waveforms, Error analysis, Squares(Geometry), Triangles, Measurement, Sampling, Reprints.

A method has been developed for determining the parameters and errors of square and triangular waveforms, relative to idealized waveforms, even when the waveforms are highly distorted. The method is based on measurements obtained by sampling the waveform. Then, an idealized waveform is fitted to the sampled data using a least squared error algorithm. The errors in the waveform are defined as the deviations between the data samples and the ideal waveform. Also, the parameters of the measured waveform are defined as the corresponding parameters of the fitted ideal waveform.

000,937
PB91-107516 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

EMR Test Facilities Evaluation of a Small Reverberating Chamber Located at RADC, Griffiss AFB, Rome, New York.

M. L. Crawford, J. M. Ladbury, B. F. Riddle, and E. B. Larsen. Jun 90, 82p NISTIR-90/3939
See also PB88-178827. Sponsored by Rome Air Development Center, Griffiss AFB, NY.

Keywords: Griffiss Air Force Base, Rome Air Development Center, Electromagnetic shielding, Electromagnetic pulses, Radio frequencies, Electrical measurement, Test facilities, Weapons systems, Performance evaluation, Graphs(Charts), *Reverberation chambers, *Electromagnetic susceptibility.

The report describes measurement procedures and results from evaluating a small reverberating chamber located at Rome Air Development Center (RADC), Rome, New York. The chamber was developed for measuring and analyzing the electromagnetic susceptibility/vulnerability (EMS/V) of weapon systems and the radio frequency (rf) shielding effectiveness of enclosures and materials. A brief description of the facility is given, including instrumentation for its evaluation and calibration by the National Institute of Standards and Technology (NIST). Work was done earlier at NIST to evaluate the RADC large reverberating chamber. A follow-on project to construct and evaluate a small chamber is discussed in the report. Conclusions are that the chamber can be used at frequencies down to 500 MHz for cw testing, and for pulsed rf immunity testing with pulse widths as short as 0.3 microsec. Estimates of measurement uncertainties are given.

000,938
PB91-107656 PC A06
National Inst. of Standards and Technology, Gaithersburg, MD.

Journal of Research of the National Institute of Standards and Technology. July-August 1990. Volume 95, Number 4.

1990, 122p
Also available from Supt. of Docs. as SN703-027-00035-1. See also PB91-107664 through PB91-107680, and PB90-256793.

Keywords: *Research, Gas discharges, Laplace transformation, Standards, Waveform metrology, Collisional plasmas, Inverse Laplace transforms.

Contents:
Standards for Waveform Metrology Based on Digital Techniques;
The Diffusion of Charged Particles in Collisional Plasmas--Free and Ambipolar Diffusion at Low and Moderate Pressures;
Tables of the Inverse Laplace Transform of the Function $e^{-\beta \sin^{-1} x}$ ($-\beta < \beta < \beta$)).

000,939
PB91-112383 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Electrical Fast Transient Tests: Applications and Limitations.

Final rept.
F. D. Martzloff, and T. F. Leedy. 1989, 8p

See also PB90-271529.
Pub. in Conference Record of the IEEE (Institute of Electrical and Electronics Engineers) Industry Applications Society Annual Meeting, Part 2, San Diego, CA., October 1-5, 1989, p1625-1632.

Keywords: Transmission lines, Power lines, Process control, Tests, Reprints, *Transients.

The Technical Committee TC 65 of the International Electrotechnical Commission (IEC) has promulgated a new document requiring demonstration of the immunity of industrial process control equipment to fast transients occurring in power and data lines. These fast transients contain high-frequency components, intuitively expected to suffer greater attenuation than the lower frequency components as they propagate along the lines. Quantifying this intuitive expectation provides a perspective on the severity of the situation and helps defining realistic test requirements. To that end, the paper describes specific measurements conducted for typical low-voltage power line configurations; modeling of the attenuation provides a tool for understanding the significance of the line parameters and extends the usefulness of results to general cases.

000,940
PB91-112813 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST Special Reports, October 1990.
Special pub.
Oct 90, 37p NIST/SP-797
Also available from Supt. of Docs. as SN003-003-03054-6. See also PB90-244435.

Keywords: *Research, Awards, Quality control, Automation, Character recognition, Handwriting, Dimensional measurement, Microelectronics, Semiconductor devices, National Institute of Standards and Technology, US NIST, Standard reference databases, Optical fibers, Fifth force.

Contents:
Research Update;
Four Companies Win Baldrige Award;
NIST, Industry Work Together for Automated Quality;
Seven R and D 100 Awards Go to NIST;
Teaching Machines Their ABCs;
Technologies of the Future Identified;
To Measure a Molecule;
Key Industries Invest To Boost Quality;
No Evidence for Fifth Force Found;
Tech Transfer Awards Announced;
New Publications;
Conference Calendar.

000,941
PB91-118489 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Superconducting Inductance Bolometer with Potential Photon-Counting Sensitivity: A Progress Report.

Final rept.
J. E. Sauvageau, and D. G. McDonald. 1988, 8p
Pub. in Proceedings of International Conference on Optical Radiometry, London, England, April 12-13, 1988, p39-46.

Keywords: *Bolometers, Inductance, Sensitivity, Prototypes, Reprints, Superconducting devices, Microstrip devices, Temperature dependence.

The bolometer is based on the temperature dependence of the inductance of a superconducting microstrip line. As the device is superconducting, it has no Johnson noise. It can be impedance matched to an optimized SQUID preamplifier, the quietest of all amplifiers, and its bias current is relatively unrestricted by self heating. It is shown theoretically that this device can have a sensitivity comparable to that of an optical photon counting detector, or a NEP(sub e) of 5.4×10^{-18} to the -18 power W/square root of (Hz). The authors' experimental prototype device is designed to test the theory of operation, but not at the highest levels of sensitivity.

000,942
PB91-120105 PC A06/MF A01

General

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

Measurement and Evaluation of a TEM (Transverse Electromagnetic)/Reverberating Chamber.

Technical note (Final).

M. L. Crawford, M. T. Ma, J. M. Ladbury, and B. F. Riddle. Jul 90, 118p NIST/TN-1342

Also available from Supt. of Docs. as SN003-003-03055-4. Sponsored by Army Electronic Proving Ground, Fort Huachuca, AZ. Electromagnetic Environmental Effects Div.

Keywords: *Electromagnetic compatibility, *Test facilities, Radio frequencies, Electrical measurement, Performance evaluation, Transmission lines, Vulnerability, Graphs(Charts), *Reverberation chambers, TEM cells, Scale models.

The report summarizes the measurement and evaluation of a 1/10 scaled model TEM/reverberating chamber developed as a single, integrated facility for testing radiated electromagnetic compatibility/vulnerability (EMC/V) of large systems over the frequency range, 10 kHz to 40 GHz. The facility consists of a large shielded enclosure configured as a transverse electromagnetic (TEM), transmission line-driven, reverberating chamber. TEM mode test fields are generated at frequencies below multimode cutoff, and mode-stirred test fields are generated at frequencies above multimode cutoff. Both the chamber's cw and pulsed characteristics are measured and analyzed. The report also discusses the basis for such a development including the theoretical concepts, the advantages and limitations, the experimental approach for evaluating the operational parameters, and the procedures for using the chamber to perform EMC/V measurements. A full-scale chamber that will provide a test volume of 8 m x 16 m x 30 M is proposed. Some projections of the full-scale chamber's estimated characteristics and operational parameters are also given.

000,943

PB91-144527

(Order as PB91-144451, PC A05/MF A01)

National Inst. of Standards and Technology, Boulder, CO.

Software Techniques to Improve Data Reliability in Superconductor and Low-Resistance Measurements.

L. F. Goodrich, and A. N. Srivastava. 1990, 15p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n5 p575-589 Sep/Oct 90.

Keywords: *Electrical measurement, *Superconductivity, Computer applications, Figure of merit, Critical current, Electrical resistivity, Reliability(Electronics), Temperature dependence, Data editors, Outliers.

Software techniques have been developed to take low-amplitude data in various patterns, assign a figure of merit to a set of data readings, edit data for erroneous readings (or other experimental variations), and to alert the experimenter if the detected errors are beyond the scope of the software. Erroneous voltage readings from digital voltmeters, intermittent electrical connections, and an array of similar variations in data have been detected through the use of a data editor. The fixed-limit data editor removes readings that are inconsistent with the distribution of the majority of the data readings. The frequency of erroneous readings from a particular digital voltmeter ranges from 1 error per 100,000 readings to 1 error per 100 readings. The magnitude of the error can be as large as 3% of full scale with a zero volt input to the voltmeter. It may be necessary to have multiple meters measuring voltages in the same circuit in order to generate these erroneous readings. The software techniques described here have been used in a variety of measurements, such as resistance-versus-temperature measurements made on cryoconductors or superconductors, and voltage-versus-current measurements made on superconductors to determine the critical current.

ENERGY

Electric Power Transmission

000,944

PB90-205808

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Systems and Instruments in Site Surveys.

Final rept.

F. D. Martzloff, and T. M. Gruzs. 1990, 6p

Pub. in Powertechnics Magazine 6, n3 p34-39 Mar 90.

Keywords: *Site surveys, *Power equipment, *Metrology, Comparison, Engineering standards, Methodology, Reprints.

Every on-site survey of power quality utilizes a variety of methods and instruments, requiring careful interpretation of survey results. A close examination of underlying assumptions in nine published surveys shows that some differences can be reconciled, but indicates the need for standards.

000,945

PB90-228032

PC A05/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electricity Div.

Research for Electric Energy Systems - An Annual Report (1989).

R. J. Van Brunt. Jun 90, 92p NISTIR-4339

See also report for 1988, PB90-112442. Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.

Keywords: *Surges, *Power transmission lines, *Electric fields, *Dielectrics, Dielectric breakdown, Kerr cells, Kerr electrooptical effect, Power lines, Chemical detection, Graphs(Charts), Electric corona, Mathematical models, Electric discharges, *Gaseous dielectrics, *Liquid dielectrics, Resistive high voltage dividers.

The report documents the technical progress in four investigations which make up the project 'Support of Research Projects for Electrical Energy Systems,' funded by the U.S. Department of Energy and performed by the Electricity Division of the National Institute of Standards and Technology (NIST). Specifically these investigations include: (1) an evaluation and critique of techniques for measuring ambient magnetic fields in support of epidemiological and in vitro studies of biological field effects; (2) development of techniques for detecting the toxic gas S2F10 in SF6 and measuring its production rate from corona discharges in SF6; (3) optical and electrical measurements of pre-breakdown partial-discharge phenomena in dielectric liquids; and (4) development of improved electro-optical methods for measurement and characterization of fast, transient high-voltage impulses. The work discussed in the report is part of an ongoing research activity at NIST.

000,946

PB90-241597

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Coupling, Propagation, and Side Effects of Surges in an Industrial Building.

Final rept.

F. D. Martzloff. 1990, 11p

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Industry Applications 26, n2 p193-203 Mar/Apr 90.

Keywords: *Electromagnetic wave transmission, *Surges, *Power lines, Measurement, Data transmission, Electromagnetic interference, Data links, Industrial buildings, Reprints.

Measurements were made in an industrial building to determine the propagation characteristics of surges in the ac power wiring of the facility. The surges, of the unidirectional type or the ring-wave type described in American National Standards Institute/Institute of Electronics and Electrical Engineering Standard C62.41-1980, were injected at one point of the system and the resulting surges arriving at other points were

measured. The results show how unidirectional surges couple through transformers and produce a ring wave component in the response of the system. An unexpected side effect of these surges, applied to the power lines only, was the apparent damage suffered by the data line input components of some computer-driven printers.

000,947

PB91-112441

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

AC Electric and Magnetic Field Measurement Fundamentals.

Final rept.

M. Misakian. 1990, 5p

See also PB89-173470.

Pub. in Proceedings of International Symposium on High Voltage Engineering (6th), New Orleans, LA., August 28-September 1, 1989, v2 p1-5 1990.

Keywords: *Electric fields, *Electric measuring instruments, *Magnetic fields, *Alternating current, *Power lines, Field emission, Power transmission lines, Electric power transmission, Field strength, Calibrating, Reprints.

Questions raised in the early 1970's regarding possible adverse environmental effects due to high-voltage ac transmission line fields focused attention on the need for accurate measurements of the power-frequency electric and magnetic fields. Following a brief description of the fields near ac power lines, the paper will survey the instrumentation, calibration procedures, measurement techniques and standards that have been developed since the early 1970's to characterize the electric and magnetic fields near ac power lines.

Energy Use, Supply, & Demand

000,948

PB90-170358

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Energy Rating of Refrigerators with Variable Defrost Controls.

Final rept.

B. M. Mahajan. 1988, 10p

Sponsored by Department of Energy, Washington, DC. Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v94 pt1 p330-339 1988.

Keywords: *Refrigerators, *Defrosting, Control equipment, Refrigerating, Ice control, Compressors, Refrigerating machinery, Efficiency, Reprints, *Energy consumption.

The paper deals with refrigerator-freezers and freezers that are equipped with variable defrost control (VDC) systems. The modified long-time automatic defrost test procedure and the procedure to calculate per day (or test cycle) energy consumption for machines equipped with VDC are examined. The effects of compressor run-time between defrosts (CT) on per day energy consumption are evaluated, and a procedure for computing a generic value of CT is suggested.

Fuels

000,949

DE90005343

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Boulder, CO. Center for Chemical Engineering.

Thermal measurements on structure 1 and structure 2 pure clathrate hydrates and on natural gas samples. Final report.

Progress rept.

Nov 89, 27p DOE/MC/21089-2775

Contract AI21-84MC21089

Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: *Hydrates, Oxides, Tetrahydrofuran, *Clathrates, Natural Gas Hydrate Deposits, Progress

Report, Sample Preparation, Specific Heat, Thermal Expansion, *Thermodynamic Properties, EDB/033000, EDB/400201.

This study was designed to give thermal property information about both synthetic and natural hydrates. The work on the synthetic hydrates was to precede work with the natural hydrates so that all necessary techniques would be developed and established as suitable. In this way, measurements on the natural sample would have the best possible chance for successful completion. This report describes measurements made on tetrahydrofuran hydrates and ethylene oxide hydrates. 20 refs., 7 figs.

000,950

PB90-135856

Not available NTIS
National Inst. of Standards and Technology (NIST),
Gaithersburg, MD. Organic Analytical Research Div.
Identification and Comparison of Low-Molecular-Weight Neutral Constituents in Two Different Coal Extracts.

Final rept.

H. C. K. Chang, M. Nishioka, K. D. Bartle, S. A. Wise,
J. M. Bayona, K. E. Markides, and M. L. Lee. 1988,
13p

Pub. in Fuel 67, n1 p45-57 Jan 88.

Keywords: *Chemical analysis, Molecular weight, Gas chromatography, Aromatic hydrocarbons, Aliphatic hydrocarbons, Nuclear magnetic resonance, Reprints, *Coal extracts, High performance liquid chromatography, Mass fragmentography, Polycyclic hydrocarbons.

A two-step pyridine and then tetrahydrofuran solvent extraction procedure at room temperature under nitrogen gas flow was used to extract two different U.S. coals, PSOC-592 (Illinois No. 5) and PSOC-521 (Rock Springs No. 7, Wyoming). Aliphatic and aromatic hydrocarbons were separated using neutral alumina column chromatography. The aromatics were then fractionated according to the number of aromatic carbons by high performance liquid chromatography (HPLC). These neutral compounds were identified by gas chromatography (GC) and gas chromatography/mass spectrometry (GC/MS). n-Alkanes (C17-C31), pristane, phytane, hopanes (17 alpha H, 21 beta H), and moretanes (17 beta H, 21 alpha H) were found in aliphatic fractions of both coal extracts. Low-Molecular-weight (2-4 rings) polycyclic aromatic hydrocarbons (PAH) were the major compounds in the aromatic fraction of the PSOC-592 coal extract. However, pentacyclic triterpenoid-like hydroaromatic hydrocarbons were the major components in the extract of the PSOC-521 coal. A number of new compounds were identified for the first time. Complementary structural information was obtained from (1)H and (13)C NMR analysis of the isolated fractions.

000,951

PB90-153495

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Metallurgy Div.
Experimental and Model Determinations of Coal Mineral and Slag Phase Equilibria.

Final rept.

J. W. Hastie, D. W. Bonnell, and E. R. Plante. 1987,
1p

Pub. in Jnl. of the Electrochemical Society 134, n8B
pC471 1987.

Keywords: *Coal, *Combustion products, *Oxide minerals, *Slags, *Chemical equilibrium, Mathematical models, Gases, Liquid phases, Vapor phases, Solid phases, Mass spectroscopy, Reprints.

Under typical coal combustion conditions, conversion of mineral matter to slag and vapor phase components can often be treated as a multicomponent phase equilibria problem. Special experimental mass spectrometric and modeling approaches have been used to determine the phase equilibria behavior of representative coal mineral and slag systems. The experimentally validated model utilized the SOLGASMIX multicomponent equilibrium code together with a specially determined data base for complex oxide liquids and solids.

000,952

PB90-192410

Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.
Microbial Metal Leaching and Resource Recovery Processes.

Final rept.

G. J. Olson, and F. E. Brinckman. 1989, 8p

Pub. in Frontiers in Bioprocessing, p412-419 1989.

Keywords: *Biodegradation, Ores, Reprints, *Metal leaching, *Biotechnology, *Resource recovery.

Microbiologically catalyzed reactions are important in copper recovery from dump leaching operations in the western United States and are also commercially employed in uranium bioleaching in Canada. There is strong interest worldwide in extending bioleaching technologies to strategic and precious metal-containing ores and wastes. Microorganisms important in ore leaching are also being considered for precombustion removal of sulfur from coal or demetalation of other fossil fuel sources essential to environmentally acceptable energy sources. Controlled bioprocessing schemes, employing bioreactors and optimized conditions, are near for precious metal-containing ores. However, knowledge is still incomplete regarding key fundamental mechanisms of microbial metal ore dissolution, genetics of ore leaching bacteria, microbial ecology of the ore leaching environment, and the full range of metals transformations catalyzed by microorganisms. NBS research therefore aims at investigating critical microbial adhesion and its importance in bioleaching, dissolution pathways of strategic metal-containing ores and wastes by microorganisms, iron ore beneficiation and development of quantitative standards for metal ore bioleaching.

000,953

PB90-219601

PC A16/MF A02
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Chemical Engineering.

Measurements of Coefficients of Discharge for Concentric Flange-Tapped Square-Edged Orifice Meters in Natural Gas Over the Reynolds Number Range 25,000 to 16,000,000.

Technical note (Final).

J. R. Whetstone, W. G. Cleveland, B. R. Bateman,
and C. F. Sindt. Sep 89, 369p NIST/TN-1270

Also available from Supt. of Docs. as SN003-003-02974-2. Sponsored by American Petroleum Inst., Washington, DC.

Keywords: *Orifice flow, *Natural gas, *Orifice meters, Mathematical models, Test facilities, Flow meters, Gas meters, Venturi meters, Reynolds number, Gas flow, Experimental data.

The report describes the data acquisition systems and procedures used in the American Petroleum Institute (API)-sponsored orifice discharge coefficient project performed in natural gas flows and conducted at the test loop of the Natural Gas Pipeline Company of America (NGPL) in Joliet, Illinois. Measurements of orifice discharge coefficients for 6- and 10-inch diameter orifice meter runs were made using critical venturis for mass flowrate measurement with associated measurement of pressures and temperatures. Eleven venturis were calibrated at the Colorado Engineering Experiment Station, Inc. (CEESI). Measurements of absolute and differential pressure and temperature for venturi and orifice meter conditions were made using an automated data acquisition system. Temperature and pressure measurements were directly related to U.S. national measurement standards. Daily calibration of absolute and differential pressure transducers using pressure working standards was designed into the measurement procedures. Collected over a 2-year period, the database contains tests on 44 orifice plates in 8 beta ratios for two meter sizes (6- and 10-inches). The database contains 1,345 valid test points.

000,954

PB90-257668

PC A05/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Thermophysics Div.
Survey of Selected Topics Relevant to Bioprocess Engineering.

Technical note (Final).

J. B. Hubbard, E. J. Clark, and J. M. H. Levelt

Sengers. May 90, 91p NIST/TN-1276

Also available from Supt. of Docs.

Keywords: Carbon dioxide, Mass transfer, Proteins, Oxygen, Solubility, Culture media, Thermodynamics, *Biotechnology, *Bioprocess engineering, Isoelectric point.

The following is a collection of reports on topics considered important and generic in biotechnology and bioprocess engineering: (1) Isoelectric points of proteins; (2) Solubility and mass transfer of oxygen in bioreactors; (3) Solubility and mass transfer of carbon dioxide in bioreactors. The reports arose from a survey of the past and current biotechnology literature with special effort given to a critique of data measurement

quality. The format is as follows. The technological importance of a topic is briefly discussed, followed by a critical review of relevant physical properties, data presentation, and measurement techniques. A 'conclusions and recommendations' section summarizes the findings and contains specific recommendations for future research projects. The last section consists of an annotated bibliography and references pertaining to the survey.

Heating & Cooling Systems

000,955

DE90009016

PC A04/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Building Technology.

Experimental evaluation of two nonazeotropic refrigerant mixtures in a water-to-water breadboard heat pump.

M. Kauffeld, W. Mulroy, M. McLinden, and D. Didion.

Feb 90, 64p ORNL/M-1117

Contract AC05-84OR21400

Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: *Coolants, *Heat Pumps, Carnot Cycle, Comparative Evaluations, Compiled Data, Compressors, Design, Energy Efficiency, Enthalpy, Evaporation, Flow Rate, Heat Exchangers, Heat Transfer, Interactions, Interfaces, Modifications, ORNL, Optimization, Performance Testing, Pumps, Scale Models, Specifications, Thermal Conductivity, Thermodynamics, Tables(data), EDB/320106, EDB/320303, *Refrigerants.

As part of the Department of Energy/Oak Ridge National Laboratory Building Equipment Research program, the National Institute of Standards and Technology constructed an experimental, easily reconfigurable, water-to-water, breadboard heat pump apparatus in order to compare pure R22 to nonazeotropic refrigerant mixtures. Performance of the heat pump charged with a range of compositions of the binary mixtures R22/R14 and R13/R12 were compared to R22. The advantage claimed for mixtures in this application is improved thermodynamic efficiency as a result of gliding refrigerant temperatures in the evaporator and condenser in low lift, high glide applications typical of air conditioning. 9 refs., 24 figs., 4 tabs.

000,956

PB90-150210

Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Building Environment Div.

Energy Analysis of Heat Pumps.

Final rept.

T. L. Tsaros, R. A. Gaggioli, and P. A. Domanski.

1987, 17p

Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions, v93 pt2 p1781-1797 1987.

Keywords: *Heat pumps, Heat exchangers, Computerized simulation, Compressors, Reprints, Energy consumption, Energy analysis, Exergy, HPSIM computer program.

The HPSIM computer program for modelling heat pumps has been augmented to include exergy analysis. Exergy transports between the components, to the loads, and to the environment are evaluated. Also, the exergy consumptions in each component are determined, as well as each type of consumption in the heat exchangers. Typical results are presented for the operation of a nominal 3.5 ton residential air-to-air heat pump, in both the cooling and heating modes, at four loads.

000,957

PB90-161993

PC A07/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Building Environment Div.

Evaluation of Thermal Probe Method for Estimating the Heat Loss from Underground Heat Distribution Systems.

J. B. Fang, and R. A. Grot. Dec 88, 126p NISTIR-88/4009

Sponsored by Department of Energy, Washington, DC.

Building Services Div.

ENERGY

Heating & Cooling Systems

Keywords: *District heating, *Distribution systems, *Underground facilities, *Thermal measuring instruments, *Heat loss, Temperature, Soil mechanics, Thermal conductivity, Heat transmission, Thermal measurement, Pipes(Tubes).

An automated, microcomputer controlled instrumentation system developed for in-situ measurements of the earth temperatures and soil thermal conductivities at different depths and for calculating the heat losses from the underground district heating pipes is described. Step-by-step use and operation procedures of the developed heat loss measuring system and computer software package are presented. The heat loss rates and locations of underground pipes are calculated from the measured values of soil thermal conductivity and the earth temperatures around the pipes using the non-linear least squares method. The thermal probe technique was used to estimate the heat loss rates and the depths of buried steam supply and condensate return pipes installed at the James Madison University, Harrisonburg, Virginia.

000,958
PB90-219585 PC A06/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Quantification of Heat Losses through Structural Supports for Shallow Trench Heat Distribution Systems.

J. B. Fang. Oct 89, 106p NISTIR-89/4134
Sponsored by Tri-Service Building Materials Committee, Washington, DC.

Keywords: *Heat loss, *District heating, *Pipes(Tubes), *Supports, Distribution systems, Mathematical models, Heat transmission, Thermal insulation, Heat transfer, Structural members, Finite element method.

Shallow trench heat distribution systems generally contain numerous structural supports which are often in direct contact with hot carrier pipes and form highly conductive heat flow paths, and are major sources of heat loss. Quantification of the heat loss caused by thermal bridges due to pipe supports and prediction of thermal fields were achieved using three finite element computer models of two-dimensional, steady-state heat conduction within a rectangular concrete trench containing two insulated pipes with and without pipe supports, and the surrounding earth. The theoretical basis, computational scheme, and the data input and outputs of the developed computer programs for sample calculations are described. Two trench pipe support systems studied include the horizontal anchoring and the vertical supports. The thermal bridges due to structural supports contribute approximately 17 times more to total heat loss compared to similar pipes with no pipe supports.

000,959
PB90-269481 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.
Thermal Analysis of Directly Buried Conduit Heat Distribution Systems.

J. B. Fang. Aug 90, 97p NISTIR-4365
Sponsored by Tri-Service Building Materials Committee, Washington, DC.

Keywords: *District heating, *Thermal analysis, *Pipes(Tubes), *Distribution systems, *Military facilities, Heat loss, Heat transmission, Thermal insulation, Computer programs, Heat transfer, Mathematical models, Finite element method.

The calculations of heat losses and temperature field for directly buried conduit heat distribution systems were performed using the finite element computer programs. The finite element analysis solved two-dimensional, steady-state heat transfer problems involving two insulated parallel pipes encased in the same conduit casing and in separate casings, and the surrounding earth. Descriptions of the theoretical basis, computational scheme, and the data input and outputs of the developed computer programs are presented. Numerical calculations were carried out for predicting the temperature distributions within the existing high temperature hot water distribution system and two insulated pipes covered in the same metallic conduit and the surrounding soil. The predicted results generally agree with the experimental data obtained at the test site.

000,960
PB91-112862 PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.

Initial Laboratory Evaluation of a Single Solution Circuit Cycle for Use with Nonazeotropic Refrigerants.

M. Buschmeier, W. Mulroy, and D. Didion. Oct 90, 46p NISTIR-4406
Contract DE-AC05-84OR21400

Prepared in cooperation with Hanover Univ. (Germany, F.R.). Sponsored by Department of Energy, Washington, DC., and Oak Ridge National Lab., TN., and Martin Marietta Energy Systems, Inc., Oak Ridge, TN.

Keywords: *Thermal cycling tests, *Air conditioning, Refrigerants, Mixtures, Heat pumps, Heat transfer, Graphs(Charts), Technology assessment, *Single solution circuit, Nonazeotropic refrigerant mixtures, Laboratory tests.

Tests were conducted at the National Institute of Standards and Technology (formerly National Bureau of Standards) to evaluate a single solution circuit cycle for use with nonazeotropic refrigerant mixtures. The single solution circuit cycle incorporates a liquid refrigerant pump in parallel with a compressor. This allows separate control of refrigerant composition to match load and of refrigerant temperature change (glide) in the two-phase region to match the heat source or sink temperature glide. Load matching by composition shifting to match light loads was found to be an inefficient air conditioning mode control strategy. Nonlinearity of enthalpy vs. temperature in the two-phase region of the tested nonazeotropic refrigerant mixture (R22/R11) limited the efficiency gains possible by glide matching to a 19% improvement over pure R22. The cycle did function as intended, allowing glide matching over a wide composition change. It is felt that with a more linear refrigerant, substantial efficiency gains over the normal vapor compression cycle would be possible for applications in which the heat source and sink glides vary substantially with load.

Policies, Regulations & Studies

000,961
PB90-501206 CP D01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Applied Mathematics.

NBS (National Bureau of Standards) Life-Cycle Cost (NBSLCC) Program (for Microcomputers).

Software.
S. Petersen, and R. T. Ruegg. Jan 90, 1 diskette NBS/SW/DK-90/006

The software is contained on 5 1/4-inch diskettes, double density (360K), compatible with the IBM PC microcomputer. The diskettes are in the ASCII format. Price includes documentation, PB86-180253.

Keywords: *Software, *Buildings, *Economic analysis, Forecasting, Prices, Diskettes, *Life cycle costs, *Energy conservation, L=BASIC, H=IBM PC.

The diskette provides the NBSLCC programs and related files referenced in NBS SP 709, Comprehensive Guide for Least-Cost Energy Decisions. The National Bureau of Standards Life-Cycle Cost (NBSLCC) programs perform economic analysis of buildings, building systems and components with special emphasis on energy conservation projects. The NBSLCC program (Vers. 2.32) contains the 1989 U.S. Department of Energy's energy price forecasts, as released in January 1990. The NBSLCC program has had a number of enhancements, including color screens and highlighted menus that make it easier for the user to decide what to do next. Several small bugs were removed from the program. Software Description: The software is written in the BASIC programming language for implementation on an IBM/PC or compatible microcomputer under the MS-DOS operating system. Memory requirement is 64K.

000,962
PB91-113613 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Energy Prices and Discount Factors for Life-Cycle Cost Analysis 1991. Annual Supplement to NIST Handbook 135 and NBS Special Publication 709.

Annual rept.
B. C. Lippiatt, and R. T. Ruegg. Oct 90, 62p NISTIR-85/3273-5
See also PB86-223104, PB87-180253, PB88-138227, and PB90-219858. Sponsored by Federal Energy Management Program, Washington, DC., and Department of Energy, Washington, DC. Federal Energy Management Program Staff.

Keywords: *Cost analysis, *Prices, Residential buildings, National government, Fuels, Present worth, Economic analysis, Electric appliances, Tables(Data), *Life cycle costs, *Energy supplies, Energy conservation, Energy policy.

The 1991 annual edition of energy prices and discount factors supports the Federal life-cycle costing methodology by updating the energy price projections and discount factors that are described, explained, and illustrated in NIST Handbook 135 (HB 135). The data are provided as an aid to implementing life-cycle cost evaluations of potential energy conservation and renewable energy investments in existing and new federally owned and leased buildings. It supports private-sector life-cycle cost analysis by updating the energy price indices that are described, explained, and illustrated in NBS Special Publication 709 (SP 709). It also supports the Energy Conservation Mandatory Performance Standards for New Federal Residential Buildings (10 CFR 435) by providing a table of factors for updating appliance label values.

Solar Energy

000,963
DE89000887 PC A03/MF A01
National Inst. of Standards and Technology, Boulder, CO.

Diagnostics of Glow Discharges Used to Produce Hydrogenated Amorphous Silicon Films: Annual Subcontract Report, June 15, 1987--November 30, 1988.

A. Gallagher, D. A. Doughty, J. Doyle, M. He, and G. H. Lin. Mar 89, 21p SERI/STR-211-3473
Contract AC02-83CH10093
Portions of this document are illegible in microfiche products.

Keywords: *Silicon Solar Cells, Amorphous State, Fabrication, *Glow Discharges, Photovoltaic Cells, Progress Report, Thin Films, ERDA/140501.

A simple, inexpensive, accurate method of measuring surface reaction probabilities (beta) of depositing species has been developed. This method has been applied to low-power silane discharges, obtaining beta = 0.4 for typical, high-film-quality deposition conditions. Explaining this result will require further developments, such as introducing more than one type of surface bond, in current deposition models. A method has also been developed to measure the spatial distribution of depositing species between the electrodes of a deposition discharge. This method has been applied to low-power, RF silane discharges under conditions in which excellent a-Si:H film quality is obtained. This has unmistakably verified rapid H reactions with SiH sub 4, and the dominance of SiH sub 3 deposition, and several other conclusions of the "standard model" reported here. In particular, it supports the predictions of the model regarding the cause of film-quality deterioration at high powers, partly the result of a loss in SiH sub 3 deposition by SiH sub 3 + SiH sub 3 reactions. 10 refs., 3 figs. (ERA citation 14:024280)

000,964
PB91-112185 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
Comparison of Experimental and Calculated Performance of Integral Collector-Storage Solar Water Heaters.
Final rept.
A. H. Fanney, and S. A. Klein. 1987, 7p
Pub. in Solar Energy 38, n5 p303-309 1987.

Keywords: *Experimental data, Hot water heating, Performance evaluation, Predictions, Comparison, Re-

prints, *Solar water heaters, Solar collectors, Thermal energy storage equipment.

Experimental measurements of the monthly performance of an integral collector-storage solar water heater for a one-year period are compared with performance predictions using the method of Zollner et al. The prediction method requires two parameters which were obtained from indoor experiments with a solar simulator. The experimental measurements are also compared with predictions in which the two parameters were obtained from short-term outdoor tests.

000,965

PB91-133918

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Office of Energy-Related Inventions.

Evaluation of Solar Energy Inventions.

Final rept.

T. A. Coultas. 1986, 5p

Pub. in Proceedings of Biennial Congress of the International Solar Energy Society - Intersol 85, Montreal, Quebec, Canada, June 23-29, 1985, p2361-2365 1986.

Keywords: *Solar energy, *Inventions, *Evaluation, Research projects, Grants, Reprints, *Research and development, Solar energy conversion, Energy systems, Energy sources.

The United States Federal Nonnuclear Energy Research and Development Act of 1974 (Public Law 93-577) established a comprehensive national program for research and development of all potentially beneficial energy sources and utilization technologies. One part of the Act directs the National Bureau of Standards (NBS) to evaluate all promising nonnuclear energy-related inventions, particularly those submitted by independent inventors and small companies, for the purpose of obtaining direct grants for their development from the Department of Energy (DOE). NBS established the Office of Energy-Related Inventions (OERI) do to these evaluations.

General

000,966

PB90-221813

PC A09/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Energy-Related Inventions.

Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Institute of Standards and Technology Status Report for Recommendations 251 through 486.

May 90, 177p NISTIR-4313

Supersedes PB89-141154. See also PB90-225988. Sponsored by Department of Energy, Washington, DC. Inventions and Innovation Div.

Keywords: *Inventions, Summarizing, Evaluation, Product development, Recommendations, *Technology innovation, *Energy Related Inventions Program, National Institute of Standards and Technology, Department of Energy, US DOE, Research programs, Energy conservation.

The report is a brief description of the Energy Related Inventions Program and all inventions recommended by the National Institute of Standards and Technology to the Department of Energy since the inception of the program, including a brief summary of the current status of each.

000,967

PB90-225988

PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Energy Related Inventions Program: A Joint Program of the Department of Energy and the National Institute of Standards and Technology Status Report for Recommendations 1 through 250.

May 90, 174p NISTIR-4319

Supersedes PB89-141154. Sponsored by Department of Energy, Washington, DC.

Keywords: *Inventions, Recommendations, Indexes(Documentation), *National Institute of Standards and Technology, *Department of Energy.

A brief description of the Energy Related Inventions Program and of all inventions recommended by the National Institute of Standards and Technology to the

Department of Energy since the inception of the program, including a brief summary of the current status of each.

ENVIRONMENTAL POLLUTION & CONTROL

Air Pollution & Control

000,968

DE85016803

PC A12/MF A01
National Bureau of Standards (NEL), Gaithersburg, MD. Center for Chemical Engineering.

Evaluation of Industrial Combustion Control Systems. Final Report.

C. Presser, and H. G. Semerjian. Oct 84, 254p DOE/CS/40521-T1

Contract AT01-81CS40521

Portions of this document are illegible in microfiche products. Original copy available until stock is exhausted.

Keywords: *Combustion Control, *Furnaces, Air Pollution Abatement, Carbon Dioxide, Carbon Monoxide, Combustion Kinetics, Efficiency, Flue Gas, Fuel-Air Ratio, Hydrocarbons, Industry, Nitrogen Oxides, Opacity, Operation, Oxygen, Sulfur Dioxide, ERDA/400800, ERDA/010800, ERDA/500200.

This study evaluated O sub 2 and CO monitoring systems used for combustion controls to provide reliable data on their performance, operating range and accuracy. The study concentrated on three in-situ O sub 2 and two in-situ CO monitoring systems which are applicable to furnace and boiler controls. The project provides technical information for cost/benefit analysis of combustion control systems and to help expedite implementation of combustion control technology by industry. The evaluation of the stack gas monitoring systems was carried out for ranges of furnace operating parameters such as fuel to air mixture ratio, burner firing rate, heat extraction rate, fuel type, combustion air preheat temperature, and cyclic operating conditions, which are based on information gathered from typical operational practices of representative industrial furnaces and boilers. The experiments were performed in the NBS experimental furnace under both natural gas and No. 2 fuel oil fired conditions. An on-line gas sampling/analysis system was used as a reference system for comparative evaluation of the stack gas monitors. The system is set up to determine the level of CO, CO sub 2, O sub 2, NO/NO/sub x/ and total hydrocarbons in the stack gases. (ERA citation 10:046905)

000,969

PB90-188475

Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Equipment Div.

Comparison of the Chromotropic Acid and Pararosaniline Methods for Measuring Formaldehyde Concentrations of Pressed-Wood Product Emissions.

Final rept.

S. Silberstein. 1990, 5p

Sponsored by Consumer Product Safety Commission, Washington, DC.

Pub. in American Industrial Hygiene Association Jnl. 51, n2p102-106 1990.

Keywords: *Formaldehyde, *Chemical analysis, *Wood particle boards, Concentration(Composition), Comparison, Performance evaluation, Test chambers, Reprints, *Air pollution detection, *Indoor air pollution, Chromotropic acid, Pararosaniline.

Formaldehyde concentrations of particleboard emissions in special measuring chambers were determined by both the chromotropic acid and pararosaniline methods, and the results were compared. Airborne and formalin-based calibration methods were compared also. An additional experiment was done to consider the possibility that aspects of the measuring

system other than the calibration could bias results obtained from either analytical method. Synthetic formaldehyde atmospheres were substituted for pressed-wood products in the measuring chambers, and the concentrations were measured by both the chromotropic acid and pararosaniline methods. Formaldehyde concentrations determined by chromotropic and pararosaniline methods agreed both on synthetic formaldehyde atmospheres and on emissions from five lots of particleboard from four different manufacturers.

000,970

PB90-192493

Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Development of Multicomponent Parts-per-Billion-Level Gas Standards of Volatile Toxic Organic Compounds.

Final rept.

G. C. Rhoderick, and W. L. Zielinski. 1990, 12p

Pub. in Monitoring Methods for Toxics in the Atmosphere, ASTM STP (American Society for Testing and Materials Special Technical Publication) 1052, p63-74 1990.

Keywords: *Gas analysis, *Hazardous materials, *Standards, Waste disposal, Calibrating, Concentration(Composition), Performance evaluation, Gravimetric analysis, Microanalysis, Reprints, *Air pollution detection, *Volatile organic compounds, *Air quality, *Incineration, *Air pollution sampling, Toxic substances, Trace amounts.

The demand for stable, low-concentration multicomponent standards of volatile toxic organic compounds for quantifying national and state measurements of ambient air quality and hazardous waste incineration emissions has markedly increased in recent years. In response to this demand, a microgravimetric technique was developed and validated for preparing such standards; these standards ranged in concentration from several parts per million (ppm) down to one part per billion (ppb) and in complexity from one organic up to 17. Studies using the gravimetric procedure to prepare mixtures of different groups of organics, including multicomponent mixtures in the 5 to 20 ppb range, revealed a very low imprecision. The procedure is based on the separate gravimetric introduction of individual organics into an evacuated gas cylinder, followed by the pressurized addition of a precalculated amount of pure nitrogen. Additional studies confirmed the long-term stability of these mixtures. The uncertainty of the concentrations of the individual organics at the 95% confidence level ranged from less than 1% relative at 1 ppm to less than 10% relative at 1 ppb. Over 100 primary gravimetric standards have been developed, validated, and used for certifying the concentrations of a variety of mixtures for monitoring studies.

000,971

PB90-206749

Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.

Comparison of Liquid Chromatography with Fluorescence Detection and Gas Chromatography/Mass Spectrometry for the Determination of Polycyclic Aromatic Hydrocarbons in Environmental Samples.

Final rept.

S. A. Wise, L. R. Hilpert, G. D. Byrd, and W. E. May.

1990, 18p

Pub. in Polycyclic Aromatic Compounds 1, n1-2 p81-98 1990.

Keywords: *Environmental surveys, *Chemical analysis, *Aromatic polycyclic hydrocarbons, Gas chromatography, Mass spectroscopy, Fluorescence, Comparison, Sediments, Particles, Reprints, Standard reference materials, Liquid chromatography, Water pollution detection, Air pollution detection, Sediment-water interfaces.

Liquid chromatography (LC) with fluorescence detection and gas chromatography/mass spectrometry (GC/MS) have been compared for the determination of polycyclic aromatic hydrocarbons (PAHs) in a variety of environmental samples. Three sets of data are presented in the paper in which LC/fluorescence and GC/MS were used for the analysis of the same samples. These three data sets include the comparison of results from: certification measurements for three natural matrix Standard Reference Materials (SRMs), an international round robin for the determination of PAHs in air and diesel particulate samples, and the analysis of four marine sediment reference materials. The re-

Air Pollution & Control

sults from these studies indicate that the two techniques generally provide comparable results for the measurement of PAHs in environmental samples (in the range of 0.1 to 300 micrograms), with differences in the two techniques between 5-20%. However, at low levels, anthracene and perylene are best measured using LC/fluorescence because of their selective and sensitive fluorescence detection characteristics. In contrast, GC/MS provides more accurate results for the determination of benzo(ghi)perylene because of its low-fluorescence sensitivity.

000,972
PB90-219577 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research. Exhaust Gas Analysis for Harmful Species: 19F1A Fire Fighting Trainer at Mayport, Florida. R. S. Levine, and K. Greenaugh. May 90, 23p NISTIR-4318
Sponsored by Naval Training Systems Center, Orlando, FL.

Keywords: *Training devices, *Gas analysis, *Smoke, *Fire fighting, Sample preparation, Gas chromatography, Mass spectroscopy, Aromatic polycyclic hydrocarbon, Nitroso compounds, Navy, Concentration(Composition), *Toxic substances, *Air pollution sampling, *Air pollution detection, Mayport(Florida).

Gas sampling and subsequent analysis was carried out in a prototype Navy Firefighter Trainer to determine whether toxic species would be released to the environment by the Trainer. The Trainer uses propane gas for fires, and makes artificial smoke by vaporizing the smoke agent, butylated triphenyl phosphate, in hot air. There was concern that the smoke agent would react with the propane flame to form toxic products. No evidence of reaction or toxic species beyond those to be expected from a clean propane flame was found.

000,973
PB90-219791 PC A03/MF A01
Massachusetts Inst. of Tech., Cambridge. Adsorption Modeling for Macroscopic Contaminant Dispersal Analysis. J. W. Axley. May 90, 44p NIST/GCR-90/573
Contract 43NANB919513
Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.

Keywords: *Air flow, *Adsorption, *Desorption, *Mathematical models, *Building, Air pollution, Dynamics, Formaldehyde, Sources, Chemisorption, Isotherms, Performance evaluation, Adsorbents, Construction materials, Equilibrium, Boundary layers, Diffusion, Linear systems, *Equilibrium adsorption models, *Boundary layer diffusion controlled adsorption models, *Air quality, *Indoor air pollution, Mass balance, Environmental transport, Langmuir equations.

Two families of macroscopic adsorption models are formulated, based on fundamental principles of adsorption science and technology, that may be used for macroscopic (e.g., whole-building) contaminant dispersal analysis. The first family of adsorption models - the Equilibrium Adsorption (EA) Models - are based upon the simple requirement of equilibrium between adsorbent and room air. The second family - the Boundary Layer Diffusion Controlled Adsorption (BLDC) Models - add to the equilibrium requirement a boundary layer model for diffusion of the adsorbate from the room air to the adsorbent surface. Two members of each of these families are explicitly discussed, one based on the linear adsorption isotherm model and the other on the Langmuir model. The linear variants of each family are applied to model the adsorption dynamics of formaldehyde in gypsum wall board and compared to measured data.

000,974
PB90-241563 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div. Theoretical Comparison Between Intentional Elemental and Isotopic Atmospheric Tracers. Final rept. W. R. Kelly, and J. M. Ondov. 1990, 8p
Pub. in Atmospheric Environment 24A, n3 p467-474 1990.

Keywords: Atmospheric composition, Fly ash, Aerosols, Coal, Comparison, Reprints, *Tracer techniques, Isotope applications.

A theoretical comparison has been made between intentional elemental and intentional isotopic tracers for the study of the fate of emissions into the atmosphere. The use of an elemental tracer requires a very large signal to background ratio because the latter cannot be determined while the tracer experiment is in progress. It is shown that the variation in the ambient background is the major source of uncertainty for the elemental tracer. The use of a stable isotopic tracer is definitive because the isotopic composition of the background is constant and can be measured in real time during the isotopic analysis of the sample. It is concluded that stable isotopic tracers are inherently superior to elemental tracers; however, this conclusion now needs to be demonstrated in an actual field experiment.

000,975
PB90-261033 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div. Measurement of Large Scale Oil Spill Burns. Final rept. D. Evans, W. Walton, H. Baum, R. Lawson, R. Rehm, R. Harris, A. Ghoniem, and J. Holland. 1990, 39p
Pub. in Proceedings of Arctic and Marine Oil Spill Program Technical Seminar (13th), Edmonton, Alberta, Canada, June 6-8, 1990, p1-38.

Keywords: *Crude oil, *Smoke, *Fire tests, *Water pollution abatement, *Measurement, *Air pollution, Environmental impacts, Emission, Combustion products, Reprints, *Oil spills, Oil pollution.

Research has shown that burning can be an effective means to remove oil from the surface of the water. The combustion characteristics of crude oil have been measured in large laboratory tests using a nominal one meter diameter pool fire. The work reports on progress mid-way through a 2 1/2 year research program. The objective of the research is to develop measurement equipment and calculations that can be used to characterize oil spill burning at operational scale during field trials of the technology. Field scale measurement techniques for fire radiation, smoke yield, particulate sampling, plume trajectory are described. Progress in the calculation of particulate deposition downwind of the burn site is presented.

000,976
PB91-101055 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div. Polycyclic Aromatic Hydrocarbon Emissions from the Combustion of Crude Oil on Water. Final rept. B. A. Benner, N. P. Bryner, S. A. Wise, G. W. Mulholland, R. Lao, and M. F. Fingas. 1990, 11p
Pub. in Environmental Science and Technology 24, n9 p1418-1427 1990.

Keywords: *Aromatic polycyclic hydrocarbons, *In situ combustion, Burning rate, Crude oil, Water pollution control, Combustion products, Smoking, Concentration(Composition), Reprints, *Environmental impact assessments, *Oil spills, *Air pollution sampling, Cleanup operations.

The work involved an investigation of some of the factors necessary to assess the environmental impact of an in situ burn: the fraction of an oil layer that can be burned, the quantity of smoke, and the concentrations of 18 polycyclic aromatic hydrocarbons (PAHs) in the smoke, crude oil, and burn residue. While burning the crude oil produced less total PAHs than were in the original crude oil, the concentrations of PAHs with five or more rings were 10-20 times greater in the smoke than in the oil. By consuming much of the oil spill and reducing the amount of PAHs in the water, and by dispersing the combustion products over a larger area, in situ burning can mitigate the local environmental impact of an oil spill. There appears to be a range of conditions, such as in Arctic ice fields, where in situ burning might be the most viable cleanup method.

000,977
PB91-113654 PC A03/MF A01
Massachusetts Inst. of Tech., Cambridge. Adsorption Modeling for Macroscopic Contaminant Dispersal Analysis. J. W. Axley. May 90, 42p NIST/GCR-90/573
Contract 43NANB919513
See also PB90-219791. Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.

Keywords: *Air flow, *Adsorption, *Desorption, *Mathematical models, Houses, Formaldehyde, Construction materials, Boundary layer, *Indoor air pollution, Air quality, Laboratory tests, Environmental transport.

Two families of macroscopic adsorption models are formulated, based on fundamental principles of adsorption science and technology, that may be used for macroscopic (such as whole-building) contaminant dispersal analysis. The first family of adsorption models - the Equilibrium Adsorption (EA) Models - are based upon the simple requirement of equilibrium between adsorbent and room air. The second family - the Boundary Layer Diffusion Controlled Adsorption (BLDC) Models - add to the equilibrium requirement a boundary layer model for diffusion of the adsorbate from the room air to the adsorbent surface. Two members of each of these families are explicitly discussed, one based on the linear adsorption isotherm model and the other on the Langmuir model. The linear variants of each family are applied to model the adsorption dynamics of formaldehyde in gypsum wall board and compared to measured data.

000,978
PB91-118281 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Environment Div.

Development of Models for the Prediction of Indoor Air Quality in Buildings. Final rept.

R. Grot, and J. Axley. 1987, 27p
Sponsored by Environmental Protection Agency, Washington, DC., and Department of Energy, Washington, DC.

Pub. in Proceedings of AIVC Conference Ventilation Technology (8th) - Research and Application, Uberlingen, FRG, September 21-24, 1987, p1-27.

Keywords: *Computerized simulation, *Buildings, Air flow, Environmental engineering, Mathematical models, Reprints, *Indoor air pollution, *Air quality.

The National Bureau of Standards has undertaken a research effort to develop a general indoor air quality simulation program for buildings. At present there exist three computer programs which can be used to analyze interzonal air movements in multizoned buildings and predict the level of contaminants due to a wide variety of contaminants. The paper will introduce the reader to the scientific and mathematical basis of the models, the preparation of building input data for these programs, and the use of the models for both residential and commercial buildings.

000,979
PB91-118612 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Problems and Artifacts on Extraction Replicas of Membrane Filters. Final rept.

S. Turner, E. B. Steel, and E. S. Landis. 1990, 10p
Pub. in Materials Research Society Symposium Proceedings, v199 p157-166 1990.

Keywords: *Membranes, *Asbestos, Particle size, Electron microscopy, Replicating, Reliability, Reprints, Air sampling, Laboratory tests.

For studies of particles suspended in air or water, material is commonly deposited onto membrane filters. Submicrometer particles collected in or on the surface of the filters can be prepared for analysis by transmission electron microscopy by extraction replica methods. To identify the problems and artifacts generated during the preparation process, evaluations were made of replicas prepared internally at NIST and prepared by laboratories involved in the analysis of air-collected asbestos. Problems or artifacts that could affect the counting and analysis of asbestos particles were identified and characterized. Results of evaluations of replicas prepared by eighteen laboratories in an interlaboratory study are summarized.

000,980
PB91-134312 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Effects of Systematic Error, Estimates and Uncertainties in Chemical Mass Balance Apportionments: Quail Roost II Revisited.

Final rept.
D. H. Lowenthal, R. C. Hanumara, K. A. Rahn, and L. A. Currie. 1987, 10p
Pub. in Atmospheric Environment 21, n3 p501-510 1987.

Keywords: *Error analysis, Aerosols, Multivariate analysis, Reprints, *Mass balance, *Simulation test data, Emission factors.

The Quail Roost II synthetic data set II is used to derive a comprehensive method of estimating uncertainties for chemical mass balance (CMB) apportionments. Objective diagnostic procedures are applied to data set II to identify collinear sources and evaluate the effects of collinearity on source-strength estimates and their uncertainties. All sources contributing to a series of aerosol samples must be considered when calculating uncertainties for source strengths estimated by CMB apportionments. Covariance in source-strength estimates can be due to collinearity and systematic errors in source specification and composition. Unless covariances as well as variances of source-strength estimates for a series of samples are used to propagate errors, estimated uncertainties may be unrealistically low.

Environmental Health & Safety

000,981
PB90-261231 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Toxic Potency of Fire Smoke: Measurement and Use.

Final rept.
B. C. Levin, and R. G. Gann. 1990, 9p
Pub. in Fire and Polymers: Hazards Identification and Prevention, ACS Symposium Series No. 425, Chapter 1, p9-11 1990.

Keywords: *Toxicity, *Smoke, *Fires, *Hazards, Chemical properties, Combustion products, Measurement, Gas analysis, Models, Exposure, Reprints, N-gas model.

Accurate measurement of the toxic potency of smoke is a key to reducing human life loss in fires. The paper summarizes the approaches taken in measuring toxic potency and highlights four needed issues still to be researched. Direct comparison of only toxic potency values is not a valid means of determining the fire safety of materials and is not sufficient for evaluating fire hazard. The paper describes the N-Gas Model (a new method of assessing toxic potency) and two approaches (in which toxic potency is one of the factors) for assessing fire hazard: (a) HAZARD I, a comprehensive tool for calculating the outcome of a fire, and (b) a fire hazard index for comparing the contributions of alternative materials to the toxicity component of fire hazard.

Pesticides Pollution & Control

000,982
PB90-170713 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Di- and Tributyltin Species in Marine and Estuarine Waters. Inter-laboratory Comparison of Two Ultraviolet Analytical Methods Employing Hydride Generation and Atomic Absorption or Flame Photometric Detection.

Final rept.
A. O. Valkirs, P. F. Seligman, G. J. Olson, F. E. Brinckman, C. L. Matthias, and J. M. Bellama. 1987, 5p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Analyst 112, n1 p17-21 Jan 87.

Keywords: *Tin organic compounds, *Water chemistry, *Antifouling coatings, Biocides, Chemical analysis, Atomic spectroscopy, Flame photometry, Reprints, *Tin/tributyl, *Tin/dibutyl, *Pesticide residues, *Water

pollution sampling, Comparative evaluations, Marine environments.

Di- and tributyltin compounds present in marine and estuarine waters at sub-parts per billion (less than micrograms/liter) levels were determined using two different chemical speciation procedures. Generally, good analytical agreement was obtained from split samples independently analyzed by a simultaneous hydride generation-dichloromethane extraction procedure followed by gas chromatographic separation and flame photometric detection (GC-FPD, performed at the National Bureau of Standards) and by a hydride generation procedure followed by purge and trap collection with boiling-point separation and atomic absorption detection (HG-AA, performed at the Naval Ocean Systems Center). Sea water samples containing tributyltin at sub-p.p.b. levels can be stored frozen (-20 C) in polycarbonate containers for up to 2-3 months without any serious loss of analyte.

Radiation Pollution & Control

000,983

PB90-192667 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.

Preliminary Radon Progeny Measurements in Three Federal Office Buildings.

Final rept.
S. Silberstein, and R. A. Grot. 1990, 8p
Pub. in Environmental Radon: Occurrence, Control and Health Hazards, p201-208 1990.

Keywords: *Radon, *Office buildings, Comparison, Houses, Reprints, *Indoor air pollution, *Air quality, *Daughter products, *Air pollution sampling, Federal agencies.

The National Institute of Standards and Technology conducted preliminary radon progeny measurements of three Federal buildings as part of an indoor air quality study. Progeny levels in two buildings in the Washington metropolitan area were extremely low compared to levels commonly found in houses. The progeny levels of a Portland building were closer to typical house levels. The results suggest that measurements of additional buildings would be promising in finding construction and operating methods that could be applied to lower radon progeny levels of residences.

Solid Wastes Pollution & Control

000,984

PB90-225954 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.

Review of Current Research and Activities Involving Characterization, Abatement and Disposal of Lead-Containing Paint Films.

M. E. McKnight. May 90, 14p NISTIR-90/4285

Keywords: *Paints, *Waste disposal, Regulations, Research projects, Abatement, Measurement, Maintenance standards, Decontamination, Air pollution, *Lead paint poisoning, *Solid wastes, Characterization, Domestic wastes.

In response to a recent regulation for abating lead-based paint in housing and other environmental regulations, research projects and other activities are being conducted to provide information on procedures for carrying out abatement and maintenance of lead-containing paint films in a safe and cost-effective manner. Relevant Federal regulations, and current research projects and other activities addressing the issues are reviewed.

000,985

PB90-235417 PC A04/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Development of Test Methods to Determine the Compatibility of Liquid Hazardous Materials with Polyethylene Packagings.

Final rept. 18 Jun 89-18 Dec 89.
J. M. Crissman. May 90, 52p NISTIR-4346
Contract DTRS-57-89-X-00121
Sponsored by Department of Transportation, Washington, DC. Research and Special Programs Administration.

Keywords: *Hazardous materials, *Packaging materials, *Polyethylene, Materials handling, Transport properties, Transportation, Plastics, Polymers, Permeability, Peroxy organic compounds, Compatibility, Methodology, Tests, Tables(Data), Hydrocarbons, *Liquid waste disposal, Transport regulations, Packaging rules.

The report describes work done for the Department of Transportation, Office of Hazardous Materials Transportation to develop test methods which can be used to determine whether a liquid hazardous material may be shipped in a specific type of polyethylene packaging. Current federal regulations require that each prospective lading be tested individually in proposed polyethylene packagings and do not make provision for liquids which may be unstable at 21 C. One area being explored is the possibility of dividing the liquids into groups and authorizing the transportation of all the liquids in the group based on tests done using one standard liquid from that group. The feasibility of basing compatibility tests on the use of standard liquids is assessed and recommendations are made as to the conditions under which such a scheme can be used. An empirical scheme known as the 'Permachor' method for ranking the permeability of liquid hazardous materials is proposed.

000,986

PB90-254442 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Chlorine Mass Balance in the Combustion of Refuse-Derived Fuel.

Final rept.
K. L. Churney, A. E. Ledford, T. J. Buckley, and E. S. Domalski. 1988, 10p
Pub. in Proceedings of Biennial National Waste Processing Conference on Technical Communication: A Key to the Future (13th), Philadelphia, PA., May 1-4, 1988, p47-56.

Keywords: *Chlorine, Combustion products, Calcium oxides, Calorimeters, Thermochemistry, Reprints, *Refuse derived fuels, *Mass balance, Municipal wastes, Waste utilization.

Chlorine mass balance studies have been carried out in the combustion of municipal solid waste (MSW) using the combustor of the NBS multikilogram capacity flow calorimeter. This arrangement allows for a more accurate examination of the combustion chemistry of MSW than is possible in a real-world incinerator. The changes in the distribution of chlorine between the volatile and the nonvolatile combustion products caused by the addition of lime to the MSW are discussed.

Water Pollution & Control

000,987

PB90-146374 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Burning, Smoke Production, and Smoke Dispersion from Oil Spill Combustion.

D. Evans, G. Mulholland, D. Gross, H. Baum, W. Walton, and K. Saito. Oct 89, 58p NISTIR-89/4091
Also available from Supt. of Docs. Prepared in cooperation with Kentucky Univ., Lexington. Sponsored by Minerals Management Service, Reston, VA.

Keywords: *Smoke, *Combustion, *Crude oil, *Water pollution, Energy transfer, Assessments, Burning rate, Toluene, Decanes, Vaporizing, Fuels, Estimates, Fires, Measurement, Dilution, *Oil spills, Particulates, Downwind.

The combustion of crude oil layers floated on water were studied to assess the potential of using combustion to mitigate oil spills. Burning rates for n-decane,

Water Pollution & Control

toluene and Alberta Sweet crude oil were measured in a 1.2 m diameter pool. These were used to estimate the energy transfer rate required to vaporize the fuel as part of an energy balance at the liquid surface. Smoke emission per unit of fuel consumed was dramatically reduced in the case of burning oil layers thin enough to cause boiling in the supporting water layer. A new aging/dilution facility is described that allows for measurement of optical properties and sedimentation velocities as the smoke ages. These characteristics are important in estimating smoke properties downwind of the oil spill fire. A formulation is presented that will provide for estimates of downwind particulate deposition of the fire smoke for a steadily burning oil spill.

000,988
PB90-149428 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Application of a Nd:YAG Laser-Pumped Dye Laser to the Determination of Nickel in River Sediment Using Nonresonance Flame Atomic Fluorescence Spectrometry.
 Final rept.
 M. S. Epstein, G. C. Turk, and J. C. Travis. 1988, 3p
 Pub. in Jnl. Anal. At. Spectrom. 3, n4 p523-525 1988.

Keywords: *Nickel, *Quantitative analysis, *Sediments, Standards, Rivers, Reprints, *Water pollution detection, Fluorescence spectroscopy, Standard Reference Material 1645, Neodymium lasers, YAG lasers.

A Nd:YAG laser-pumped dye laser is used as a source for the excitation of the nickel nonresonance atomic fluorescence in an air-acetylene flame. Detection limits are poorer than previous data from flashlamp-pumped dye laser experiments, but measurement precision is improved. Nickel is determined in a very complex standard reference material (NBS SRM 1645 - River Sediment).

General

000,989
PB90-254756 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
History of the Section on Statistics and the Environment.
 Final rept.
 W. Liggett, and D. Splitstone. 1990, 2p
 Pub. in the American Statistician 44, n2 p94-95 May 90.

Keywords: *Statistical analysis, Personnel development, Professional personnel, Reprints, *Environment management, *Environmental protection, American Statistical Association.

The section on Statistics and the Environment, begun in 1990, was preceded by two decades of concerted effort to bring the best statistical methodology to the resolution of environmental concerns. The article surveys the part of this effort reflected in the professional activities of statisticians.

HEALTH CARE

Health Care Delivery Organization & Administration

000,990
PB90-237355 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Hospital Energy Analysis Toolkit (HEAT): User Manual.
 Final rept.
 S. F. Weber, and B. C. Lippiatt. Sep 90, 23p NISTIR-4408, NIST/SW/DK-90/012A
 For system on diskette, see PB90-504036. Sponsored by Public Health Service, Rockville, MD.

Keywords: *Cost effectiveness, Benefit cost analysis, Heating, Cooling, Documentation, *Hospital administration, *Energy conservation, Decision support system.

The Hospital Energy Analysis Toolkit (HEAT) is a menu-driven microcomputer software program designed to help facility managers of existing hospitals evaluate the cost effectiveness of specific Energy Saving Methods (ESMs). The program estimates the energy savings and cost effectiveness of specific ESMs in a user-defined hospital environment. Hospitals are defined in terms of an unlimited number of actual functional space zones, each modeled after one of 21 prototype zones. For each defined zone, the user specifies the floor area, and for some zones the user specifies the types of heating and cooling systems, the percentage of space being actively used, and the window orientation. The user also defines an Energy Saving Plan by specifying the current and planned status of each energy parameter applicable to the particular zone. HEAT then computes and reports the energy and economic savings resulting from the Plan. A benchmarking function lets users compare current energy use of the entire hospital with national norms to see whether further analysis is warranted. HEAT offers easy-to-use menus and function keys, on-line help screens, and data validation.

000,991
PB90-504036 CP D99
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Hospital Energy Analysis Toolkit (HEAT), Version 1.0 (for Microcomputers).
 Software.
 15 Sep 90, 1 diskette NIST/SW/DK-90/012
 System: Intel 8088/286/386; MS DOS operating system, 512K. Language: Clipper and C. A microcomputer with a hard disk drive is required. The software is contained on one 360K, 5 1/4 inch diskette, double density. File format: ASCII. Price includes documentation, PB90-237355.

Keywords: *Software, Cost effectiveness, Benefit cost analysis, Heating, Cooling systems, Diskettes, *Hospital administration, *Energy conservation, Decision support systems.

The Hospital Energy Analysis Toolkit (HEAT) is a menu-driven microcomputer software program designed to help facility managers of existing hospitals evaluate the cost effectiveness of specific Energy Saving Methods (ESMs). The program estimates the energy savings and cost effectiveness of specific ESMs in a user-defined hospital environment. Hospitals are defined in terms of an unlimited number of actual functional space zones, each modeled after one of 21 prototype zones. For each defined zone, the user specifies the floor area, and for some zones the user specifies the types of heating and cooling systems, the percentage of space being actually used, and the window orientation. The user also defines an Energy Saving Plan by specifying the current and planned status of each energy parameter applicable to the particular zone. HEAT then computes and reports the energy and economic savings resulting from the Plan. A benchmarking function lets users compare energy use of the entire hospital with national norms to see whether further analysis is warranted. HEAT offers easy-to-use menus and function keys, on-line help screens, and data validation.

Health-Related Costs

000,992
PB91-112367 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Measuring Medical Cost and Life Expectancy Impacts of Changes in Cigarette Sales.
 Final rept.
 B. C. Lippiatt. 1990, 18p
 Sponsored by Consumer Product Safety Commission, Bethesda, MD.
 Pub. in Preventive Medicine 19, n5 p515-532 Sep 90.

Keywords: *Tobacco, *Smoking, *Sales, *Economic models, Economic analysis, *Cigarettes, *Health economics, *Life expectancy, *Health care costs.

A change in cigarette sales triggers changes in medical-care costs and in years of life expectancy. Changes in sales result from changes in excise tax policy, agricultural policy, cigarette design, smoking behavior, or anti-smoking laws. The model uses data on medical costs, life expectancy, cigarette price elasticity, and smoking demographics to estimate medical-cost and life-year impacts for any change in cigarette sales. It takes into account the medical costs incurred by quitters over their extra years of life, the asymmetry of impacts for increases and decreases in sales, and the delayed medical effects for ages not yet subject to the health risks of smoking. For example, a 1% decrease in U.S. cigarette sales increases life expectancy in the United States by 1.45 million years and increases medical-care costs by \$405 million for ages 25 to 79. This amounts to only \$280 in added medical costs for each extra year of life. By generating aggregate health impacts at the margin, the model becomes a valuable tool for evaluating programs that affect smoking.

INDUSTRIAL & MECHANICAL ENGINEERING

Laboratory & Test Facility Design & Operation

000,993
DE90009056 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Reference data in support of energy programs.
 Final report.
 Progress rept.
 M. W. Chase. 19 Mar 90, 13p DOE/ER/13494-T1 Contract A101-86ER13494
 Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: *Research Programs, Chemistry, Data Base Management, Data Processing, Education, Fracture Mechanics, Grants, Information Systems, Materials Testing, Optimization, Physics, Planning, Progress Report, Recommendations, Resource Management, *Standards, Technology Transfer, EDB/990300.

The Standard Reference Data (SRD) of the National Institute of Standards and Technology conducted a program for compilation and evaluation of physical, chemical, and materials properties data relevant to energy research and development. This report provides a description of the manner in which the program was run and a report of the results. The basis for DOE support for this program on reference data was the realization that data from the results of basic and applied research need to be compiled and evaluated in order to: (a) more effectively transfer research results into development and process design, (b) build a body of reliable data on which estimation and prediction methods can be based, and (c) provide guidance to researchers about gaps in available data and areas in which further research is needed.

000,994
NUREG/CR-5484 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
pH Sensors Based on Iridium Oxide.
 Formal rept. Sep 87-Jun 89.
 M. J. Tarlov, K. G. Kreider, S. Semancik, and P. Huang. Mar 90, 22p
 Also available from Supt. of Docs. Sponsored by Nuclear Regulatory Commission, Washington, DC. Div. of Engineering.

Keywords: *Indium oxides, *Thin films, *pH, *Measurement, Stability, Sensing films, Reactive sputter deposition.

Results are presented on the pH-potential response of d.c. magnetron reactively sputtered iridium oxide films. The films exhibit a nearly Nernstian response to pH, no hysteresis effects, and minimal response to ionic interferences. Sensitivity to certain redox species is observed, however. In addition, methods are discussed for preparing model iridium oxide sensor surfaces for ultrahigh vacuum surface analytical studies. Stoichiometric IrO₂-like surfaces are shown to be relatively inert to gas phase water. However, hydroxylation of IrO₂-like surfaces can be induced by rf water plasma treatment.

000,995
N90-17903/7
 (Order as N90-17894/8, PC A16/MF A03)
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.
Radiation Thermometry at NIST: An Update of Services and Research Activities.
 G. B. Hillard. 1 Jun 89, 9p
 In JPL, Proceedings of the Second Noncontact Temperature Measurement Workshop p71-79.

Keywords: *Calibrating, *Temperature measurement, *Thermometers, Black body radiation, *Pyrometers, Simulators, Temperature scales.

An overview of activities at the National Institute of Standards and Terminology (NIST) in radiation thermometry and related temperature scale research is presented. An expansion of calibration services for pyrometers will be described as well as efforts to develop calibration services for blackbody simulators. Research relevant to the realization of the new international temperature scale (ITS 90) will be discussed.

000,996
PATENT-4 954 722 Not available NTIS
 Department of Commerce, Washington, DC.
Scanning Scattering Microscope with Hemispherical Mirror and Microfocussed Beam.
 Patent.
 J. Fine, and D. Marton. Filed 21 Jul 89, patented 4 Sep 90, 12p PB90-237264, PAT-APPL-7-382 884
 This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Surface roughness, *Light scattering, *Microscopes, *Patents, *Scanning scattering microscopes, TIS method, PAT-CL-250-571.

A method and apparatus produce two-dimensional micrographs of the overall surface microtopography of a given specimen by using a photodetector to measure the off-specularly reflected light from a focussed light beam which is projected through a hemispherical mirror onto the specimen surface as the specimen surface is scanned by the focussed beam of light. Scanning can be accomplished either by moving the specimen surface as a result of moving the sample holding member or by moving the focused beam of light by means of a light beam deflection device.

000,997
PB90-135849 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Advances in Research on Dynamic Measurements of Thermophysical Properties at High Temperatures.
 Final rept.
 A. Cezairliyan. 1989, 7p
 Pub. in Proceedings of Asian Thermophysical Properties Conference (2nd), Sapporo, Japan, September 19-22, 1989, p1-7.

Keywords: *Thermophysical properties, *Dynamics, *Measurement, *High temperature tests, Dynamic tests, Research projects, Thermodynamic properties, Thermal measurements, Measuring methods.

Recent advances in research conducted at the National Institute of Standards and Technology (formerly the National Bureau of Standards) on the development and use of dynamic techniques for the measurements of selected thermophysical properties of materials at high temperatures are presented. Emphasis is placed on work during the last five years, and discussions are limited to the techniques that utilize rapid resistive self-heating methods in the subsecond (millisecond-resolution) to submillisecond (microsecond-resolution) time regimes. For completeness, a brief description of the general method and the measurement systems, and a

concise chronology of the developments during the period 1963-1983 are also given.

000,998
PB90-146465 PC A12/MF A02
 National Inst. of Standards and Technology, Gaithersburg, MD.
Report of the National Conference on Weights and Measures (74th).
 Special pub.
 A. D. Tholen, C. S. Brickenkamp, and A. Heffernan-Turner. Sep 89, 254p NIST/SP-771
 Held in Seattle, Washington, July 16-21, 1989. Also available from Supt. of Docs. as SN003-003-02977-7. Library of Congress catalog card no. 26-27766.

Keywords: *Standards, *Measurement, *Meetings, Abstracts, Flow measurement, Specifications, Metrology, Regulations, Calibrating.

The 74th Annual Meeting of the National Conference on Weights and Measures (NCWM) was held at the Westin Hotel in Seattle, Washington during the week of July 16 through 21, 1989. The theme of the meeting was 'National Uniformity Benefits Everyone.' The Conference set standards for equipment and sales practices in the area of cash/credit pricing of retail motor fuel, and also adopted a specification that permits the use of electronic data audit trails to be used for security assurance. Sweeping changes to the Uniform Weights and Measures Law and the Uniform Weighmaster Law were also adopted; if a State chooses to adopt these new standards, a system of administrative hearings and civil penalties could serve as an alternative to criminal prosecution.

000,999
PB90-147406 PC A03/MF A01
 Tianjin Univ. (China).
Thermal Effects of Handling Ball Bars.
 Technical note (Final).
 J. Shi, T. Doiron, and B. Borchardt. Oct 89, 19p
 NIST/TN-1271
 Also available from Supt. of Docs. as SN003-003-02983-1. Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.

Keywords: *Thermal analysis, *Metrology, Measuring instruments, Thermophysical properties, Relaxation time, Test facilities, *Ball bars.

Ball bars are a primary method of testing coordinate measuring machines. The accuracy of the method depends critically on the stability of the length of the bar. The study shows the primary thermal relaxation time for ball bars to be near 15 minutes and explores the size and duration of thermal effects for two bars of different materials.

001,000
PB90-149543 Not available NTIS
 National Bureau of Standards (NEL), Boulder, CO.
 Chemical Engineering Science Div.
NBS (National Bureau of Standards) Boil-Off Calorimeter for Measuring Thermal Conductivity of Insulating Materials.
 Final rept.
 W. P. Dube, L. L. Sparks, and A. Slifka. 1988, 7p
 Pub. in Advances in Cryogenic Engineering, v34 p67-73 1988.

Keywords: *Thermal conductivity, *Thermal insulation, *Thermal measurements, *Calorimeters, Cryogenics, Reprints, Computerized control systems.

Modern temperature, pressure and flow sensors along with a high speed digital control system have been incorporated into an existing thermal conductivity apparatus (ASTM C745). The system has also been modified to include the use of liquid helium as the refrigerant, if desired. The apparatus can be used to study thermal conductivity in the temperature range from 4K to room temperature. Preliminary results on insulating materials indicate that the system update has significantly improved the precision and operational characteristics of the apparatus. Basic principles of operation, sources of system error and the reduction of system error by application of digital control and modern sensors are discussed. Preliminary data are presented.

001,001
PB90-155334 PC A04/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD. Office of Weights and Measures.

Index to the Reports of the National Conference on Weights and Measure from the First to the Seventy-Third (1905 to 1988).

Special pub. (Final).
 F. G. Bell, W. G. Mott, and N. Chaconas. Sep 89, 70p NIST/SP-769
 Supersedes PB85-200061. Also available from Supt. of Docs. Library of Congress catalog card no. 89-600745.

Keywords: *Indexes(Documentation), *Standards, *Units of measurement, *Metrology, *Meetings.

The publication comprises a subject index and a speaker index for the Reports of the National Conference on Weights and Measures from the First (1905) through the Seventy-Third (1988) and supersedes NBS Special Publication 691.

001,002
PB90-161712 PC A11/MF A02
 National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
Directory of U.S. Private Sector Product Certification Programs.
 Special pub.
 M. Breitenberg. Dec 89, 238p NIST/SP-774
 Also available from Supt. of Docs. as SN003-003-02984-0. Supersedes PB86-110913. Library of Congress catalog card no. 89-600785.

Keywords: *Directories, *Product inspection, Tests, Specifications, Standards, Quality assurance, *Private organizations, *Certification, National Institute of Standards and Technology.

The document presents information on 132 private sector groups in the United States which engage in product certification activities. Entries describe the type and purpose of each organization, the nature of the activity, products certified, standards used, certification requirements, any accreditation or recognition by a U.S. or foreign private sector or government agency, availability of services, methods of cost determination, and other relevant details. The directory is part of an ongoing NIST (formerly NBS) effort to establish and maintain comprehensive information on standards, regulations, certification programs and related topics.

001,003
PB90-169442 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Surface Phenomena and Their Influence on Ultra-high Vacuum Gauges.
 Final rept.
 T. E. Madey. 1987, 1p
 Pub. in Jnl. of Vacuum Science and Technology A 5, n5 p3249 1987.

Keywords: *Vacuum gages, *Ionization gages, Pressure measurement, Ultrahigh vacuum, Surface chemistry, Reprints, *Surface reactions.

To a surface scientist, a hot filament ionization gauge is a remarkably complex device whose operational properties are determined by a wide range of surface processes. The hot filament itself is a rich source of surface chemistry, including thermal desorption of gases, gas-solid reactions, and atomization of gases. Its electron emission characteristics are controlled by fractional monolayers of impurities, and its life-time is limited by surface reactions and the formation of volatile products. Electron bombardment of the grid of the gauge can lead to heating of the grid, causing thermal desorption, or to electron stimulated adsorption and desorption (ESA and ESD). ESD can be particularly vexing, giving rise to spurious ion signals that result in apparent pressures 10x to 100x greater than true pressures. Other surface phenomena which affect gauging include sputtering, charging, photoemission (the x-ray limit), secondary electron emission, and electron-induced polymerization.

001,004
PB90-169798 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Standard Reference Materials for Use in Precision Thermometry.

Final rept.
B. W. Mangum. 1987, 10p
Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p44-1-44-10.

Keywords: *Temperature measurement, Precision, Reprints, *Standard reference materials, Fixed points.

Several Standard Reference Materials (SRMs) have been developed at the NBS in recent years for use in precision thermometry. They are either fixed-point materials or devices with fixed-point temperatures in the range from 0.015 K to 2053 C. The present article reviews the use and importance of thermometric fixed points in precision thermometry and of SRMs that are providing some of those fixed points.

001,005

PB90-170101 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.

Residual Currents in Several Commercial UHV Bayard-Alpert Gauges.

Final rept.
A. R. Filippelli. 1987, 8p
Pub. in Jnl. of Vacuum Science and Technology A 5, n5 p3234-3241 1987.

Keywords: *Vacuum gages, Ultrahigh vacuum, Hydrogen, Reprints, *Bayard-Alpert ionization gages, Commercial equipment, Residual currents, Pressure dependence.

Residual currents have been determined for several commercial UHV Bayard-Alpert gauges, including two modulated gauges, by comparison against an extractor gauge. Residual currents in the modulated gauges were also determined by the modulation method (Red-head mode I) and these results are compared with those of the first method. Residual current modulation factors were estimated by combining the results of these two methods. One notable aspect of this work is the finding that residual current values can differ by more than a factor of 10 among nominally identical gauges. Another interesting and somewhat surprising feature of these measurements, which were performed in H2 at pressures in the range 4 x 10 to the -9 power to 4 x 10 to the -5 power Pa, is that there was no evidence of hysteresis in the response of any of the gauges to changes in the H2 pressure.

001,006

PB90-170515 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

NBS (National Bureau of Standards)/Industry Collaboration on Instrumentation Development.

Final rept.
P. L. Heydemann. 1987, 8p
Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p1-1-1-8.

Keywords: *Measuring instruments, *Industry, Reprints, *National Institute of Standards and Technology, Coordinated research programs, Government industry relations.

The U.S. instrumentation industry and the National Bureau of Standards may have a common interest in the development of new measuring instrumentation. NBS needs this instrumentation to carry out its own mission in support of industry and commerce. The instrumentation industry needs new commercial products to maintain its competitive position in the market. Both could gain from close cooperation. NBS has the facilities and the multidisciplinary staff to carry out fundamental and applied research. Industry knows how to engineer a new instrument for production. In the paper the legal situation that governs industry/government collaborations, and the possible organization of collaborative research and development projects will be briefly reviewed. Some of the technical work that might be accomplished under such agreements will be explored. The possibility of joining forces in the development of a few specific types of instruments that are of interest to the metrological community will be closely examined.

001,007

PB90-188491 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Effects of Timing Jitter in Sampling Systems.

Final rept.
T. M. Souders, D. R. Flach, C. Hagwood, and G. Yang. 1990, 6p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n1 p80-85 Feb 90.

Keywords: *Sampling, *Time measurement, *Vibration, Electrical measurement, Waveforms, Estimates, Bias, Mean, Median(Statistics), Reprints.

Timing jitter generally causes a bias (systematic error) in the amplitude estimates of sampled waveforms. Equations are developed for computing the bias in both the time and frequency domains. Two principal estimators are considered: the sample mean and the so-called Markov estimator used in some equivalent-time sampling systems. Examples are given using both real and simulated data.

001,008

PB90-188541 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.

CMM (Coordinate Measuring Machines) Standards.

Final rept.
R. C. Veale, and R. J. Hocken. 1989, 4p
Pub. in Quality, pQ-3, Q-4, Q-6, Q-8 Dec 89.

Keywords: *Standards, Performance evaluation, Test facilities, Measuring instruments, Reprints, *ANSI B89.1.12, *Coordinate measuring machines.

The B89.1.12 Standard for the performance evaluation of Coordinate Measuring Machines has contributed significantly both to the public acceptance and the improved performance of coordinate measuring machines in the United States. Work is now underway to update the Standard. In addition, two new American National Standard Institute (ANSI) groups have been formed to deal with the problem of making CMM data conform to ANSI Y14.5 specifications.

001,009

PB90-192444 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.

Metrological Electron Microscope for the Certification of Magnification and Linewidth Artifacts for the Semiconductor Industry.

Final rept.
M. T. Postek, W. J. Keery, and S. Jones. 1989, 8p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers)-Integrated Circuit Metrology, Inspection, and Process Control III, v1087 p38-45 1989.

Keywords: *Dimensional measurement, *Electron microscopes, *Standards, *Semiconductors(Materials), Units of measurement, Electron microscopy, Electron optics, Metrology, Length, Reprints.

The National Institute of Standards and Technology has, for several years, been developing a metrological electron microscope system traceable to national standards of length. The metrology instrument will certify standards for the calibration of the magnification of scanning electron microscopes (SEM) and for the certification of artifacts for SEM linewidth measurement. These artifacts are not only directed to instruments used in the semiconductor community but will also be useful for the various other applications to which the SEM is currently being used. The SEM-based metrology system now operational at the Institute will be described as well as its design criteria and procedures for its characterization. The design and criteria for new lithographically produced SEM low-accelerating-voltage magnification standard to be calibrated on this system will also be presented.

001,010

PB90-192527 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO. Thermophysics Div.

Heat Capacity, Cp, of Fluids from Transient Hot Wire Measurements.

Final rept.
H. M. Roder, and C. A. Nieto de Castro. 1987, 2p
Pub. in Cryogenics 27, n6 p312-313 1987.

Keywords: *Specific heat, *Thermal measurements, *Thermal measuring instruments, Thermal diffusivity, Thermal conductivity, Thermophysical properties, Gases, Liquids, Thermodynamic properties, Equations of state, Reprints.

The authors report the first measurements of the thermal diffusivity that cover a wide range of thermodynamic states including the dilute gas, the dense gas, the compressed liquid, and near critical conditions. The specific heat is obtained from simultaneous measurements of thermal conductivity and thermal diffusivity in a transient hot wire instrument, while the density is obtained from an equation of state. Values for the specific heat, CP, of argon were obtained at two temperatures, 172 and 275 K, with pressures to 70 MPa. For these temperatures the densities range from the dilute gas to 2.2 times critical density while the specific heat varies by a factor of 7 from the dilute gas value

001,011

PB90-192535 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Thermophysics Div.

Measurement of Thermal Conductivity and Thermal Diffusivity of Fluids Over a Wide Range of Densities.

Final rept.
H. M. Roder, and C. A. Nieto de Castro. 1989, 12p
Pub. in Thermal Conductivity 20, p173-184 1989.

Keywords: *Fluids, *Density, *Thermal measuring instruments, *Thermal measurements, *Thermal conductivity, *Thermal diffusivity, Gases, Argon, Thermophysical properties, Specific heat, Thermodynamic properties, Reprints.

A transient hot wire apparatus was revised to make simultaneous measurements of thermal conductivity and thermal diffusivity of fluids for a wide range of densities. In addition, the theory of the method had to be revised to allow correct evaluation of the thermal diffusivity. The authors illustrate the new method and theory with data for argon along 6 isotherms between 172 and 325 K with pressures up to 70 MPa and densities up to 30 mol/L. For thermal conductivity, the precision is about 0.3% and the accuracy better than 1.0%. For thermal diffusivity the accuracy is estimated to be 5%. From the two variables measured and from the density taken from the equation of state values of the specific heat, CP, of the fluid were obtained. The actual status of the application is described and present limitations are analyzed.

001,012

PB90-198920 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.

Directory of NVLAP (National Voluntary Laboratory Accreditation Program) Accredited Laboratories, 1990.

N. M. Trahey, J. Horlick, and V. R. White. Mar 90, 70p NISTIR-90/4280

Keywords: *Laboratories, *Directories, *National Voluntary Laboratory Accreditation Program, Test and evaluation.

The directory lists laboratories that have been accredited, as of March 1, 1990, under the NVLAP procedures. Indexes A, B, and C list the accredited laboratories (for all programs except Asbestos) alphabetically by name, by field of testing, and by state, respectively. Each laboratory's scope of accreditation, which lists the specific test methods for which it is accredited, is presented in Index D. Index E lists the accredited Asbestos laboratories alphabetically by city within state.

001,013

PB90-205931 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.

Versatile Scan Generator and Data Collector for Scanning Tunneling Microscopes.

Final rept.
R. D. Cutkosky. 1990, 5p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Review of Scientific Instruments 61, n3 p960-964 Mar 90.

Keywords: Electron microscopes, Laboratory equipment, Data acquisition, Signal processing, Reprints, *Scanning tunneling microscope, *Scan generator.

An instrument has been constructed for generating the complex scanning and data-collection sequences required for scanning tunneling microscopy. The instrument is controlled by and returns data to a laboratory computer over an IEEE-488-bus. A very high data-collection speed was achieved through the use of a digital

signal-processing microprocessor coupled to a 16-bit I/O processor.

001,014
PB90-206756 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Liquid-in-Glass Thermometers - Why Are They Still Being Used Today.
Final rept.
J. A. Wise. 1988, 3p
Pub. in ASTM Standardization News, p48-50 May 88.

Keywords: *Temperature measuring instruments, History, Utilization, Laboratory equipment, Medical equipment, Reprints, *Thermometers.

Liquid-in glass thermometers have been used to measure temperature for approximately 400 years and are still used by the thousands in clinical, petro-chemical, and industrial laboratories. The reasons are that they are inexpensive, reasonably accurate, and easy to use.

001,015
PB90-206848 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Magnetic Microstructure Imaging Using Scanning Electron Microscopy with Polarization Analysis.
Final rept.
J. Unguris, R. J. Celotta, D. T. Pierce, and G. G. Hembree. 1987, 3p
Pub. in Analytical Electron Microscopy, p350-352 1987.

Keywords: *Magnetic measurement, Electrons, Polarization(Spin alignment), Laboratory equipment, Microstructure, Reprints, *Scanning electron microscopy.

The paper summarizes a talk presented at the Microbeam Analysis Society Meeting which reviewed the techniques of Scanning Electron Microscopy with Polarization Analysis (SEMPA). The paper briefly reviews the techniques, describes the required apparatus and provides several examples of measurements made using SEMPA. References to more detailed review papers are provided.

001,016
PB90-207069 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Scanning Electron Microscope-Based Metrological Electron Microscope System and New Prototype Scanning Electron Microscope Magnification Standard.
Final rept.
M. T. Postek. 1989, 13p
Pub. in Scanning Microscopy 3, n4 p1087-1099 1989.

Keywords: *Laboratory equipment, *Standards, Magnification, Calibrating, Reprints, *Metrological electron microscope, *Scanning electron microscope, Metrology.

A metrological electron microscope has been developed at the National Institute of Standards and Technology traceable to national standards of length, and a new prototype magnification standard meeting the current needs of the scanning electron microscope (SEM) user community has been fabricated. The metrology instrument is designed to certify standards for the calibration of the magnification of the SEM and for the certification of artifacts for linewidth measurement done in the SEM. The artifacts will be useful for various applications in which the SEM is currently being used. The SEM-based metrology system is now operational at the Institute, and its design criteria and the progress on the characterization of the instrument are presented. The design and criteria for the new lithographically produced SEM low accelerating voltage magnification standard to be calibrated on the system are also discussed.

001,017
PB90-217977 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Precision Engineering and Experimental Physics: William A. Rogers, the First Academic Mechanician in the U.S.
Final rept.
C. J. Evans, and D. J. Warner. 1988, 11p
Pub. in the Michelson Era in American Science 1870-1930, p2-12 1988.

Keywords: *Precision, *Measurement, *Gratings(Spectra), *Biographies, Length, Measuring instruments, History, Reprints, *Rogers, William A.

Although largely ignored by historians both of science and of technology, William A. Rogers (1832-98) is a significant figure in the evolution of fine mechanics and precision measurement in the USA in the latter part of the 19th century. He developed practical length standards for both science and industry and contributed to their dissemination in the USA. He built comparators, linear and circular dividing engines, and diffraction grating ruling engines. His designs and his publications demonstrate an excellent fundamental understanding of fine mechanism and precision instrumentation. The paper has three main themes; first it outlines Rogers' career, highlighting his major technical achievements. Secondly, it indicates Rogers' influence on both science - through his collaboration and interactions with Rowland, Morley and Michelson - and industry. Finally, it provides one possible explanation for American domination of the diffraction grating ruling art.

001,018
PB90-232752 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Weights and Measures.
Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures. 1. Specifications and Tolerances for Field Standard Weights (NIST (National Institute of Standards and Technology) Class F). Revised 1990.
Final rept.
G. L. Harris. May 90, 15p NIST/HB-105/1/REV90
Also available from Supt. of Docs. as SN003-003-030313-9.

Keywords: *Weight measurement, *Specifications, Tolerances(Mechanics), Standards, Weight(Mass), Weight indicators, Measurement, Measuring instruments, Handbooks.

The handbook provides minimum requirements for field standard weights used to test commercial weighing devices. It supersedes Handbook 105-1 (1972 edition).

001,019
PB90-242215 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.
Instrumentation Everywhere (Editorial).
Final rept.
R. S. Turgel. 1990, 1p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n1 p1, Feb 90.
Keywords: *Instruments, Measurement, Accuracy, Reprints.

The editorial for the special issue on papers presented at the selected Instrumentation and Measurements Technical Conference held in Washington, DC on April 25-27, 1989 emphasizes both the extent to which instrumentation penetrates our everyday lives and the need for further development of instrumentation at the highest levels of accuracy.

001,020
PB91-101121 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Quick and Easy Multiple Use Calibration Curve Procedure.
Final rept.
R. J. Carroll, C. H. Spiegelman, and J. Sacks. 1988, 6p
See also AD-A198 227. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Technometrics 30, n2 p137-141 1988.

Keywords: *Calibrating, *Confidence limits, Regression analysis, Statistical analysis, Nonparametric statistics, Reprints.

The standard multiple use calibration procedure due to Scheffe insists that with probability (1-delta), at least (1-alpha) of the calculated confidence intervals contain the true unknown. The procedure is fairly difficult to use because it relies on tables which are not generally available. The authors consider a different requirement, namely that with probability (1-delta) the expected proportion of intervals containing the true unknown be at least (1-alpha). Intervals which satisfy this re-

quirement use only standard t- and F-distribution tables. As is intuitively clear, the resulting intervals are generally much shorter than those constructed to satisfy Scheffe's requirement. An example is given to illustrate the techniques.

001,021
PB91-101329 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Observation of Gold Thin Film Growth with Reflection Electron Microscopy.
Final rept.
T. Jach, G. Hembree, and L. B. Holdeman. 1990, 8p
Pub. in Thin Solid Films 187, p133-140 1990.

Keywords: *Test equipment, *Thin films, *Gold, *Metal films, Crystal growth, Diffusion, Reaction kinetics, Surface chemistry, Supersaturation, Reprints, *Reflection electron microscopy, Morphology.

The morphology of gold thin films, grown on amorphous substrates which were held at fixed temperatures was studied with reflection electron microscopy (REM). The grazing incidence geometry of the technique permitted the observation of nucleated growth, anisotropic growth, and columnar growth with high resolution. The observed growth is compared with the kinetics predicted by diffusion constants. In addition, whisker growth was observed under conditions of high effective supersaturation that can be distinguished from previously reported whisker growth. The features observed with REM are virtually invisible when examined by high resolution scanning electron microscopy.

001,022
PB91-118497 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Statistical Engineering Div.
Space Balls: Or Estimating the Diameter Distribution of Monosize Polystyrene Microspheres.
Final rept.
S. Schiller. 1988, 6p
Pub. in Proceedings of Symposium on the Interface, Computing Science and Statistics (20th), Fairfax, VA., April 1988, p737-742.

Keywords: *Dimensional measurement, Polystyrene, Diameters, Simulation, Reprints, *Microspheres, Standard reference materials.

Polystyrene microspheres, with nominal diameters in the range of 3 to 30 micrometers, were manufactured in space on the shuttle Challenger and are certified by the National Bureau of Standards as Standard Reference Materials; they provide an important tool for calibrating instruments that are used to examine very small particles. In order to be useful, their diameter distributions must be well-characterized. One measurement technique proposed is to form closely packed hexagonal arrays on a microscope slide with the spheres, measure the row lengths, and impute the diameters from these. The obvious diameter estimate is the row length divided by the number of spheres in the row. However, because the diameters are not identical, there are always air gaps in these arrays which inflate the diameter estimates. These air gaps cannot be measured by the microscope, nor can they be modelled mathematically. The approach to this estimation problem is to simulate arrays of the spheres and determine the behavior of the air gaps. Modelling of the diameters in terms of row lengths is done using the simulation results and tested on data from actual photomicrographs.

Nondestructive Testing

001,023
PB90-217886 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Research on Inverse Problems in Materials Science and Engineering.
Final rept.
S. J. Norton, J. A. Simmons, A. H. Kahn, and H. N. G. Wadley. 1988, 21p
Pub. in Proceedings of NATO (North Atlantic Treaty Organization) Advanced Research Workshop on Signal Processing and Pattern Recognition in Nonde-

Nondestructive Testing

structive Evaluation of Materials, Quebec, Canada, August 19-22, 1987, p1-21 1988.

Keywords: *Nondestructive tests, Acoustic signals, Electrical resistivity, Eddy current tests, Signal processing, Reprints, Characterization, Temperature dependence, Tomography, Computer graphics, Image analysis, Convolution integrals.

The role of inverse problems in the characterization of materials is discussed. Four such problems are described in detail: deconvolution for acoustic emission, tomographic reconstruction of temperature distribution, electrical-conductivity profiling and inverse scattering. Each exploits a priori information in a different way to mitigate the ill-conditioning inherent in most inverse problems.

001,024
PB91-107524 PC A04/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
NVLAP Program Handbook. Acoustical Testing Services.
 R. L. Gladhill, and P. R. Martin. Oct 90, 52p NISTIR-4428
 See also PB90-112327.

Keywords: *Acoustic measurement, *Nondestructive tests, *Laboratories, Performance evaluation, Acoustic measuring instruments, Acoustic properties, Test facilities, Sound transmission, Vibration, *Accreditation, Test methods.

The document explains the operational and technical requirements of the National Voluntary Laboratory Accreditation Program for Acoustical Testing Services. All of the steps leading to the accreditation are discussed. Technical requirements are explained indicating how the NVLAP criteria are applied. The Handbook is intended for use by the staff of accredited laboratories, those seeking accreditation, other laboratory accreditation systems, and others needing information on the requirements for NVLAP accreditation under the program.

Quality Control & Reliability

001,025
PB90-169806 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.
Radiation Standards and Calibrations: Documentation Available from NBS (National Bureau of Standards).
 Final rept.
 W. R. Ott. 1987, 5p
 Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p29-1-29-5.

Keywords: *Radiation, *Quality control, Reprints, *National Institute of Standards and Technology, *Calibration standards.

The NBS Calibration Services Users Guide (SP 250) is being supplemented by a number of special publications that provide a detailed description of the important features of specific NBS calibration services. These documents provide a description of the: specifications for the service; design philosophy and theory; NBS measurement system; NBS operational procedures; assessment of measurement uncertainty, including random and systematic errors and an error budget; and internal quality control procedures used by NBS. The Center of Radiation Research (CRR) is in the process of publishing 21 similar documents in a series of SP 250 supplements. The documents cover all of the calibration services offered by CRR. The paper gives a brief overview of the content of the calibration documents available from CRR.

General

001,026
PB91-107599 PC A09/MF A02

National Inst. of Standards and Technology, Gaithersburg, MD. Office of Standards Code and Information.
Directory of European Regional Standards-Related Organizations.
 Final rept.
 M. Breitenberg. Sep 90, 196p NIST/SP-795
 Also available from Supt. of Docs. as SN003-003-03038-4.

Keywords: *Standards, *Metrology, *Directories, Organizations, Europe, Measurement, Regulations, Quality assurance, *European Community.

The publication contains information on organizations which participate in standards-related activities. The organizations listed in the directory are European organizations involved in standards-related activities. The volume describes the work of these organizations in these areas and other information of interest. Because the standards situation in Europe is changing rapidly due to the formation of the European Single Market, some organizations have recently undertaken new activities or made changes in some of their prior activities to participate more effectively in the endeavor. Some of these changes may not be reflected in their entries. The volume is designed to serve the needs of federal agencies and standards writers for information on European organizations involved in standardization and related activities. It may also be useful to manufacturers, engineers, purchasing agents, and others interested in the European standards activities.

Planning Model for Unifying Information Modeling Languages for Product Data Exchange Specification (PDES).
 J. Tyler. Jan 90, 12p NISTIR-90/4234

Keywords: *Data bases, Information systems, Abstracting, Semantics, Communications networks, *Information modeling, *Product Data Exchange Specification, Modeling languages.

The paper describes a mechanism for resolving issues surrounding the use of multiple information modeling paradigms. Several diverse modeling languages have been used to define and formalize the information needed to fully represent the multiple disciplines needed for a complete product model. This prompted a committee of the IGES/PDES Organization to undertake a research project to unify these divergent paradigms. Some intermediate results of the project are discussed including the Planning Model, which is intended to serve as a baseline for future development of a neutral repository for storing semantics.

001,029
PB90-161753 PC A07/MF A01
 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Management of Networks Based on Open Systems Interconnection (OSI) Standards: Functional Requirements and Analysis.
 Special pub. (Final).
 R. Aronoff, M. Chernick, K. Hsing, K. Mills, and D. Stokesberry. Nov 89, 133p NIST/SP-500/175
 Also available from Supt. of Docs. Library of Congress catalog card no. 89-600778.

Keywords: *Communication networks, *Information systems, Information processing, Network analysis, Secure communications, Architecture, Protocols, Performance evaluation, Open Systems Interconnection, Network management, Expert systems.

The report examines current and proposed network management systems to determine both user and functional requirements for network management. It then compares the derived functional requirements to the emerging standards being developed by the ISO and others to determine where and how the requirements are being met by these emerging standards. The examination of requirements is generally restricted to those that are necessary for interoperability. These are organized and examined in six broad areas: Architecture, and the management functional areas of configuration management, fault management, security management, performance management and accounting management. The report also contains a discussion of requirements that transcend these areas and a discussion of future requirements beyond the scope of current standardization. Examples include automated network management and a standard operator interface. Finally the report also contains a discussion of applying OSI management to the emerging Integrated Services Digital Network (ISDN) technology.

001,030
PB90-215864 PC A16/MF A02
 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Proceedings of the Hypertext Standardization Workshop. January 16-18, 1990 National Institute of Standards and Technology.
 Special pub. (Final).
 J. Moline, D. Benigni, and J. Baronas. Mar 90, 360p NIST/SP-500/178
 Held in Gaithersburg, MD., January 16-18, 1990 at the National Institute of Standards and Technology. Also available from Supt. of Docs. as SN003-003-02998-0.

Keywords: *Meetings, *Standards, Standardization, Information systems, Models, *Hypertext, Hypermedia, National Institute of Standards and Technology, Data bases.

The report constitutes the proceedings of a 3-day workshop on Hypertext Standardization held at the National Institute of Standards and Technology (NIST) on January 16-18, 1990. The major purpose of the Hypertext Standardization Workshop was to provide a forum for presentation and discussion of existing and proposed approaches to hypertext standardization. The stated workshop goals were to consider hypertext system definitions, to identify viable approaches for pursuing standards, to seek commonality among alternatives whenever possible, and to make progress to-

Information Systems

001,027
PB90-147919 PC A05/MF A01
 National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Information Systems Engineering Div.
Guide to Data Administration.
 Special pub. (Final).
 B. K. Rosen, and M. H. Law. Oct 89, 85p NIST/SP-500/173
 Also available from Supt. of Docs. as SN003-003-02967-0. Library of Congress catalog card no. 89-600766.

Keywords: *Data management, *Information systems, Data processing, Data base management, Models, Computer information security, Policies, Dictionaries, *Data administration, Information resources management, Computer aided software engineering.

The guide provides a reference model for the various activities performed by Information Resource Management, Data Administration, Data Modeling Tools Administration, and Database Administration. The functions of Data Administration are discussed in detail. Data Administration is responsible for defining an information architecture, and for establishing policies for naming conventions, information modeling techniques and methodologies, data element specification, system information integration, and data protection. The importance of the Three Schema Architecture is described. Computing tools useful for Data Administration, such as data dictionary systems and computer-aided software engineering (CASE) tools, are addressed. The guide stresses the useful features of these computing tools. Use of the Information Resource Dictionary System (IRDS) Standard, approved by the American National Standards Institute (ANSI) and a Federal Information Processing Standard (FIPS), is discussed.

001,028
PB90-160375 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.

LIBRARY & INFORMATION SCIENCES

wards a coordinated plan for standards development, i.e., a hypertext reference model.

001,031
PB90-219841 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST (National Institute of Standards and Technology) Standard Reference Data Products 1990 Catalog.
Special pub. (Final).
M. W. Chase. May 90, 46p NIST/SP-782
Also available from Supt. of Docs. as SN003-003-03004-0. See also PB90-183310.

Keywords: *Catalogs(Publications), Indexes(Documentation), Chemical analysis, Atomic physics, Reaction kinetics, Properties, Molecular structure, Molecular spectroscopy, Thermochemistry, Thermophysical properties, *National Institute of Standards and Technology, *Data bases, Materials science.

The National Institute of Standards and Technology's Standard Reference Data Program provides reliable, well-documented data to scientists and engineers for use in technical problem-solving, research, and development. The catalog lists classic data compilations in hard-copy form and current databases in the Standard Reference Database Series. These data compilations have been subdivided into seven categories. Prices and ordering information are located at the back of the document.

001,032
PB90-219866 PC A09/MF A01
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD. Information Systems Engineering Div.
Information Management Directions: The Integration Challenge.
Special pub. (Final).
E. N. Fong, and A. H. Goldfine. Sep 89, 178p NIST/SP-500/167
Also available from Supt. of Docs. as SN003-003-02973-4. See also PB87-156725. Library of Congress catalog card no. 89-600755.

Keywords: *Information systems, *Meetings, Standards, Systems engineering, *Data base management systems, Knowledge bases(Artificial intelligence), Integrated systems, Distributed computer systems.

The report constitutes the results of a 3-day workshop on the integration challenge of information management. The workshop was the fifth in the Information Management Directions series. The purpose of these workshops is to examine, in depth, key trends and strategies that affect the future of the information management profession. The focus of the fifth workshop was on issues related to integration and productivity. The 72 workshop participants were organized into five working panels, which met to discuss the integration of knowledge and data management; the integration of technical and business data management; the integration of systems planning, development, and maintenance tools and methods; the integration of distributed, heterogeneous computing environments; and architectures and standards for information management.

001,033
PB90-241621 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Information Resources and Services Div.
Computer-Generated Graphical Analysis of Citation Searches.
Final rept.
M. L. Nelson. 1990, 6p
Pub. in Proceedings of National Online Meeting, New York, NY., May 1-3, 1990, p309-314 1990.

Keywords: *Information retrieval effectiveness, *Graphic methods, *Computer graphics, Atomic spectroscopy, Performance evaluation, Images, Human factors engineering, Reprints, *Citation searches, Data bases.

Online citation searches were performed for a number of publications on the subject of atomic spectroscopy. The searches were requested by a National Institute of Standards and Technology physicist who is a member of the U.S. National Research Council Committee on Line Spectra of the Elements. This committee surveys data needs for diverse groups of data users and coordinates data compilation and evaluation activities. The references found in the searches were retrieved

by electronic mail and entered into a personal computer. The source journal titles were analyzed in spreadsheet/graphics programs. The resulting color and black and white images provided a quick and effective method of evaluating the citation search results. They will be used for comparison with the more subjective data on data usage which the Committee had compiled from questionnaires.

001,034
PB91-107276 PC A03/MF A01
National Inst. of Standards and Technology (NCTL), Gaithersburg, MD. Office Systems Engineering Group.
Dynamic Characteristics of Hypertext.
R. Furuta, and P. D. Stotts. Aug 90, 14p NISTIR-4404
Grant NSF-CCR-8810312
Prepared in cooperation with Maryland Univ., College Park. Sponsored by National Science Foundation, Washington, DC., and Northrop Research and Technology Center, Palos Verdes Peninsula, CA.

Keywords: *Documents, *Data processing, Time, Dynamic characteristics, *Text processing, *Hypertext systems, Sensors.

A dynamic hypertext changes even in the absence of user activity. Hypertexts are comprised of structure, content, and context, and dynamic operations may affect any of them. Dynamic operations are synchronous (related to the hypertext's description) or asynchronous. The paper argues that such dynamic characteristics are an important component of many hypertext systems, surveying existing implementations to examine the different realizations of dynamic operations, and that dynamic applications are also of importance within the hypertext domain.

001,035
PB91-107284 PC A06/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Information Resources and Services Div.
Data Bases Available in the Research Information Center of the National Institute of Standards and Technology.
Special pub. (Final).
D. Cunningham. Sep 90, 120p NIST/SP-799
Supersedes PB89-160014. Also available from Supt. of Docs. as SN003-003-03051-1.

Keywords: *Catalogs, *Information systems, *Information centers, *National Institute of Standards and Technology, *Data bases, *Bibliographic data bases, *On line systems.

Data Bases available online in the Research Information Center of the National Institute of Standards and Technology (NIST) are listed by acronym and by full title. In addition, descriptions of the data bases, dates covered, producers, hard copy counterpart, principal sources and vendors are listed. A general subject index and a cross reference index are also supplied.

001,036
PB91-107565 PC A06/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
FTAM Interoperability Tests.
C. A. Edgar. Aug 90, 113p NISTIR-4435

Keywords: *Tests, Computer networks, Standards, Computer programs, *File management systems, *Computer program transferability, FTAM(File Transfer Access and Management), Computer program verification, Protocols.

The File Transfer, Access and Management (FTAM) standard enables users to transfer, access and manage large groups of information in a consistent manner within an open environment. The document defines FTAM interoperability tests designed to test the interoperability between FTAM implementations supplied by different vendors. Implementations are assumed to be based on the FTAM International Standard (IS 8571). Interoperability testing tests the ability to perform overall operations between two or more vendor specific implementations. The complexity of OSI protocols makes exhaustive testing impractical on both technical and economic grounds. Furthermore, there is no guarantee that a system which has passed a set of interoperability tests will interoperate with other systems or conform to any specification. Rather, passing the tests provides a level of confidence that the system will likely interoperate with other systems and should behave in a consistent manner in representative instances of communication.

Operations & Planning

001,037
PB90-218074 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD. Information Resources and Services Div.
Measurement Research and the National Institute of Standards and Technology's Research Information Center.
Final rept.
S. W. Klein. 1990, 9p
Pub. in Science and Technology Libraries 10, n3 p73-81 1990.

Keywords: *Information centers, *Information services, Research, Metrology, Measurement, Standards, User needs, Reprints, *US National Institute of Standards and Technology.

The National Institute of Standards and Technology (NIST) develops and refines measurements in the physical sciences and engineering to support a wide variety of standardization activities. NIST's Research Information Center supports the Institute's research by matching its information collections to the needs of NIST scientists and engineers and by providing specialized information services.

001,038
PB90-241647 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Information Center Assists Users in Identifying Standards and Provides Technical Assistance.
Final rept.
J. R. Overman. 1990, 4p
Pub. in ASTM (American Society for Testing and Materials) Standardization, p28-31 Jun 90.

Keywords: *Technical assistance, *Standardization, Regulations, Foreign countries, Information services, Reprints, *National Center for Standards and Certification Information, Government agencies, Certification.

The National Center for Standards and Certification Information provides information on United States, foreign and international standards, regulations and rules of certification. The Center serves as a referral service and focal point in the United States for information about standards and standards-related activities. The Center is part of the Office of Standards Code and Information, which also includes a technical office and developing countries assistance program.

Reference Materials

001,039
PB90-182213 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST (National Institute of Standards and Technology) Research Reports, January 1990.
Special pub. (Final).
Jan 90, 36p NIST/SP-770
Also available from Supt. of Docs. as SN003-003-02993-9. See also PB89-235113.

Keywords: *Research, Superconductivity, Automation, Genes, Steels, Fires, Information retrieval, Fire safety, National Institute of Standards and Technology, High-temperature superconductors, Biotechnology, Molecular biology, Computer aided manufacturing, Computer information security, Data bases, Center for Advanced Research in Biotechnology.

Contents: Research updates; The long road to superconductivity; Following the low road (low-temperature superconductivity); An answer to the challenge--automation; Biotechnology research facility dedicated; Switches that turn on genes; The shop of the '90's (automated factories); How to reduce the risk of 'virus' attacks (computer security); Performance of steels exposed to fire predicted; Model to fight fire deaths, costs; Data, anyone; New publications; Conference calendar.

001,040
PB90-183245 PC A12/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD. Information Resources and Services Div.

Reference Materials

NIST (National Institute of Standards and Technology) Serial Holdings 1990.

Special pub. (Final).
M. L. Kingston. Jan 90, 262p NIST/SP-77790ED
Also available from Supt. of Docs. as SN003-003-02990-4. Supersedes PB89-114755.

Keywords: *Periodicals, *Bibliographies, Libraries, National government, Meetings, *National Institute of Standards and Technology, Library collections, Technical information centers.

The publication contains holdings information for approximately 5,000 titles held in the National Institute of Standards and Technology (NIST) Research Information Center, representing current and noncurrent journals, periodicals, annuals, memoirs, proceedings and transactions.

001,041

PB90-244435

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

NIST (National Institute of Standards and Technology) Research Reports, May 1990.

Special pub. (Final).
May 90, 37p NIST/SP-783
Also available from Supt. of Docs. as SN003-003-03020-1. See also PB90-182213.

Keywords: *Research, Chemical reactions, Gravitimeters, Integrated circuits, Buildings, Fire safety, Railroads, Wheels, National Institute of Standards and Technology, US NIST, Laser radiation, Picosecond pulses, Oil exploration, Very large scale integration, Loma Prieta earthquake, Earthquake engineering.

Contents: Research update; Lyons new head of NIST; President seeks boost for NIST in '91; Looking for 'good' vibrations; Milestone--500 very good ideas; Measuring in the Lilliputian world of semiconductors; Loma Prieta--A primer for public policy; More than just for safety's sake; Stress and strain on the railroad train; New publications; Conference calendar.

PDES (Production Data Exchange Specification) Physical File Exchange Testing in the PDES Validation System.

J. E. Fowler. Feb 90, 31p NISTIR-90/4252

Keywords: *Tests, Standards, *Product Data Exchange Specification, Data file, Computer aided design.

The document describes the testing of Product Data Exchange Specification (PDES) physical data file exchange between software systems within the validation testing architecture.

001,044

PB90-257734

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Introduction to the NIST PDES Toolkit. National PDES Testbed Report Series.

S. N. Clark. Jul 90, 14p NISTIR-4336
See also PB90-250093.

Keywords: *Standards, Product development, *Computer aided design, *Computer aided manufacturing, *Software tools, PDES(Product Data Exchange Specification), National Institute of Standards and Technology, Data bases.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. A software toolkit for manipulating PDES data has been developed at the National PDES Testbed at the National Institute of Standards and Technology (NIST). The toolkit includes software for processing PDES information models, defined in the Express language, and PDES product models, stored as STEP physical files. The components of the NIST PDES Toolkit are discussed, as are several applications which have been built using the Toolkit.

Recommended Technical Specifications for Procurement of Systems for a Cleaning and Deburring Workstation.

F. M. Proctor, and R. Russell. 21 Jun 89, 15p NISTIR-89/4115

Keywords: *Cleaning, *Deburring, Equipment specifications, Automation, Computer systems hardware, Computer systems programs, *Automated Manufacturing Research Facility, *Workstations, Robotics, Computer aided manufacturing.

The manual provides the recommended technical specifications for systems modeled after the Cleaning and Deburring Workstation of the Automated Manufacturing Research Facility. These specifications are functional only; they do not list the manufacturers of equipment, but only describe the function and capabilities of the various component systems.

001,047

PB90-217910

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

RCS Application Example: Tool Changing on a Horizontal Machining Center.

Final rept.
J. Fiala, and A. Wavering. 1987, 10p
Pub. in Proceedings of International Conference on Robotics and Factories of the Future (2nd), San Diego, CA., July 28-31, 1987, p715-724.

Keywords: *Manipulators, *Tooling, *Machining, Automation, Reprints, Automated Manufacturing Research Facility, Robotics, Real time systems, Control systems, Workstations, Programming.

A large six-axis manipulator performs material handling tasks for a horizontal machining center in the National Bureau of Standards' Automated Manufacturing Research Facility. The manipulator is controlled by the Real-time Control System (RCS), a hierarchical control system developed by the Robot Systems Division at NBS. The manipulator is used to load and unload parts for the machine and, recently, to change tools on the machine. The paper describes the development of tool changing as a new RCS application, including the creation of new commands to be sent to RCS from a workstation controller and the techniques used to program manipulator movements. The integration of force sensing to monitor tool insertion and removal as well as the addition of a changeable end effector for handling tools are discussed.

001,048

PB90-220286

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.

Concept for a Reference Model Architecture for Real-Time Intelligent Control Systems (ARTICS).

Technical note.
J. Albus, R. Quintero, R. Lumia, M. Herman, R. Kilmer, and K. Goodwin. Apr 90, 30p NIST/TN-1277
Also available from Supt. of Docs. as SN003-003-03011-2.

Keywords: *Automation, *Standards, Technology transfer, Models, Computer systems hardware, Computer systems programs, Systems engineering, *Robotics, *Control systems, Computer architecture, Real time systems, Protocols, Computer aided manufacturing.

The paper presents a concept for the development of a reference model open-system architecture for real-time, sensory interactive, intelligent machine systems. Central to this notion is a desire to accelerate technological development, technology transfer and commercialization of world class control system products in the field of robotics, intelligent machines and automation. A plan is outlined whereby a reference model Architecture for Real-Time Intelligent Control Systems (ARTICS) can be defined through the cooperative efforts of industry, academia and government. As envisioned ARTICS would be a series of evolving guidelines specifying an infrastructure of hardware components, software components, interfaces, communications protocols and application development tools. An ARTICS reference model would make it possible for industry to develop and market a diverse line of control system components which could be interchangeable and realizable on many different vendors' intelligent machine systems platforms.

MANUFACTURING TECHNOLOGY

Computer Aided Manufacturing (CAM)

001,045

PB90-149964

PC A05/MF A01

National Inst. of Standards and Technology (MSEL), Boulder, CO. Materials Reliability Div.

Development of a Computer-Controlled Hot-Deformation Apparatus at NIST (National Institute of Standards and Technology).

Y. W. Cheng, Y. Rosenthal, and H. I. McHenry. Oct 89, 100p NISTIR-89/3925

Keywords: *Hot working, *Forging, Quenching(Cooling), High strength steels, Low alloy steels, Simulation, *Computer aided manufacturing, Thermomechanical treatment, Control systems.

The report describes a computer-controlled hot-deformation apparatus suitable for thermomechanical-processing (TMP) simulation of forging and steel plates. The apparatus was designed and built at the National Institute of Standards and Technology, and has the following main features: a servohydraulic load frame with a 250 kN capacity in tension or compression; a variable-actuator traveling speed up to 55 mm/s; a multiple-strike capability with controllable displacements and strain rates; a maximum heating rate of 150 c/s with a 10 kW induction heater (for a cylindrical steel specimen 9 mm in diameter and 18 mm in height); a maximum cooling rate of 25 c/s with helium-gas cooling; and vacuum to 1.33 x 10 sup (-3) Pa (1 x 10 sup (-5) Torr) within 25 min. Source codes of the computer programs that perform system control, data acquisition, and data analysis are included in the report. The apparatus has been used to perform the direct-quenching simulation of the ASTM A710 plate steel, and forging simulation of the directly cooled microalloyed AISI 1522 and 1141 steels. Results of the studies are presented.

001,046

PB90-183252

PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Computer Aided Design (CAD)

001,042

AD-A215 871/15

Not available NTIS

National Bureau of Standards, Gaithersburg, MD. Automation Sensors Group.

Design of a Conformal Tactile Sensing Array.

I. McCammon. 1984, 7p
Availability: Pub. in Proceedings of SPIE, Intelligent Robots and Computer Vision, v521 p296-301 1984. No copies furnished by DTIC/NTIS.

Keywords: Air flow, Arrays, Automation, Computer programming, Conformal structures, Control, Detection, *Detectors, Displacement, Electrooptics, Fingers, Manufacturing, Pins, Proximity devices, Regulations, Rigidity, *Robotics, Standards, Stiffness, *Touch, Artificial intelligence, *Computer aided manufacturing, Grasping, Gripping, Workpieces, Reprints.

In the course of the National Bureau of Standards' program in measurements and standards for automated manufacturing and robotics, a tactile sensing array with a high degree of conformability has been developed. The array consists of a pneumatically controlled matrix of displacement pins which provides a deformable grasping surface, and a corresponding array of optoelectronic proximity sensors which determine workpiece orientation and geometry. Regulation of air flow into the finger to control grasping stiffness permits the sensing and handling of very delicate or complex objects. Additional features of the design include programmable array rigidity, zero mechanical hysteresis, and gripper mounted packaging. (AW)

001,043

PB90-183294

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.

001,049
PB90-221789 PC A23/MF A03
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Mfg. Engineering.
Proceedings of CIMCON '90.
Special pub. (Final).
A. Jones. May 90, 535p NIST/SP-785
Also available from Supt. of Docs. as SN003-003-03010-4.

Keywords: *Meetings, Mathematical models, Automation, Systems engineering, Standards, Technology transfer, *Computer aided manufacturing, Computer architecture, Control systems, Data integrity, Expert systems, Distributed computer systems, Computer software, Workstations.

The proceedings presents papers on computer integrated manufacturing including: Toward a Global Architecture for Computer Integrated Manufacturing; A Scalable Architecture for CIM Shop Floor Control; A Reference Model for Computer Integrated Manufacturing From the View Point of Industrial Automation; An Approach to Implementing CIM in Small and Medium Size Companies; Highly Extendable CIM Systems Based on an Integrated Platform; Server Networks: A CIM Architecture Design Environment; Towards a Distributed Control Architecture for CIM; CIM-OSA - A Vendor Independent CIM Architecture; Progress Towards Standards for CIM Architectural Frameworks; The Development of a CIM Architecture for the RAMP Program; An Approach to Develop and Maintain Data Quality; Distributed Knowledge Based Systems for Computer Integrated Manufacturing; Uniform Dataflow Software System for Global CIM Application; A Systems Theoretic View of Computer Integrated Manufacturing.

001,050
PB90-247438 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Factory Automation Systems Div.
Extending the Standard for the Exchange of Product Data to Represent Two-Dimensional Apparel Pattern Pieces.
Y. T. Lee. Jun 90, 28p NISTIR-4358
Sponsored by Defense Logistics Agency, Alexandria, VA.

Keywords: *Standards, Patterns, Prototypes, *Clothing industry, *Computer aided manufacturing, *STEP(Standard for the Exchange of Product Data), National Institute of Standards and Technology, File structures.

An Apparel Pattern Information Model (APIM) is introduced to demonstrate the feasibility of extending the emerging international Standard for the Exchange of Product Data (STEP) to include the exchange of apparel pattern data. The paper focuses on a representation of two-dimensional (flat) patterns. It shows how this representation is capable of capturing the same information that can be expressed in one widely-used, but proprietary, format.

001,051
PB90-250044 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST Working Form for STEP: National PDES Testbed.
S. N. Clark. 11 Jun 90, 12p NISTIR-4351REV

Keywords: *Standards, Models, *Computer aided manufacturing, *PDES(Product Data Exchange Specification), Computer aided design, Data structures, STEP(Standard for the Exchange of Product Model Data), Software tools.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. The neutral exchange medium for PDES product models is the STEP physical file format. The National PDES Testbed at NIST has developed software to manipulate and translate STEP models. The software consists of an in-memory working form and an associated physical file parser, STEPparse. The design and capabilities of STEPparse and of the STEP Working Form are discussed.

001,052
PB90-250093 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST PDES Toolkit: Technical Fundamentals. National PDES Testbed Report Series.
S. N. Clark. Jul 90, 30p NISTIR-4335REV

Keywords: *Standards, *PDES(Product Data Exchange Specification), *Computer aided manufacturing, *Software tools, National Institute of Standards and Technology, Translators.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. A software toolkit for manipulating PDES data has been developed at the National PDES Testbed at NIST. A technical overview of this PDES Toolkit is provided. Fundamental software libraries are described, and techniques for creating applications based on the Toolkit are discussed.

001,053
PB90-254483 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Mathematical Decomposition and Simulation in Real-Time Production Scheduling.
Final rept.
W. Davis, and A. Jones. 1987, 5p
Pub. in Proceedings of European Simulation Multi-Conference, Vienna, Austria, July 7-10, 1987, p88-92.

Keywords: *Production control, *Scheduling, Real time operations, Production engineering, Industrial engineering, Decomposition method, Simulation, Algorithms, Reprints, *Computer aided manufacturing.

The paper discusses an on-line, real-time production scheduling algorithm for automated manufacturing systems. Decomposition theory is used to transform a multi-criteria, production scheduling problem from a block angular structure into a two-level hierarchical structure. The top level, called the supreal, considers a list of jobs, due dates, precedence constraints, and objectives. It generates a set of potential scheduling rules and evaluates those rules using an on-line, distributed simulation package. The supreal outputs a list of tasks with proposed start and finish times to each of the lower level systems under its control. Each lower level system, called an infimal, then uses a similar simulation approach to sequence those tasks and generate actual start and finish times. These times, together with status on all other tasks, provide the feedback needed by the supreal to close the control loop.

001,054
PB91-118232 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Factory Automation Systems Div.
Distributed Data Bases on the Factory Floor.
Final rept.
C. M. Furlani, D. Libes, E. J. Barkmeyer, and M. J. Mitchell. 1989, 9p
Pub. in Computerization and Networking of Materials Data Bases, ASTM STP 1017, p126-134 1989.

Keywords: Automation, Reprints, *Computer aided manufacturing, *Distributed data bases, Automated Manufacturing Research Facility, Data base administrators, Control systems.

A major facility for manufacturing research exists at the National Institute of Standards & Technology (NIST). The Automated Manufacturing Research Facility (AMRF) serves as a test bed and demonstration facility in support of research by workers from NIST, industry, academia, and other government agencies. The AMRF has been designed as a 'data driven' control system. This permits it to handle a broad range of parts for automated manufacturing, but requires an effective interface between the data generated in a manufacturing system and the control modules that use the data. To meet this requirement, a distributed data system, the Integrated Manufacturing Data Administration System (IMDAS), has been developed. It is designed to provide the control systems of the AMRF access to the data necessary to support the design, planning, manufacturing, and inspection of parts.

Computer Software

001,055
PB90-250069 PC A03/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.
QDES Administrative Guide: National PDES Testbed.
S. N. Clark. 21 May 90, 19p NISTIR-4334

Keywords: *Windowing techniques, *Editing, Standards, Manufacturing, Guidelines, QDES, PDES, Computer aided design, STEP models, Smalltalk programming language, Product data exchange, Data base administrators.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. The neutral exchange medium for PDES product models is the STEP physical file format. The National PDES Testbed at NIST has developed QDES, a window-based editor for STEP product models. The editor, written in Smalltalk 80, is schema-driven: in the Testbed context, an Express information model is used to describe the objects to be manipulated; QDES itself thus has no a priori knowledge of its domain. The document describes administrative procedures for QDES. Some architectural issues are also presented.

001,056
PB90-250077 PC A03/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
NIST STEP Working Form Programmer's Reference. National PDES Testbed.
S. N. Clark. 11 Jun 90, 31p NISTIR-4353

Keywords: Standards, *Programming manuals, Manufacturing, Test beds, Specifications, Parsers, PDES, STEP models, Computer aided design, Translators, Product data exchange.

The Product Data Exchange Specification (PDES) is an emerging standard for the exchange of product information among various manufacturing applications. The neutral exchange medium for PDES product models is the STEP physical file format. The National PDES Testbed at NIST has developed software to manipulate and translate STEP models. The software consists of an in-memory working form and an associated physical file parser, STEPparse. The internal operation of the STEPparse parser is described. The implementation of the data abstractions which make up the STEP Working Form is discussed, and specifications are given for the Working Form access functions. The creation of STEP translators using STEPparse is discussed.

001,057
PB91-107250 PC A04/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Automated Production Technology Div.
AMPLE Core Interpreter: User's Guide (Version 1.0).
J. C. Boudreaux. Sep 90, 73p NISTIR-4388

Keywords: *Manufacturing, *Programming languages, *Interpreters, *Controllers, Prototypes, Specifications, *Automated Manufacturing Programming language, *AMPLE programming language, *Man computer interface, *Computer aided manufacturing, User manuals(Computer programs), High level languages.

The Automated Manufacturing Programming Language Environment (AMPLE) system was developed in the Center for Manufacturing Engineering to provide a uniform environment for the construction of control interfaces to industrial processes. The AMPLE Core Interpreter, Version 1.0 is a working prototype, implemented in MicroSoft C 5.0 for PC/AT-class personal computers under MS-DOS. The User's Guide is an introduction to the prototype which is being circulated at this time to provide the manufacturing community and other potential users with an operational specification of AMPLE.

Engineering Materials

001,058
PB90-135930 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.

Damage-Enhanced Creep in a Siliconized Silicon Carbide: Mechanics of Deformation.

Final rept.
T. J. Chuang, and S. M. Wiederhorn. 1988, 7p
Sponsored by Department of Energy, Oak Ridge, TN.
Pub. in Jnl. of the American Ceramic Society 71, n7
p595-601 Jul 88.

Keywords: *Damage, *Creep tests, *Silicon carbides, *Deformation, *Continuum mechanics, Tension, Compression, Bending, Loads(Forces), Silicone coatings, High temperature tests, Flexural strength, Reprints.

Continuum mechanics methods were adopted to analyze the creep deformation of a siliconized silicon carbide at elevated temperatures. All major loading modes including tension, compression and bending are considered. In tensile creep, deformation was accompanied by cavitation damage at stresses in excess of a temperature dependent threshold level, resulting in a bilinear power-law creep behavior. On the other hand, a single power-law equation is adequate to characterize the creep behavior in compression, since no damage is found at all levels of applied stress. For transient creep under bending, it was found that time-dependent neutral axes for stress and strain do not coincide, although they do converge towards a single axis at steady state. The underlying mechanisms for both tension and compression creep can be attributed to interaction of SiC particles and nonlinear viscous flow of silicon phase; creep damage in tension further enhances deformation from $n = 4$ to 10 where n is stress exponent. Nucleation rather than growth of cavities is regarded as the limiting process responsible for the accelerated creep meaning the material possesses a high degree of tolerance against damage.

001,059

PB90-152794 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Creep Deformation of Ceramics in Four Point Bending.

Final rept.
K. Jakus, and S. M. Wiederhorn. 1988, 5p
Sponsored by Department of Energy, Oak Ridge, TN., and National Science Foundation, Washington, DC.
Pub. in Jnl. of the American Ceramic Society 71, n10
p832-836 1988.

Keywords: *Creep properties, *Deformation, *Ceramics, *Bending, High temperature tests, Flexural strength, Aluminum oxide, Loads(Forces), Curvature, Measurement, Reprints.

Flexural testing was investigated as a method of studying the creep of ceramic materials at elevated temperatures. Three techniques were used to evaluate the steady state creep exponent: two of them were based on the measurement of the surface curvature of a flexure specimen after testing; the third was based on the more conventional technique of measuring displacement rate as a function of applied load and exposure time. Applied to a grade of commercial vitreous bonded alumina, the techniques yielded disparate results for the steady state creep exponent. The discrepancy in results is believed to be a consequence of the fact that ceramics tend to creep more readily in tension than in compression, leading to a shift in the neutral plane for stress and strain in flexural specimens, which results in an extended primary creep. A local enhancement of creep under the loading points of the test specimens was observed in the materials tested; the creep enhancement was attributed to contact stresses at the loading points.

001,060

PB90-242272 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Applications of the Double-Crystal Diffractometry to the Understanding of Ceramic Fracture.

Final rept.
W. Wong-Ng, S. W. Freiman, C. R. Hubbard, B. H. Hockey, S. Weissmann, and C. F. Lo. 1988, 9p
Pub. in Ceram. Trans. 1, n2 p1183-1191 1988.

Keywords: *Ceramics, *X ray diffraction, *Aluminum oxide, Microstructure, Defects, Topography, Strains, Residual stress, Measurement, Crystal structure, Reprints, *Fracture mechanics.

An understanding of the stress state existing in a ceramic microstructure is important for predicting structural failure. An x-ray method has been developed which combines the analysis of the defect structure of

the crystallites by double crystal diffractometry with the imaging of the crystallites by x-ray topography. The potential applications of the versatile tool for measurement of residual microstrain in ceramic materials is currently being investigated. A brief discussion of the principle of the technique is presented. The method has been employed to elucidate the differences in fracture behavior of two 94% aluminum oxide ceramics.

001,061

PB91-118224 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Brittle Fracture Behavior of Ceramics.

Final rept.
S. W. Freiman. 1988, 11p
Pub. in American Ceramic Society Bulletin 67, n2
p392-402 1988.

Keywords: *Ceramics, *Brittle fracturing, *Brittleness, Crack propagation, Failure, Fractures(Materials), Toughness, Fracture properties, Microstructure, Reprints.

The paper reviews the brittle fracture process in ceramic materials. A fracture mechanics approach is used to separate the crack growth resistance of the material from the driving forces and the flaw severity. Fracture surface analysis is shown to be a useful tool in understanding failures of actual components. Effects of environmentally enhanced crack growth are discussed both from a fundamental point of view as well as in the reliability of ceramic structures. Toughening mechanisms in ceramics are reviewed and the fracture process discussed in terms of the direct affects of ceramic microstructure.

001,062

PB91-118273 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Considerations in Ceramic Friction and Wear Measurements.

Final rept.
R. S. Gates, J. P. Yelllets, D. E. Deckman, and S. M. Hsu. 1988, 23p
Sponsored by Department of Energy, Washington, DC., and Energy Conversion and Utilization Technologies Div.
Pub. in Selection and Use of Wear Tests for Ceramics, ASTM STP 1010, p1-23 1988.

Keywords: *Ceramics, *Wear, *Friction, *Tribology, Wear tests, Wear inhibitors, Wear resistance, Lubricants, Standards, Test facilities, Reprints.

Technical ceramic materials offer tremendous potential in a wide variety of engineering applications. Their unique blend of physical, chemical, and mechanical properties provide innovative design opportunities for advanced concepts such as low-heat rejection engines, high-efficiency gas turbines, high temperature bearings, and high-speed, high-precision cutting tools. Unfortunately, many of the critical friction and wear (tribological) properties of advanced ceramics are not well defined or understood. Research in materials science of advanced ceramics is developing very rapidly. As materials change and new materials are constantly being developed, the evaluation of these materials for tribological applications becomes a critical issue. The paper explores several important considerations in friction and wear testing of ceramic materials. Detailed test sample characterization is required to define the materials pair. Sample preparation, selection of load and speed, environmental control, and contamination effects are crucial to the meaningful tribological evaluation of ceramic materials. Specific examples are given using a modified four-ball wear tester with alumina specimens.

001,063

PB91-118463 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Data.

Socioeconomic Barriers in Computerizing Materials Data.

Final rept.
J. Rumble. 1989, 11p
Pub. in Computerization and Networking of Materials Data Bases, ASTM STP 1017, p216-226 1989.

Keywords: *Materials, *Information systems, Reprints, *Socioeconomic factors, Data bases, Data base management, Technology utilization, On line systems.

While the computer technology, both hardware and software, exists to allow easy and comprehensive access to computerized data on engineering materials, only a few data bases are publicly available today. The reason for this is a set of barriers based on socioeconomic factors that are only partly recognized. In the paper, the use of materials data is examined to identify some of these socioeconomic barriers. They primarily arise from three factors: complex usage patterns, a relatively new computer audience combined with an exploding computer technology, and a lack of understanding of the positive impact of computerized materials data. Ways to overcome these barriers are suggested.

Joining

001,064

PB90-152539 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.

Metal Transfer in Gas Metal Arc Welding: Droplet Rate.

Final rept.
S. Liu, and T. A. Siewert. 1989, 7p
Pub. in Welding Jnl. 68, n2 p52-s-58-s Feb 89.

Keywords: *Gas metal arc welding, *Weld metal, Welding current, Filler metal, Electric current, Drops(Liquids), Process control, Reprints.

The study reports the changes in droplet-transfer mode and rate during gas metal arc welding as the voltage is varied at a series of current levels. Statistical analysis of the arc current and voltage data showed that during operation outside the optimum range, the welding arc was unstable and the current output was very irregular with varying cycle time between each droplet transfer. At the maximum droplet-transfer rate, the droplet-transfer cycle time was very consistent and revealed a narrow rate range, which correlated with the high stability and lower spatter at these optimum operating conditions.

001,065

PB90-219551 PC A06/MF A01
National Inst. of Standards and Technology, Boulder, CO.

Computerization of Welding Data: Proceedings of the Conference and Workshop.

Special pub. (Final).
T. A. Siewert, J. E. Jones, and H. G. Ziegenfuss. Mar 90, 108p NIST/SP-781
Held in New Orleans, Louisiana on October 19-21, 1988. Also available from Supt. of Docs. See also PB88-236807. Prepared in cooperation with American Welding Inst., Louisville, TN., and American Welding Society, Miami, FL.

Keywords: *Meetings, *Welding, Information systems, Artificial intelligence, *Computer applications, Data bases, Computer software, Expert systems.

The publication comprises the proceedings of an October 1988 conference on computerization of welding data. A written summary of each speaker's presentation is included in its appropriate conference session. Overview of Computers and Databases: Databases for technology; Review of the 1986 Workshop-Computerization of welding information; On-line access to worldwide sources of materials performance data; ASM International's Materials Properties Data System; Application of artificial intelligence to welding; Welding Applications Software: Computerized software for welding engineers; Computer applications in welding; Welding Case Studies: Update on procedure qualification records and welding procedure specifications; Computers in welding--from breadboards to desktops; Weld Improvement Program: Weld and Welder Tracking System; and Expert systems for diagnosing problems in welding power sources.

001,066

PB91-118562 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.

Review of the 1986 Workshop: Computerization of Welding Information.

Final rept.
T. A. Siewert. 1988, 8p
Pub. in Proceedings of Conference and Workshop on Computerization of Welding Information (2nd), Knoxville, TN., August 5-6, 1986, p9-16 1988.

Keywords: *Meetings, *Welding, Welding rods, Welding machines, Weldments, Weld metal, Heat affected zone, Fillets, Welding fluxes, Reprints, *Data bases.

The report deals with whether national welding productivity could be improved through the development of welding databases. The participants included forty-two welding engineers, welding managers, and computer scientists. Introductions to various topics by specialists in these areas were followed by group discussion. These groups identified the most useful topics for welding databases, in descending order of importance, to be: (1) General welding procedures, (2) Properties of the weld, heat-affected zone, and base metals, (3) Procedure qualification records, (4) Welding variables. For each of these topics, the participants identified potential users, content, and sources of information. The participants concluded that: (1) A significant portion of the data needs can be met by existing information, but this information should be carefully screened and reviewed before inclusion in databases, (2) Databases should be accessible to the greatest number of potential users, (3) Databases should use the latest computer technology and be upgradable to new technology as it becomes available.

Manufacturing, Planning, Processing & Control

001,067
PB90-161720 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
Role of the National Institute of Standards and Technology as It Relates to Product Data Driven Engineering.
H. M. Bloom. Jul 89, 39p NISTIR-89/4078

Keywords: Industrial engineering, *Product development, Competition, Productivity, Automation, *Product Data Exchange Standard, National Institute of Standards and Technology, Technology utilization, Information management.

The various activities of the National Institute of Standards and Technology (NIST) in the development of a Product Data Exchange Standard (PDES) will be discussed. The NIST activities will be described in terms of the unique position that the agency has in the area of standards and technology development in the United States. The NIST has an active role in participating in the formal development of the PDES standard. In addition, NIST is engaged in research and development programs involving information technologies necessary for implementing PDES and engineering technologies that make use of product data. Specific applications such as mechanical part fabrication are being used to provide a testbed for the validation and verification of PDES. The paper addresses how PDES can be used to implement needed technologies such as concurrent engineering that will improve American Industrial competitiveness. The combination of PDES implementations with concurrent engineering is called 'Product Data Driven Engineering'.

001,068
PB90-241233 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Three Dimensional Modeling of Optical Microlithography for Positive Photoresists.
Final rept.
E. Barouch, B. Bradie, H. Fowler, and S. V. Babu. 1990, 9p
Pub. in Microlithography News I, n5 p16-24 May/June 90.

Keywords: *Lithography, Mathematical models, Simulation, Reprints, *Microlithography, *Photoresists, Three-dimensional calculations, WKB approximation.

A three dimensional planar substrate positive photoresist simulation process in optical microlithography is presented. This system includes components for the

calculation of the aerial image, the exposure-bleaching of the resist material, and the dissolution process. Standard computational techniques are being employed for the aerial image. The exposure model uses a continuum approximation of the Berning's field equation in conjunction with a suitably chosen WKB approximation. The local mathematical equivalence of the solvent diffusion system to the front propagation described by the eikonal system is employed by the dissolution algorithm. The algorithm does not produce shock waves or discontinuities in the developed profiles.

001,069
PB91-112482 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Advanced Deburring and Chamfering System.
Final rept.
K. N. Murphy, and F. M. Proctor. 1990, 6p
Pub. in Proceedings of International Symposium on Robotics and Manufacturing (3rd), British Columbia, Canada, July 18-21, 1990, 6p.

Keywords: *Deburring, *Chamfering, Force, Robots, Reprints, *Robotics, *Computer aided manufacturing, Real time systems, Control systems, Automated Manufacturing Research Facility.

A second-generation automated deburring cell is currently under development at the National Institutes of Standards and Technology. This cell will be capable of automatically generating, from part geometry and machining information, a series of robot paths for deburring aerospace parts made from superalloys. In order to compensate for the inaccuracy of robots when following computed coordinates, an actively-controlled end effector will be used to precisely position a rotary file in response to forces sensed at the part edge.

Quality Control & Reliability

001,070
PATENT-4 963 826 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.
Reference Standard Block for Use in Nondestructive Test Probe Calibration and Method of Manufacture Thereof.
Patent.
T. E. Capobianco, W. P. Dube, and K. W. Fizer. Filed 18 Jul 89, patented 16 Oct 90, 9p PB91-100974, PAT-APPL-7-381 553
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Nondestructive tests, *Eddy current tests, *Patents, Fatigue(Materials), Airframes, Cracks, *Reference standard blocks, *Probes(Electromagnetic), *Calibration, Metal fatigue, PAT-CL-324-202.

A reference standard and a method for manufacturing a reference standard for use in calibrating an eddy current probe is disclosed. The reference standard is produced from a block of metal that is deformed by an indentation tool to provide a notch of prescribed dimensions. The reference standard is compressed along an axis substantially transverse to the longitudinal axis of the notch to substantially close the notch. A family of reference standards formed in this manner can be produced to calibrate an eddy current probe prior to use of the probe in evaluating metal components such as aircraft framework for the presence of fatigue cracks and the like.

001,071
PB90-184961 PC A13/MF A02
National Inst. of Standards and Technology, Gaithersburg, MD.
Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 74th National Conference on Weights and Measures 1989 (1990 Edition).
Handbook.
H. V. Oppermann. Oct 89, 281p NIST/HB-44/90ED
Also available from Supt. of Docs. as SN003-003-02964-5. Supersedes PB89-129134.

Keywords: *Weight indicators, *Measuring instruments, *Handbooks, Specifications,

Tolerances(Mechanics), Standards, Moisture meters
Volume unit meters.

Handbook 44 was first published in 1949. The 1990 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures with the assistance of the Office of Weights and Measures of the National Institute of Standards and Technology. It includes amendments adopted by the 74th annual meeting of the National Conference on Weights and Measures in 1989. Handbook 44 is published in its entirety each year following the annual meeting of the National Conference on Weights and Measures. The current edition includes new standards for mass flow meters in the Vehicle-Tank Meters Code and the Milk Meters Code.

001,072
PB90-188194 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Metrology in Microlithography.
Final rept.
D. Nyysönen. 1987, 53p
Pub. in VLSI (Very Large Scale Integration) Electronics Microstructure Science, v16 p265-317 1987.

Keywords: *Metrology, *Electron microscopy, *Optical microscopes, Dimensional measurement, Accuracy, Reprints, Very large scale integration, VHSIC(Circuits).

The advent of VLSI and VHSIC technologies has had enormous impact on the requirements for accuracy and precision of dimensional metrology. Accurate and precise measurements are needed to improve yield, to ensure that lithographic and critical dimension measurement systems meet specifications, to establish control of fabrication processes, and to relate measurements to theory or to serve as input data to modeling or simulation programs. The push to micrometer and submicrometer feature sizes on larger and larger wafers requires dimensional measurement systems with precision and accuracy which can take up only a small fraction of the error budget of 10% or less allowed in process control. By the gauge maker's rule, the measurement system tolerance must be three to ten times less than the tolerance on the part being manufactured. The book chapter discusses some of the unique requirements which metrology places on optical and scanning electron microscope measurement systems and provides a framework for realistically evaluating the capabilities of a given dimensional-measuring system in the context of the purpose for which the measurement system is to be used.

001,073
PB90-191404 PC A09/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.
Uniforms Laws and Regulations as Adopted by the (74th) National Conference on Weights and Measures 1989 (1990 Edition).
Handbook.
C. S. Brickenkamp, and J. Koenig. Oct 89, 176p
NIST/HB-130/90ED
Also available from Supt. of Docs. as SN003-003-02962-9. Supersedes PB89-129563.

Keywords: *Weight measurement, *Regulations, Packaging, Units of measurement, Handbooks, Standardization, Revisions, Automotive fuels, Labels, Prices, Commodities, Sales, Consumer affairs, *Weights and measures, Open dating, Unit pricing.

The handbook, revised annually, compiles the uniform laws and regulations developed by the Committee on Laws and Regulation of the National Conference on Weights and Measures (NCWM). The compilation itself was approved by the NCWM in 1979, and this edition includes amendments adopted by the Conference at its annual meeting in 1989. The edition also contains a completely revised Uniform Weighmaster Law. The NCWM recommends adoption and promulgation by the states of these uniform laws and regulations as updated in the handbook.

001,074
PB90-192402 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Intercomparison of AC Voltage Using a Digitally Synthesized Source.

Final rept.
N. M. Oldham, W. F. Bruce, C. M. Fu, A. Cohee, and A. G. Smith. 1990, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 39, n1 p6-9 Feb 90.

Keywords: *Electrical measurement, *Standards, *Alternating current, Electric potential, Comparison, Consistency, Reprints.

An ac voltage intercomparison was conducted by the National Institute of Standards and Technology (NIST) to determine the consistency of ac voltage measurements made at various standards laboratories. The transport standard used for this purpose was an NIST-developed digitally synthesized sinusoidal voltage source whose rms value was calculated by measuring the dc level of each of the steps used to synthesize the sine wave. The uncertainty of the calculated voltage at approximately 7-V rms is typically within + or - 10 parts per million (ppm) from 15 Hz to 7.8 kHz. The approach incorporates a technique of determining ac voltage with reference to a measured standard dc voltage, which is independent of the traditional thermal voltage converter approach. Preliminary measurements made at each of the participating laboratories agree with the calculated value to within + or - 20 ppm. The results indicate that at 7 V, in the low audio-frequency range, the ac voltage measurement techniques implemented at these laboratories are near the state-of-the-art.

001,075
PB90-192642 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.

Applications of Capacitive Array Sensors to Non-destructive Evaluation.

Final rept.
P. J. Shull, J. C. Moulder, P. Heyliger, M. Gimple, and B. A. Auld. 1988, 7p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7A, p517-523 1988.

Keywords: *Nondestructive tests, *Capacitance, Measuring instruments, Dielectrics, Conductors, Ceramics, Epoxy resins, Electrical measurement, *Robotics.

Capacitive array sensors have recently been developed for robotic applications such as proximity and feature detection. The authors describe recent studies performed at NBS Boulder exploring applications of capacitive arrays to nondestructive evaluation. Capacitive sensors can be used on either conductors or insulators, a decided advantage over inductive sensors. On metals the capacitive sensor only responds to surface flaws, but on dielectrics it responds to both surface and subsurface defects. The depth of field penetration into dielectric materials can be controlled by varying the spacing of the active elements electronically. The authors studied the response on a miniature (2.5 x 4.5 mm) nine-element capacitive array to a variety of simulated and real flaws in conductors and dielectrics. Applications of the sensor to thickness monitoring of thermal barrier coatings, flaws in ceramics, and dielectric cure monitoring of epoxy resins were explored.

001,076
PB90-194994 PC A03/MF A01
Peyton Associates, Tarrytown, NY.

Conduct and Administration of U.S. Participation and Leadership in International Standardization, Testing, and Certification in the Decade of the 1990s.

D. L. Peyton. Mar 90, 18p NIST/GCR-90/572
Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.

Keywords: *United States, *Tests, *Standardization, Recommendations, Evolution(Development), Quality assurance, Standards, *Certification, *International cooperation.

Based on 22 years' experience in domestic and international standards activities, the author reviews the evolution of the U.S. standards system. The study addresses new factors in considering the future roles of the U.S. Government and the private sector to improve the present health and efficacy of the national approach to standardization, testing, certification, quality assurance, and laboratory accreditation. The consen-

sus view is to separate standardization from other related activities, and for strong governmental participation in private sector policy, planning and programs where there is a substantial public interest. Congressional action is recommended to establish an infrastructure to deal with complex testing and certification issues affecting trade competition, probably in the form of a quasi-governmental corporation. Two National Commissions should be established for separate study of standardization and of testing, certification, and related areas.

001,077
PB90-241472 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Standard Reference Materials for Eddy Current Nondestructive Evaluation: Research Material 8458.

Final rept.
F. R. Fickett, and T. E. Capobianco. 1990, 7p
Pub. in Proceedings of Measurement Science Conference, Anaheim, CA., February 8-9, 1990, 7p.

Keywords: *Eddy current tests, *Nondestructive tests, *Standards, Electrical properties, Eddy currents, Electromagnetic testing, Cracks, Calibrating, Cracking(Fracturing), Fatigue(Materials), Reprints.

Eddy current nondestructive evaluation (NDE) is widely used in the world of transportation, and especially in evaluation of the structural integrity of aircraft. Small cracks, subsurface cracks, and cracks forming in places where access is difficult, such as bolt holes, can only be detected in the field by the use of electromagnetic methods. A large number of commercial instruments and their associated probes are available for this purpose. For optimum performance, these instruments must be calibrated. This is usually accomplished by measuring artificial flaws in the form of drill holes, spark-cut (EDM) notches, or saw slots of varying dimensions in aluminum alloy plates. The problem with such calibrations is that these 'standard' flaws bear little resemblance to an actual fatigue crack. The authors discuss the present situation in this field and describe research now underway at NIST to develop flaw Standard Reference Materials (SRM's) and Research Materials (RM's) that more closely approximate the behavior of actual fatigue cracks.

001,078
PB90-244476 PC A08/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Progress Report of the Quality in Automation Project for FY89.

T. V. Vorbarger, and B. R. Scace. May 90, 160p
NISTIR-4322

See also report for 1988, PB89-193296. Sponsored by Naval Research Lab., Washington, DC. Navy Manufacturing Technology Program.

Keywords: *In-process quality control, *Automation, Verification inspection, Process control, Surface roughness, Light scattering, Real time operations, Controllers, Inspection, Monitors, Machine tools, *Quality in automation project, QIA project, Progress report, Sensors.

The project's purpose is to develop a quality assurance program that demonstrates 'deterministic metrology' in an automated manufacturing environment using commercially available and affordable equipment within the project in detail. A vertical machining center and a CNC turning center are both undergoing pre-process characterization. A prototype of the 'real time error corrector' hardware is currently under test. High speed on-machine probing of test parts at speeds of up to 100 in/min has been demonstrated. A system architecture and programming language environment has been selected. A commercial coordinate measuring machine has been installed and is currently undergoing characterization. Several methods of real-time surface texture analysis are under consideration. One of these methods is the use of optical scattering analysis. Once the initial experiments have been completed and the system components have been procured and tested, the entire system will undergo testing using standard test parts.

001,079
PB90-257650 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. Office of Weights and Measures.

State Weights and Measures Laboratories: State Standards Program Description and Directory.

Special pub. (Final).
G. L. Harris. Jun 90, 70p NIST/SP-791
Also available from Supt. of Docs. as SN003-003-03024-4. Supersedes PB85-178879.

Keywords: *Laboratories, *Standards, *Directories, Units of measurement, States(United States), Tolerances(Mechanics), Measurement, *State services, *Weights and measures, National Type Evaluation Program, Calibration, Certification, State Standards Program.

In support of its mission to promote uniform standards of measurement throughout the country, the National Institute of Standards and Technology (NIST) received funding in 1965 to provide new standards of mass, length, and volume to State weights and measures laboratories. This program, called the (New) State Standards Program, also provided the equipment needed to perform calibrations in these measurement areas. Part I describes the certification program whereby NIST certifies State weights and measures laboratories. Part II is the directory of State weights and measures laboratories and lists the services they provide to State and local weights and measures agencies as well as to industry. The directory is intended to assist potential users of the laboratory services in locating and obtaining needed measurement services.

001,080
PB91-101220 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Building a PC-Based Knowledge Base for Improving NDE (Nondestructive Evaluation) Reliability.

Final rept.
J. T. Fong, and B. Bernstein. 1988, 23p
Pub. in Proceedings of International Conference on Pressure Vessel Technology (6th), Beijing, China, September 11-15, 1988, v2 p1349-1371.

Keywords: *Nondestructive tests, *Data processing, Reliability, Prototypes, Pipes(Tubes), Pressure vessels, Ultrasonic tests, Reprints, *Expert systems, Data bases, Knowledge bases(Artificial intelligence), Personal computers, Fracture mechanics.

The paper describes a design and partial implementation of a prototype expert system for processing nondestructive evaluation (NDE) data contributed by inspectors of critical structures, components, and weldments such as pressure vessels and piping in chemical and electric power generating plants. The system is designed to integrate the analysis, database, and graphics features of a software in a personal computer (PC) environment to assist the user in: building a knowledge base on selected NDE methods; estimating and improving the reliability of NDE procedures using the knowledge base; and processing specific NDE data with expert-assisted analysis and interpretation for decision support. When fully implemented, the prototype system is designed to serve as the NDE input module to probabilistic fracture assessment codes such as PRAISE for piping and VISA-II for pressure vessels.

001,081
PB91-101311 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Statistical Engineering Div.

Minimum Cost Inspection Intervals for a Two-State Process.

Final rept.
H. K. Iyer, and D. F. Vecchia. 1990, 13p
Pub. in Jnl. of Quality Technology 22, n3 p210-222 Jul 90.

Keywords: *Process control, *Product inspection, Probability theory, Control charts, Quality assurance, Sampling, Reprints.

Any automated process can be said to be in state 0 (operating properly) or, if a malfunction occurs, to be in state 1 (not operating properly). Periodic inspection is necessary to make sure that the process is in state 0. The authors derive the minimum cost inspection interval for such a process with failure probability p, based on costs of inspection, repair, and nonconforming items. The authors also consider the case of an unknown failure probability and suggest a sequential procedure for estimating p and, simultaneously, the optimum inspection interval. Results of a simulation study show that the proposed methods work quite well.

001,082
PB91-107102 PC A09/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.

Uniform Laws and Regulations as Adopted by the National Conference on Weights and Measures (75th), 1990 (1991 Edition).
 Handbook.
 C. S. Brickenkamp. Oct 90, 182p NIST/HB-13091ED
 Also available from Supt. of Docs. as SN003-003-03048-1. Supersedes PB90-191404.

Keywords: *Weight measurement, *Regulations, *Handbooks, Units of measurement, Packaging, Standardization, Automotive fuels, Revisions, Consumer affairs, Labels, Prices, Commodities, Sales, *Weights and measures, Open dating, Unit pricing.

The handbook, revised annually, compiles the uniform laws and regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures (NCWM). The Compilation itself was approved by the NCWM in 1979, and the edition includes amendments adopted by the Conference at its annual meeting in 1990. The edition also contains a reprint of Section 2 from NCWM Publication 3 'Policy, Interpretations, and Guidelines.' The NCWM recommends adoption and promulgation by the states of these uniform laws and regulations as updated in the handbook.

001,083
PB91-107136 PC A10/MF A02
 National Inst. of Standards and Technology, Gaithersburg, MD.

Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices as Adopted by the 75th National Conference on Weights and Measures 1990 (1991 Edition).
 Handbook.
 H. V. Oppermann. Oct 90, 207p NIST/HB-4491ED
 Also available from Supt. of Docs. Supersedes PB90-184961.

Keywords: *Measuring instruments, *Weight indicators, *Handbooks, Tolerances(Mechanics), Requirements, Volume unit meters, Liquids, Vapors, Dimensional measurement, Grain moisture, Balances.

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms beginning in 1918. The 1991 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures with the assistance of the Office of Weights and Measures of the National Institute of Standards and Technology. It includes amendments adopted by the 75th annual meeting of the National Conference on Weights and Measures in 1990. Handbook 44 is published in its entirety each year following the annual meeting of the National Conference on Weights and Measures.

001,084
PB91-112425 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Dosimetry for Low-Energy Electron Machine Performance and Process Control.
 Final rept.

W. L. McLaughlin. 1990, 9p
 Pub. in Proceedings of Conference RadTech '90 North America, Chicago, IL., March 25-29, 1990, v2 p91-99.

Keywords: *Dosimetry, *Curing, Electron beams, Process control, Quality control, Reprints, Film dosimetry, Radiochromic films.

There are methods of dosimetry especially suited to electron beam curing, which can be used routinely in the real world of on-line industrial processing. They must be used properly, however, in order to provide assurance to those responsible for meeting process cure specifications, from the chemists to the QC and machine engineers. Dosimetry provides a relatively simple and inexpensive means of testing machine performance, including cure yield (k-factor), depth uniformity versus voltage, and longitudinal uniformity, even when there may be other geometrical, electrical, and atmospheric, as well as chemical, variability affecting cure efficiency. Improvements are being made in providing better dosimeters, calibrations, and wider response ranges with independence of response on atmospheric, thermal, spatial, dose rate, and read-out conditions. In fact, there is a recently published ASTM

Standard Practice E1275 on thin-film dosimeters, as well as several presently being developed on dosimetry for electron beam facilities, calorimetry as a reference standard, and estimation of dosimetry uncertainties.

001,085
PB91-112763 PC A11/MF A02
 National Inst. of Standards and Technology, Gaithersburg, MD.

Report of the National Conference on Weights and Measures (75th).
 Special pub.
 A. D. Tholen, C. S. Brickenkamp, and A. H. Turner.
 Sep 90, 245p NIST/SP-793
 Also available from Supt. of Docs. as SN003-003-03044-9. See also PB90-146465. Held in Washington DC. on July 9-13, 1990. Library of Congress catalog card no. 26-27766.

Keywords: *Weight measurement, *Regulations, *Meetings, Units of measurement, Packaging, Standardization, Automotive fuels, Consumer affairs, Tolerances(Mechanics), Specifications, Commodities, Law(Jurisprudence), Railroad tracks, Food packaging, *Weights and measures.

The 75th Annual Meeting of the National Conference on Weights and Measures (NCWM) was held during the week of July 9 through 13, 1990. The theme of the meeting was 'Progress Through Consensus Among Consumers, Regulators, and Industry.' In the authors address to the delegates, Chairman Fred Gerck of New Mexico reflected on the progress made by the NCWM in the past year. In the address, Conference President John Lyons, Director, National Institute of Standards and Technology, provided a history of the founding of the National Bureau of Standards and the NCWM. In a keynote address, Congressman Tim Valentine noted the challenges to be met by the NCWM in the future. The Conference set standards for equipment and sales practices in the area of cash/credit pricing of retail motor fuel and compressed gas cylinders. Progress in training program development and standards for moisture loss were also reported upon. Special meetings included those of the Metrologists, the Associate Membership Committee, the Retired Officials Committee, the Scale Manufacturers' Association, the American Petroleum Institute, the Industry Committee on Packaging and Labeling, the State regional weights and measures associations, and the National Association of State Departments of Agriculture Weights and Measures Division. Reports by the standing and annual committees of the Conference comprise the major portion of the publication, along with the addresses delivered by Conference officials and other authorities from government and industry.

001,086
PB91-118000 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Automated Production Technology Div.

Transient Sources for Acoustic Emission Work.
 Final rept.

F. R. Breckenridge, T. M. Proctor, N. N. Hsu, S. E. Fick, and D. G. Eitzen. 1990, 18p
 Sponsored by Office of Naval Research, Arlington, VA. Pub. in Proceedings of the International Acoustic Emission Symposium (10th), Progress in Acoustic Emission V, Sendai, Japan, October 22-25, 1990, p20-37.

Keywords: Greens function, Sound generators, Waveforms, Sources, Reprints, *Acoustic emissions, Transients.

The paper is a compilation of information about the following types of sources: pencil, capillary, capacitive transducer, conical transducer, ball impact, spark, and high explosive. Force waveforms and other relevant data concerning the sources are given and comments made on their relative merits. The ideal source would be infinitesimal in size, have a simple force waveform such as a step or delta function, and would have a relatively large amplitude which could be determined from a priori considerations. None of the sources considered in the paper approach perfection in all of these respects. Hence, the choice of a source for a particular purpose will involve tradeoffs based on the particular merits of each source.

001,087
PB91-118646 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Acoustic Emission: Nature's Ultrasound.
 Final rept.
 H. N. G. Wadley. 1986, 23p
 Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v5A p271-293 1986.

Keywords: Nondestructive tests, Ultrasonic radiation, Elastic waves, Reprints, *Acoustic emissions, Fracture mechanics, Crystal dislocations, Elastodynamics, State of the art.

Acoustic emission refers to the ultrasonic signals (elastic waves) emitted by materials undergoing microscopic changes of stress state. This naturally generated ultrasound is distinctly related to the source process (dislocation motion, fracture, and some phase changes). For example, the waveform of an acoustic emission from a crack propagation increment contains information about the location, growth distance, velocity, and orientation of the crack. Acoustic emission then is of interest as a naturally occurring phenomenon for the characterization of deformation and fracture mechanisms. It is also of interest as a possible passive monitoring technique for detecting, locating, and characterizing defects in structures. The current state-of-the-art of these applications is reviewed here in the context of an emerging science base, and future trends are discussed.

001,088
PB91-167452 (Order as PB91-167411, PC A05/MF A01)
 National Inst. of Standards and Technology, Gaithersburg, MD.

Survey of Industrial, Agricultural, and Medical Applications of Radiometric Gauging and Process Control.
 J. H. Hubbell. 1990, 11p
 Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n6 p689-699, Nov/Dec 90.

Keywords: *Process control, *Radiometry, *Metrology, Electrons, Gamma rays, Neutrons, Density, Albedo, Moisture, Mineral industry, Agriculture, Forestry, Medical equipment, Buildings, Thickness gages, Bibliographies, Surveys.

Photon and particle radiations (gamma rays, x rays, bremsstrahlung, electrons and other charged particles, and neutrons) from radioactive isotopes, x-ray tubes, and accelerators are now widely used in gauging, production control, and other monitoring and metrology devices where avoidance of mechanical contact is desirable. The general principles of radiation gauges, which rely on detection of radiation transmitted by the sample, or on detection of scattered or other secondary radiations produced in the sample, are discussed. Examples of such devices currently used or at least shown to be feasible in industrial, transportation, building, mining, agricultural, medical, and other metrology situations are presented, drawing from a total of 146 selected technical and review paper reference sources here cited.

Robotics/Robots

001,089
N90-29891/0 (Order as N90-29874/6, PC A19/MF A03)
 National Inst. of Standards and Technology, Gaithersburg, MD.

Requirements for Implementing Real-Time Control Functional Modules on a Hierarchical Parallel Pipelined System.
 T. E. Wheatley, J. L. Michaloski, and R. Lumia. 31
 Jan 89, 10p
 In JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 5 p163-172.

Keywords: *Artificial intelligence, *Computer programs, Control systems design, *Robotics.

Analysis of a robot control system leads to a broad range of processing requirements. One fundamental requirement of a robot control system is the necessity of a microcomputer system in order to provide sufficient processing capability. The use of multiple processors in a parallel architecture is beneficial for a number of reasons, including better cost performance, modular

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growth, increased reliability through replication, and flexibility for testing alternate control strategies via different partitioning. A survey of the progression from low level control synchronizing primitives to higher level communication tools is presented. The system communication and control mechanisms of existing robot control systems are compared to the hierarchical control model. The impact of this design methodology on the current robot control systems is explored.

001,090
PB90-155805 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Manipulator Primitive Level World Modeling.
 Technical note (Final).
 L. Kelmar. Dec 89, 38p NIST/TN-1273
 Also available from Supt. of Docs. as SN003-003-02978-5.

Keywords: *Manipulators, Mathematical models, Kinematics, Dynamics, Torque, Force, *Control systems, Robotics, Hierarchies.

The document describes the interfaces and functions of a World Modeling module at the second level of a hierarchical manipulator control system. The World Modeling modules maintain an internal model of the world by continuously updating the model based upon sensory input. At the second level of the control system, the Primitive Level World Modeling module supports the Level 2 Sensory Processing module and the Primitive Task Decomposition module. The document contains detailed descriptions of the interfaces between the module and the rest of the control hierarchy. It also discusses the function of the support processes within the module.

001,091
PB90-155813 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Manipulator Servo Level World Modeling.
 Technical note (Final).
 L. Kelmar. Dec 89, 33p NIST/TN-1258
 Also available from Supt. of Docs. as SN003-003-02979-3.

Keywords: *Manipulators, Mathematical models, Kinematics, Dynamics, Servomechanisms, Automatic control equipment, *Control systems, Robotics, Hierarchies.

The document describes the interfaces and functions of a World Modeling module at the lowest level of a hierarchical manipulator control system. The World Modeling modules maintain an internal model of the world by continuously updating the model based upon sensory input. At the lowest level of the control system, the Level 1 World Modeling module interfaces to and supports the Data Acquisition Sensory Processing module and the Servo Task Decomposition module. The document contains detailed descriptions of the interfaces between the Level 1 World Modeling module and the rest of the control hierarchy. The document also discusses the function of the support processes within the module. It does not attempt to provide an exhaustive list of the computations and models required by World Modeling in support of all possible devices and sensors in a manipulator control system. Rather, it aims to elucidate the classes of support processes for both Sensory Processing and Task Decomposition, considering control of a manipulator (the most complex device) as an example.

001,092
PB90-169384 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Optimal Control of a Flexible Robot Arm.
 Final rept.
 J. D. Lee, and B. L. Wang. 1988, 9p
 Pub. in Computers and Structures 29, n3 p459-467 1988.

Keywords: *Manipulators, *Automatic control, Robots, Dynamics, Control theory, Reprints, *Robotics.

The work is a computer simulation of the control of flexible robot arm. The dynamic equations for a single-link flexible robot arm have been derived rigorously. The arm has two degrees of freedom in rotation and one in translation so that the workspace is three-dimensional. The payload is simulated by attaching additional mass to the arm at a specified location. The governing equations of the plant and the measurements

are nonlinear. The process of control is divided into two stages: coarse control and fine control. Based on the optimal control theory, a linear observer is constructed for fine control. The numerical results are presented here.

001,093
PB90-169392 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Dynamic Equations for a Two-Link Flexible Robot Arm.
 Final rept.
 J. D. Lee, and B. L. Wang. 1988, 9p
 Pub. in Computers and Structures 29, n3 p469-477 1988.

Keywords: *Robots, *Manipulators, *Dynamics, Control theory, Automatic control, Inertia, Reprints, *Robotics, Finite element method.

The dynamic equations for a two-link flexible robot arm have been derived rigorously. The arm is moving on the vertical plane. The payload is simulated by attaching additional masses to the arm at any specified locations. Although the governing equations of the system and the measurements are nonlinear, they are explicitly obtained. The control strategy and the general procedures to construct a linear observer and to formulate a control law are discussed.

001,094
PB90-167790 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Testing.
 Final rept.
 K. Lau, N. Dagalakis, and D. Myers. 1988, 17p
 Pub. in International Encyclopedia of Robotics: Applications and Automation, v3 p1753-1769 1988.

Keywords: *Robots, *Tests, *Performance evaluation, Measurement, Standards, Methodology, Reprints, Robotics.

The rapid increase in the number and sophistication of robots in industry has prompted the need for standard test procedures, terminologies, and methodologies to measure and describe robot performance. However, in spite of the recent international effort pursued by many standards committees, research laboratories and industries, the majority of robot users still suffer from the lack of standard techniques and definitions for robot testing. This is largely due to the complexity of most robot designs and their wide range of intended applications. For instance, non-uniform and large workzone, lack of linear travels, multi-degree of freedom motions, uneven payload and speed are typical properties of most modern robots. The chapter gives an overview of some of the major tests and ideas developed for robot measurements. The test objectives are classified into three main categories: performance measurements, parameter measurements and environmental measurements.

001,095
PB90-167907 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Robotic Assembly by Constraints.
 Final rept.
 G. H. Morris, and L. S. Haynes. 1987, 9p
 Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Robotics and Automation, Raleigh, NC., March 31-April 3, 1987, p1507-1515.

Keywords: Robots, Assembling, Constraints, Reprints, *Robotics, *Off line systems, *Automatic programming, Computer aided design, Computer aided manufacturing.

Off-line programming of robots will become increasingly more important. The paper describes a robot programming system which is based upon the use of geometrical constraints on the degrees of freedom of a component for specifying robotic assembly actions. Two pieces of software have been developed which allow easy definition of these constraints and the order of execution in the constraints.

001,096
PB90-188467 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Prediction-Based Vision for Robot Control.
 Final rept.
 M. O. Shneier, R. Lumia, and M. Herman. 1987, 10p
 Pub. in Computer 20, n8 p46-55 1987.

Keywords: *Robots, Mathematical models, Reprints, *Computer vision, Predictions, Sensory feedback.

The design and implementation of a model-driven sensory processing system is described. The system was developed for an industrial robotics environment, and makes use of vision and range sensing to construct an internal representation of its environment. To a large extent, sensing is driven by predictions, which are based on the current state of the internal representation. After processing and matching, sensed information is used to update the representation, which can then produce new predictions. This results in a feedback loop, which serves the internal representation into registration with the world. Initial input to the system consists of generic geometric models of those parts expected to appear in the world during a task, together with initial positions for each part. The system uses two internal representations, an object-based representation, and a spatial representation. A path planning module that interfaces with the sensory system is also described.

001,097
PB90-203134 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Note on NASREM Implementation.
 J. Fiala. Mar 90, 21p NISTIR-89/4215

Keywords: *Decomposition method, *Automatic control equipment, Control theory, Parallel processors, Real time operations, *Architecture(Computers), *Robotics.

The document describes ideas formulated in the Intelligent Controls Group for the structure of a NASA/NBS Standard Reference Model Telerobot Control System Architecture implementation. A basic description of a telerobot control system architecture is given in terms of the model's parallel processing formulation and its meaning in a multiprocessing computing environment. Examples of software organization using Ada are provided to illustrate the ideas.

001,098
PB90-216839 PC A08/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
DOE (Department of Energy)/NIST (National Institute of Standards and Technology) Workshop on Common Architectures for Robotic Systems.
 Special pub. (Final).
 R. Quintero. Apr 90, 154p NIST/SP-784
 Held in Gaithersburg, Maryland on January 30-31, 1990. Also available from Supt. of Docs. Sponsored by Department of Energy, Washington, DC. Office of Technology Development.

Keywords: Technology innovation, Technology transfer, Standards, *Robotics, *Control systems, Computer software, Remote systems, Teleoperators, Real time systems.

At the request of the Department of Energy's (DOE's) Office of Technology Development the National Institute of Standards and Technology (NIST), Robot Systems Division organized and hosted the first DOE/NIST Workshop on Common Architectures for Robotic Systems. The workshop had three goals: An initial review of the methodologies currently used by the DOE sites for development and maintenance of software related to robotic and remote systems; presentations by representatives of other government agencies on lessons learned in the development of common architectures for robotic and remote systems; and a preliminary assessment of the methodology necessary to arrive at a DOE common architecture.

001,099
PB90-218389 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Control Architecture for Cooperative Intelligent Robots.
 Final rept.
 J. S. Albus. 1989, 17p
 Sponsored by NATO Advanced Research Workshops, Il Ciocco (Italy).

Pub. in Proceedings of NATO (North Atlantic Treaty Organization) Advanced Workshop on Robots and Biological Systems, Il Ciocco, Tuscany, Italy, June 26-30, 1989, p1-17.

Keywords: *Robots, *Artificial intelligence, Systems engineering, Models, Reprints, *Control systems, Computer communications.

Intelligent behavior requires a control system architecture that ties together actuators, sensors, sensory processing, task decomposition, world modeling, goal selection, and value judgments into an integrated system. A hierarchically layered architecture with horizontal communications within layers is proposed. Intelligent cooperative behavior requires common goals, common strategies, agreed upon division of labor, and a common view of the world. To the extent that all individuals in a population are working on the same top level input command, they share a common goal. To the degree that all have similar task vocabularies and control programs resident in their task decomposition modules, there exists a basis for common strategy. To the extent that all agree on the structure of the command tree, there exists a basis for division of labor. To the degree that individuals have the same information resident in their world model, they share a common view of the world. When all these exist simultaneously, there exists the basis for intelligent cooperative behavior. Communication is a mechanism for maintaining a common goal, strategy, division of labor, and world view.

001,100
PB90-219569 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
NASREM implementation of Position Determination from Motion.
 K. Chaconas, L. Kelm, and M. Nashman. 16 Jan 90, 18p NISTIR-90/4293
 See also PB90-203134.

Keywords: *Manipulators, *Position finding, *Motion, Position(Location), Tracking(Position), Algorithms, *Control systems, Three dimensional motions, Image processing.

The document describes a NASREM implementation of a system which determines three-dimensional position from motion. The system performs real-time image processing to extract the two-dimensional centroid of a moving object. It then employs an inverse perspective algorithm to transform the centroid of the moving object on a planar surface to a three-dimensional position. The position is used by the control system for a robot manipulator which tracks and catches the moving object.

001,101
PB90-219593 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Implementation of a Jacobian-Transpose Algorithm.
 J. Fiala, and A. Wavering. Apr 90, 27p NISTIR-90/4286

Keywords: *Robots, *Control theory, *Manipulators, Mathematical models, Multiprocessing, Algorithms, Servomechanisms, Computer programming, *Jacobi matrix method.

The document describes an implementation of a Cartesian servo algorithm on a seven degree-of-freedom manipulator. In the basic algorithm the servo error is computed in Cartesian coordinates and transformed to joint-space torque commands by use of the transpose of the Jacobian relating the two coordinate systems. The control algorithm is described mathematically and in terms of the computational processes operating in a multiprocessing system to achieve the control. Two applications of the algorithm are described: compliant motions for contact of the arm with the environment, and ping-pong ball catching using real-time visual feedback.

001,102
PB90-228008 PC A03/MF A01
 Florida Atlantic Univ., Boca Raton.
Quantitative Approach to Camera Fixation.
 D. Raviv. May 90, 30p NISTIR-4324
 Color illustrations reproduced in black and white. Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.

Keywords: *Robots, *Cameras, Equations of motion, *Computer vision, Robotics, Image processing.

The paper deals with quantitative aspects of camera fixation for a static scene. In general, when the camera undergoes translation and rotation, there is an infinite number of points that produce equal optical flow for any instantaneous point in time. Using a camera-centered spherical coordinate system, it is shown how to find these points in space. For the case where the rotation axis of the camera is perpendicular to the instantaneous translation vector, these points lie on cylinders. If the elevation component of the optical flow is set to zero then these points form a circle (called the Equal Flow Circle or simply EFC) and a line, i.e., all points that lie on this circle or line are observed as having the same azimuthal optical flow. A special case of the EFCs is the Zero Flow Circle (ZFC) where both components of the optical flow are equal to zero. A fixation point is the intersection of all the ZFCs. Points inside and outside the ZFC can be quantitatively mapped using the EFCs. In a set of experiments using simulated as well as real data, the authors show how the concept of the EFC and ZFC can be used to explain the optical flow produced by points near the fixation point, and to explicitly map the space while fixating. It is also shown experimentally that points near the fixation point may change the sign of their optical flow as the camera moves.

001,103
PB90-244419 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Approach to Telerobot Computing Architecture.
 J. Fiala, and R. Lumia. 18 Jun 90, 25p NISTIR-4357

Keywords: *Robots, Systems engineering, Servo mechanisms, Standards, Computer systems hardware, *Architecture(Computers), *Telerobots, *Control systems, Computer software, Channels(Data transmission), Multiprocessing(Computers), Microprocessors, Robotics.

In response to a Goddard Space Flight Center effort to look at the requirements for a computing architecture design appropriate for a telerobot, the document describes the Intelligent Controls Group approach to telerobot computing architectures. It is shown how a seven microprocessor control system can achieve teleoperation with an around-the-loop time of 10 ms. The document focuses on low-level, real-time robotics and does not discuss some issues relevant to space systems such as space-qualification and thermal design.

001,104
PB90-271628 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Model-Driven Determination of Object Pose for a Visually Servoed Robot.

Final rept.
 W. S. Rutkowski, R. Benton, and E. W. Kent. 1987, 10p
 Pub. in Proceedings of IEEE (Institute for Electrical and Electronics Engineers) International Conference on Robotics and Automation, Raleigh, NC., March 31-April 3, 1987, v3 p1419-1428.

Keywords: *Robots, *Detectors, Motion, Algorithms, Guidance, Models, Reprints, Sensors, Robotics.

The National Bureau of Standards robot sensory system utilizes multiple hierarchical levels of sensory interpretation that interact with matching levels of world modeling. At each level, the world-modeling processes generate hypotheses about the sensory data based on a prior knowledge, prior sensory input, and knowledge of robot motion. The sensory-interpretative processes use these hypotheses to facilitate their analyses of new data. The results of the analyses are used by the world-modeling processes to correct their models of the environment. This interaction requires the development of real-time algorithms for the analysis of sensory data that can usefully employ guidance from models. The authors present an algorithm for accomplishing this at the level of object location and pose determination. Its desirable features include the ability to deal with underconstrained problems, the ability to employ all the data in a structured-light image, and robustness in the face of several types of error and noise.

001,105
PB91-112088 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.

Technique for the Detection of Robot Joint Gear Tightness.

Final rept.
 N. G. Dagalakis, and D. R. Myers. 1985, 9p
 Contract N00014-83-K-0236
 Sponsored by Office of Naval Research, Arlington, VA.
 Pub. in Jnl. of Robotic Systems 2, n4 p415-423 1985.

Keywords: *Robots, *Joints(Junctions), *Gears, Adjusting, Systems analysis, Models, Reprints, *Robotics.

A new technique for the examination of gear tightness in robot joint drive systems is presented. A single robot joint is subjected to random excitation while the rest of the joints are constrained. The corresponding link motion is monitored by two accelerometers mounted on the link. The transfer function of the translational component of link acceleration is then obtained. From the half peak magnitude bandwidth of the first resonant frequency it is possible to determine whether the joint gears under testing have a tight or loose meshing. Tests were performed on the wrist rotation joint of an industrial robot in two steady state positions with the end effector loaded and unloaded.

001,106
PB91-112292 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.
Overview of Off-Line Robot Programming Systems.
 Final rept.
 R. J. Hocken, and G. Morris. 1986, 9p
 Pub. in CIRP Annals 35, n2 p495-503 1986.

Keywords: *Robots, *Manufacturing, *Automation, Cost effectiveness, Reprints, *Automatic programming, Off line systems, Robotics.

Although robots have been used in manufacturing for some years, their true economic value and efficiency of operation will only be realized when appropriate systems are developed that will enable rapid and possibly even automatic programming of industrial robots for a diversity of tasks. In the early years when robots were used only for such simple tasks as pick-and-place and spot welding in high-volume applications, teach-mode programming with playback of the taught positions was sufficient. Now, however, as the use of robots expands into the small batch domains and the variety of tasks is increased, the labor-intensive nature of these programming systems plus the loss of machine time necessary for program validation greatly limits those applications to which robots can be applied to economic advantage.

Tooling, Machinery, & Tools

001,107
PB90-152489 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
Inspection of Single-Point Diamond Turning Tools at Low Accelerating Voltage in a Scanning Electron Microscope.
 Final rept.
 M. T. Postek, and C. J. Evans. 1989, 8p
 Pub. in Scanning Microscopy 3, n2 p435-442 1989.

Keywords: *Diamond bits, *Diamond drills, *Turning(Machining), *Tools, *Product inspection, Surface finishing, Polishing, Electrical measurement, Reprints, *Scanning electron microscopy.

Single crystal diamond tools used in the machining process have been inspected in both the optical microscope and scanning electron microscope. Attention was focused on surface characteristics related to the specific polishing process and its relationship to cutting-edge structure. The need for tool inspection is discussed as well as the drawbacks with the inspection techniques presently used. Low accelerating voltage (<2.5 keV) inspection of uncoated diamond tools for machining is shown to be a viable method for the determination of polishing flaws that grossly reflect in the surface quality of the finished part.

001,108
PB90-160383 PC A03/MF A01
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Robot Systems Div.
Electronics Design of the Infrared/Ultrasonic
Sensing for a Robot Gripper.
 R. Bostelman. Nov 89, 29p NISTIR-89/4223

Keywords: *Robotics, *Ultrasonic radiation, *Infrared detectors, Manufacturing, Servomechanisms, Automatic control equipment, Bionics, Sound ranging, Optical detection, *Mechanical arms, Proximity sensing, Automated Manufacturing Research Facility.

The following paper is an overview of the electronics design of the Infrared/Ultrasonic Sensing Robot Gripper (Instrumented Gripper) designed, built and tested at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. The gripper is for use in the Automated Manufacturing Research Facilities (AMRF) Cleaning and Deburring Workstation (CDWS) at NIST. The paper begins with a System Description followed by the design of the Sensor Circuitry and the power. The Sensor Circuitry includes the sensor interface (to the sensor and the system) through the rectification and/or interpretation circuitry and finally to the output circuitry. The paper explains the experiments performed and their results in detail. Future considerations for the system follow and explain some applications for the Instrumented Gripper and further sensing ideas.

001,109
PB90-242207 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Precision Engineering Div.
National Institute of Standards and Technology
Molecular Measuring Machine Project: Metrology
and Precision Engineering Design.
 Final rept.
 E. C. Teague. 1989, 5p
 Pub. in Jnl. of Vacuum Science and Technology B 7,
 n6 p1898-1902 Nov/Dec 89.

Keywords: Metrology, Line width, Vibration isolators, Surface roughness, Precision, Design, Reprints, *Coordinate measuring machines, Scanning tunneling microscopy, Atomic force microscopy, Molecular measuring machine project.

At NIST, a high risk project has been undertaken to build an ultrahigh accuracy planar coordinate measuring machine capable of positioning and measuring to atomic scale accuracies over an area of 2500 sq mm. The design goal is to obtain a point-to-point spatial resolution of 0.1 nm of the distance between any two points within a 50 mm x 50 mm x 100 micrometer volume; with a net uncertainty for point-to-point measurements of 1.0 nm. Maximum specimen size will be 50 mm x 50 mm x 12 cubic mm. The approach has been to design the machine such that it can incorporate a probe, based on either a scanning tunneling microscope or an atomic force microscope, into a highly stable core mechanical structure. A spherical core structure, with crossed linear slideways for the probe and specimen carriages, was chosen for its high mechanical stiffness and ease of temperature control. Presented in the paper are: a summary of the precision instrument design fundamentals incorporated into the authors design; details of the overall mechanical design, X-Y drive systems, the metrology reference system, X-Y heterodyne interferometer, vibration isolation systems; and a report on the status of construction.

001,110
PB91-111899 Not available NTIS
 National Inst. of Standards and Technology (NEL),
 Boulder, CO. Chemical Engineering Science Div.
Influence of Swirling Flow on Orifice and Turbine
Flowmeter Performance.
 Final rept.
 J. A. Brennan, S. E. McFaddin, C. F. Sindt, and K. M. Kothari. 1989, 4p
 Sponsored by Gas Research Inst., Chicago, IL.
 Pub. in Flow Meas. Instrum. 1, p5-8 Oct 89.

Keywords: *Flowmeters, Orifice meters, Turbines, Nitrogen, Reprints, Vortex flow.

Tests of four different beta ratio orifice flowmeters in a 100 mm (4 inch) meter tube and two 100 mm turbine flowmeters were run in nitrogen gas at 4 MPa (580 lb/sq in abs) at pipe Reynolds numbers ranging from 0.4 to 1.6 million. Different levels of swirl were generated,

and the change in the discharge coefficients and the meter factors were determined. Differences greater than 5% were found in the discharge coefficients for certain combinations of swirl and beta ratios. The change in turbine meter factors also exceed 5% for certain combinations of swirl and meter design.

001,111
PB91-112771 PC A03/MF A01
 National Inst. of Standards and Technology (NEL),
 Gaithersburg, MD. Automated Production Technology
 Div.
Implementing Fast Part Probing and Error Compensation on Machine Tools.
 K. W. Yee, and R. J. Gavin. Oct 90, 15p NISTIR-4447

Keywords: *Machine tools, *Error correction codes, Manufacturing, Coders, Real time, Computer aided control systems.

A device has been constructed to facilitate fast probing and real-time error compensation on computer-numerical-control (CNC) machine tools without intrusion into the machine-tool controller. The device, interfaced to a PC computer, is inserted between the position feedback elements and the controller. Fast probing using a touch-trigger probe is achieved by providing high-speed access by the PC to the probe-trip positions. The device performs error-compensation by modifying the position-feedback signals going to the controller. Pulses from the 'encoder' are added or subtracted to alter the position count in the controller. The correction values are calculated by the PC using a model previously developed at NIST for predicting, in real-time, machine-tool geometric and thermal errors.

Tribology

001,112
PB90-136532 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
Wear Surface Analysis of Silicon Nitride.
 Final rept.
 D. C. Cranmer. 1988, 6p
 Sponsored by Aerospace Corp., Los Angeles, CA.
 Pub. in Lubrication Engineering 44, n12 p975-980
 1988.

Keywords: *Wear, *Surface properties, *Silicon nitrides, X-ray analysis, Microstructure, Oxidation, Interfaces, Stresses, Ceramics, Reprints, Tribology, Scanning electron microscopy, Photoelectron spectroscopy.

Wear surfaces of air-exposed Si3N4 have been characterized using a combination of scanning electron microscopy (SEM) and x-ray photoelectron spectroscopy (XPS). SEM shows the surface microstructure and major elements present and XPS shows the surface species present and the chemical states (i.e., oxide, oxynitride, nitride). The results indicate that oxidation of silicon nitride during wear is related to the distance slid and that the mechanical stresses at the interface enhance the formation of oxide rather than oxynitride.

001,113
PB90-152869 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Ceramics Div.
Microspectroscopy Applications in Tribology.
 Final rept.
 B. E. Hegemann, S. Jahanmir, and S. M. Hsu. 1988,
 3p
 Pub. in Microbeam Analysis, p193-195 1988.

Keywords: *Microanalysis, *Infrared spectroscopy, Wear, Fourier transformation, Raman spectroscopy, Lubrication, Friction, Surface roughness, Chemical analysis, Ceramics, Reprints, *Tribology.

Fourier transform infrared (FTIR) and Raman spectroscopy are techniques which are applicable for an understanding of tribological processes which are frequently studied by wear tests, such as the four-ball wear test, where friction and/or wear of materials under lubrication are monitored under different speed and load conditions. In such a test, the apparent contact area is often in the dimensional range of 0.1-1 mm. Within such a contact, the tribochemical reactions be-

tween lubricant molecules and substrate material surfaces take place. Due to the minute amount of reaction product and the complexity of the chemical composition, which may not be homogeneous across the contact zone, chemical information has been difficult to obtain. In the paper, the applicability of microspectroscopy techniques for a detailed post mortem chemical analysis of wear test specimens is explored. In particular, investigations of the use of micro-FTIR spectroscopy to post mortem four-ball wear test specimen analysis is presented. As both metal and ceramic substrates are of tribological interest, the differences in applying micro-FTIR analysis to each case is subsequently examined. New efforts in developing a time-resolved micro-Raman spectroscopy technique for tribochemical analysis is also presented.

001,114
PB90-188301 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Metallurgy Div.
Lubricated Wear Behavior of Composition Modulated Nickel-Copper Coatings.
 Final rept.
 A. W. Ruff, and N. K. Myshkin. 1989, 5p
 Sponsored by Office of Naval Research, Arlington, VA.
 Pub. in Jnl. of Tribology-Transactions of the ASME
 (American Society of Mechanical Engineers) 111, n1
 p156-160 1989.

Keywords: *Wear, *Lubrication, *Nickel alloys, *Copper alloys, *Metal coatings, *Electrodeposited coatings, Steels, Cylinders, Alkanes, Oleic acid, Glycerol, Ethanol, Electric contacts, Electrical measurement, Sliding friction, Reprints, *Tribology, Nickel coatings.

A study has been completed of the lubricated wear behavior of electrodeposited composition modulated nickel-copper alloys having two different layer spacings, 10 nm and 100 nm, under lubricated sliding conditions against type 52100 bearings steel. The alloys were prepared as coatings about 20 micrometers thick on steel cylinders. A standard crossed-cylinder wear test geometry was used. Three liquids were used: pure paraffin oil both with and without the addition of oleic acid, and a solution of 0.6 glycerine and 0.4 ethanol. Electrical measurements of the contact resistance were made to assist in interpretation of the nature of the boundary lubrication film present during sliding. Wear data and friction coefficient values were obtained, and are compared with values that were previously measured under dry wear conditions.

001,115
PB90-218405 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg,
 MD. Ceramics Div.
Computerized Tribology Information System
ACTIS.
 Final rept.
 S. M. Hsu, and S. Danyluk. 1987, 12p
 Pub. in Proceedings of ASME (American Society of
 Mechanical Engineers) International Computers in
 Engineering Conference and Exhibition, Managing
 Engineering Data: The Competitive Edge, New York, NY.,
 August 9-13, 1987, p133-144.

Keywords: *Information systems, Prototypes, Systems engineering, Reprints, *Tribology, Data bases.

A computerized database with validated numerical data, and 'best judgment values' by experts will aid in establishing tribology as an interdisciplinary science where information on lubricant chemistry, materials, mechanics, surface science, interface contact, surface topography, elastohydrodynamics, fluid mechanics, heat transfer, and mechanical designs are available. Computerization will advance the quality of research as well as identify the critical linkages in tribological systems research. The computerized tribology information system is being developed as a self-sustaining activity with government providing the initial funding for research and prototype construction. Current databases do not go beyond the establishment of bibliographic databases, and many technical challenges exist in data architecture, computer system software design, entry module design and data communication and standardization. Success in the program will have significant impact on other similar programs around the world.

001,116
PB90-271123 Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Considerations in the Standardization of Generic Wear Measurements.

Final rept.
 P. J. Blau. 1988, 11p
 Pub. in Proceedings of Meeting of the Mechanical Failures Prevention Group (41st), Patuxent River, MD., October 28-30, 1986, p61-71 1988.

Keywords: *Wear tests, *Friction, *Standards, Measurement, Metrology, Terminology, Reprints, *Tribology.

Measurements and standards development in basic and applied wear science are complex problem areas because of the diversity and complexity of the forms of wear. No single unit or combination of basic units can serve the needs of the tribology community. The terminology of tribology is clouded with ambiguities and many glossaries do not even agree on the definitions of the basic terms in the field. Physical quantitative measurements of wear can be greatly affected by both the materials and the testing methods involved in wear experiments. The development of tribology as an interdisciplinary field continues to provide significant challenges for measurement and standardization methodology.

001,117
PB91-118323 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Oxidative Degradation Mechanisms of Lubricants.
 Final rept.
 S. M. Hsu, C. S. Ku, and P. T. Pei. 1986, 22p
 Sponsored by Department of Energy, Washington, DC. Pub. in Aspects of Lubricant Oxidation, ASTM STP 916, p27-48 1986.

Keywords: *Lubricants, *Degradation, Oxidation, Durability, Wear, Environmental impacts, Catalysts, Viscosity, Experimental facilities, Reprints.

Lubricant degradation under in-service conditions can be often traced to oxidation. Environmental effects under in-service conditions are often recognized to affect the oxidation pathways of lubricants. In the study, environmental factors such as metal catalysts, fuel components, and oxides of nitrogen are studied systematically in a simple oxidation test. The test consists of bubbling air into the oil sample at 175C. Periodic samples were withdrawn and analyzed. Results show that the environmental factors not only have significant influence on the rate of oxidation, but also on the oxidation pathway of how lubricants degrade. The acid number increase was found to be an important parameter in monitoring the lubricant degradation mechanisms.

General

001,118
PB90-183286 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD.

Report on Interactions between the National Institute of Standards and Technology and the American Society of Mechanical Engineers.
 Rept. for 1982-90.
 G. K. Ehrlich. Feb 90, 34p NISTIR-90/4261
 See also PB89-172563.

Keywords: *Technology transfer, *Mechanical engineering, *Industrial engineering, Computers, Standards, Heat transfer, Pressure vessels, Solar energy, Tribology, Meetings, *National Institute of Standards and Technology, *American Society of Mechanical Engineers.

The report highlights examples of interactions between the National Institute of Standards and Technology (NIST) and the American Society of Mechanical Engineers over the past several years. It is meant to be representative, not all-inclusive. The interactions are organized by discipline in the following categories: Conferences, Committee memberships and contribution to standards, Editors, Publications, Honors and awards, and Special activities. The report illustrates many activities which are designed to disseminate NIST's most recent technical advances and to learn of the technical challenges facing engineers in industry.

001,119
PB90-192469 Not available NTIS
 National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.

Pulse Tube Refrigeration: A New Type of Cryocooler.
 Final rept.
 R. Radebaugh. 1987, 6p
 Pub. in Japanese Jnl. of Applied Physics 26, Supplement 26-3, p2076-2081 1987.

Keywords: *Stirling cycle, *Refrigerators, *Cryogenics, Cooling systems, Coolers, Refrigerating, Low temperature research, Enthalpy, Flow models, Reprints.

A variation of the Stirling cryocooler, known as pulse tube refrigeration, requires only one moving part - a pressure wave generator at room temperature. The Stirling cryocooler requires in addition a moving displacer at low temperatures to cause a phase shift between pressure and mass flow rate that leads to a refrigeration effect. The paper generalizes the Stirling cycle and shows how instantaneous heat transfer or flow through an orifice can cause a similar phase shift without a moving displacer. Temperatures as low as 60 K have been achieved in a one stage device where an orifice is used for the phase shifting. The heat transfer mechanism for phase shifting does not yield as low a temperature, but it is semireversible and was used by Wheatley to convert heat energy to acoustic energy, which in turn drove a thermoacoustic refrigerator with no moving parts. The paper compares the various pulse tube refrigerators and the Stirling refrigerator using a newly developed enthalpy flow model. Some generalizations of these concepts to systems other than gas systems are made.

001,120
PB91-107573 PC A04/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.

Heat Transfer in a Compact Tubular Heat Exchanger with Helium Gas at 3.5 MPa.
 D. A. Olson, and M. P. Glover. Jun 90, 66p NISTIR-3941
 Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.

Keywords: *Heat transfer, *Heat exchangers, Helium, Friction factor, Heat flux, Reynolds number, Mathematical models, Test facilities, Radiant heating, Experimental data, Turbulent flow.

The authors constructed a compact heat exchanger consisting of circular tubes in parallel brazed to a grooved base plate. This tube specimen heat exchanger was tested in an apparatus which radiatively heated the specimen on one side at a heat flux of up to 54 W/cm sq, and cooled the specimen with helium gas at 3.5 MPa and Reynolds numbers of 3000 to 35,000. The measured friction factor of the tube specimen was lower than that of a circular tube with fully developed turbulent flow, although our uncertainty was high due to entrance and exit losses. The measured Nusselt number, when modified to account for differences in fluid properties between the wall and the cooling fluid, agreed with past correlations for fully developed turbulent flow in circular tubes.

MATERIALS SCIENCES

Adhesives & Sealants

001,121
PB90-149378 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Ultrahigh Vacuum Leak Sealing with a Silicon Resin Product.
 Final rept.
 W. F. Egelhoff. 1988, 2p
 Pub. in Jnl. of Vacuum Science and Technology A 6, n4 p2584-2585 Jul/Aug 88.

Keywords: *Vacuum seals, *Ultrahigh vacuum, Leakage, Silicon, Bellows, Reprints, *Resins.

A description is given of a silicon resin which exhibits excellent leak sealing properties for ultrahigh vacuum systems. Techniques for using this resin successfully in leak sealing are described.

001,122
PB90-261116 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Micromechanics of Fracture in Structural Adhesive Bonds.
 Final rept.
 D. L. Hunston, A. J. Kinloch, and S. S. Wang. 1989, 13p
 Pub. in Jnl. of Adhesion 28, n2-3 p103 1989.

Keywords: *Adhesion, *Construction joints, *Epoxy resins, Adhesive bonding, Surface energy, Crack propagation, Deformation, Toughness, Stress analysis, Bonded joints, Fracture strength, Motion pictures, Reprints, Fracture mechanics, Micromechanics.

The high mode-I fracture surface energies, G(sub IC), of structural adhesives can be attributed to their ability to form large crack-tip deformation zones prior to failure. It has been suggested that the feature also controls the dependence of the adhesive bond G(sub IC) on bond thickness. The proposed explanation asserted that the physical constraint of the adherends and the nature of the crack-tip stress field in an adhesive joint alter the size and shape of the deformation zone, and this in turn changes the fracture behavior, i.e. smaller zones giving lower G(sub IC)'s. To examine the hypothesis, motion pictures were taken of fracture specimens during loading, and the stress whitening that occurred at the crack tip was used to judge the relative dimensions of the deformation zone. The experiments were conducted for bulk samples and bonded joints of different bond thicknesses. The results generally support the hypothesis that the variations in adhesive G(sub IC) as a function of bond thickness can be directly correlated with changes in the size of the deformation zone. Moreover, the movies furnish a clear picture of the deformation zone's growth patterns during loading, and this provides a critical test for future modelling efforts.

001,123
PB90-261124 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Micromechanics of Fracture in Structural Adhesive Bonds.
 Final rept.
 D. L. Hunston, A. J. Kinloch, and S. S. Wang. 1987, 11p
 Pub. in Proceedings of International SAMPE (Society for the Advancement of Material and Process Engineers) Technical Conference on the Nation's Future Material Needs (19th), Crystal City, VA., October 13-15, 1987, p142-151.

Keywords: *Adhesion, *Construction joints, *Epoxy resins, Adhesive bonding, Surface energy, Crack propagation, Deformation, Toughness, Stress analysis, Bonded joints, Fracture strength, Motion pictures, Reprints, Fracture mechanics, Micromechanics.

The high mode-I fracture surface energies, G(sub IC), of structural adhesives can be attributed to their ability to form large crack-tip deformation zones prior to failure. It has been suggested that the feature also controls the dependence of the adhesive bond G(sub IC) on bond thickness. The proposed explanation asserted that the physical constraint of the adherends and the nature of the crack-tip stress field in an adhesive joint alter the size and shape of the deformation zone, and this in turn changes the fracture behavior, i.e. smaller zones giving lower G(sub IC)'s. To examine the hypothesis, motion pictures were taken of fracture specimens during loading, and the stress whitening that occurred at the crack tip was used to judge the relative dimensions of the deformation zone. The experiments were conducted for bulk samples and bonded joints of different bond thicknesses. The results generally support the hypothesis that the variations in adhesive G(sub IC) as a function of bond thickness can be directly correlated with changes in the size of the deformation zone. Moreover, the movies furnish a clear picture of the deformation zone's growth patterns during loading, and this provides a critical test for future modelling efforts.

Carbon & Graphite

Carbon & Graphite

001,124
PB90-271263 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Thermophysics Div.
Measurement of the Radiance Temperature (at 655 nm) of Melting Graphite Near Its Triple Point by a Pulse-Heating Technique.
 Final rept.
 A. Cezairliyan, and A. P. Millier. 1990, 9p
 Sponsored by Air Force Office of Scientific Research,
 Bolling AFB, DC.
 Pub. in International Jnl. of Thermophysics 11, n4
 p643-651 Jul 90.

Keywords: *Graphite, *Blackbody radiation, *Refractory materials, Melting point, Temperature measurement, Thermophysical properties, Brightness, Radiance, High temperature tests, Pulse heating, Surface temperature, Reprints, Triple point.

Measurements of the radiance temperature of graphite at 655 nm have been performed in the vicinity of its triple point by means of a rapid pulse-heating technique. The method is based on resistively heating the specimen in a pressurized gas environment from room temperature to its melting point in less than 20 ms by passing an electrical current pulse through it and simultaneously measuring the radiance temperature of the specimen surface every 120 microseconds by means of a high-speed pyrometer. Results of experiments performed on two different grades of POCO graphite (AXM-5Q1 and DFP-1) at gas pressures of 14 and 20 MPa are in good agreement and yield a value of 4330 + or - 50 K for the radiance (or brightness) temperature (at 655 nm) of melting graphite near its triple point (triple-point pressure, approximately 10 MPa). An estimate of the true (black-body) temperature at the triple point is made on the basis of the result and literature data on the normal spectral emittance of graphite.

Ceramics, Refractories, & Glass

001,125
AD-A217 752/5 PC A11/MF A02
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
Strength and Microstructure of Ceramics.
 Final technical rept. 87-89.
 B. R. Lawn, C. J. Alpert, and S. J. Bennison. Nov 89,
 243p AFOSR-TR-90-0013
 Grants AFOSR-ISSA-87-0034, AFOSR-ISSA-88-0005

Keywords: *Aluminum oxides, Brittleness, *Ceramic materials, Control, *Crack propagation, Cracks, Fatigue tests(Mechanics), Fracture(Mechanics), Heat treatment, Interfaces, Mechanical properties, *Microstructure, Mathematical models, Optimization, Predictions, Processing, Resistance, Sizes(Dimensions), Strength(Mechanics), Test and evaluation, Theory, Toughness, Wear, Monophase ceramics, Toughening.

Results of a study program on the toughness properties of monophase ceramics are summarized. In situ observations of crack propagation in alumina and other monophase ceramics show crack interface bridging to be the principal source of increasing toughness with crack size, i.e. R-curve behavior. Fracture mechanics models describing this behavior, in the particular context of strength, are developed. Results of strengths tests confirming the essential predictions of the theory are presented. Results of wear and fatigue tests are also described. The model has strong implications concerning the controlled processing of ceramics for optimum toughness and strength properties. Keywords: Strength mechanics; Fracture resistance; Brittleness; Heat treatment; Toughening; Mechanical properties. (EDC)

001,126
PB90-136383 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
Ceramic Heat Exchangers.
 Final rept.
 S. J. Dapkunas. 1988, 4p
 Pub. in American Ceramic Society Bulletin 67, n2
 p388-391 Feb 88.

Keywords: *Ceramics, *Heat exchangers, Design, Corrosion resistance, Mechanical properties, Manufacturing.

Ceramic heat exchangers have been developed to take advantage of the corrosion resistance and mechanical properties ceramics exhibit at elevated temperatures. A review of the current and projected application of ceramic heat exchangers is presented together with an assessment of design, manufacturing, and material properties pertinent to their usage.

001,127
PB90-136896 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
NIST's (National Institute of Standards and Technology) Ultra-Clean Ceramic Processing Laboratory.
 Final rept.
 J. E. Blendell. 1989, 1p
 Pub. in Jnl. of Metals 41, n1 p53 1989.

Keywords: *Laboratories, *Ceramics, *Process control, *Clean rooms, Controlled atmospheres, Test facilities, Powder(Particles), Impurities, Additives, Test equipment, Electronics, Impurities, Reprints, *National Institute of Standards and Technology.

An ultraclean ceramic processing laboratory has been designed and constructed at the National Institute of Standards and Technology (NIST). This facility is currently being used to produce powders and ceramic samples with controlled levels of impurities and dopants. The laboratory contains a variety of equipment for ceramic powder processing. Included are: a rotary evaporator for drying solutions with minimum agglomeration, a Class 100 drying oven (300 deg C maximum temperature) that can be purged and used in an inert atmosphere, an electronic balance (0.01 mg sensitivity), an ultra-sonic disrupter for solution deagglomeration, a 12-ton press for sample compaction, and two controlled atmosphere furnaces (900 and 1,700 deg C maximum temperatures, respectively). NIST's Ultra-Clean Ceramic Processing Laboratory is available to industrial and academic researchers for cooperative research programs. It is also available for short-term proprietary research.

001,128
PB90-150095 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
Role of Interfacial Grain-Bridging Sliding Friction in the Crack-Resistance and Strength Properties of Nontransforming Ceramics.
 Final rept.
 S. J. Bennison, and B. R. Lawn. 1989, 13p
 Sponsored by Air Force Office of Scientific Research,
 Arlington, VA.
 Pub. in Acta Metallurgica 37, n10 p2659-2671 1989.

Keywords: *Grain boundaries, *Sliding friction, *Crack propagation, *Toughness, *Ceramics, Interfaces, Aluminum oxide, Mathematical models, Residual stress, Impact strength, Indentation, Microstructure, Reprints, Fracture mechanics.

A grain-bridging model of crack-resistance or toughness (R-curve or T-curve) properties of nontransforming ceramics is developed. A key new feature of the fracture mechanics treatment is the inclusion of internal residual (thermal expansion mismatch) stresses in the constitutive stress-separation relation for pullout of interlocking grains from an embedding matrix. By providing a physical account of the underlying micromechanics of the bridging process the analysis allows for predetermination of the material factors in the constitutive relation, thereby reducing parametric adjustments necessary in fitting the theoretical toughness curve to experimental data. The applicability of the model is illustrated in a case study on indentation-strength data for a 'reference' polycrystalline alumina with particularly strong T-curve characteristics. From theoretical fits to the data the constitutive relation, and thence the entire T-curve, can be deconvoluted. The 'parametric calibration', apart from demonstrating the plausibility of the model, allows for quantitative predictions as to how the toughness and strength characteristics of ceramics depend on such microstructural variables as grain size and shape, grain boundary energy, level of internal stress and sliding friction coefficient.

001,129
PB90-152646 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Design of High Strength Cement-Based Materials. Part 3. State of the Art.
 Final rept.
 H. M. Jennings. 1988, 10p
 Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.
 Pub. in Materials Science and Technology 4, n4 p291-300 Apr 88.

Keywords: *High strength concretes, *Cements, *Design, Construction materials, Microstructure, Reprints, State of the art, Fracture mechanics.

The third part of a three-part series on high strength cement-based materials describes some of the new materials that are used both for construction and for highly specialized small scale application. As far as possible explanations for improved properties are based on the microstructure and fracture mechanics of the material.

001,130
PB90-152653 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Design of High Strength Cement-Based Materials. Part 1. Fracture Mechanics.
 Final rept.
 H. M. Jennings. 1988, 8p
 Sponsored by Air Force Engineering and Services Center, Tyndall AFB, FL.
 Pub. in Materials Science and Technology 4, n4 p277-284 Apr 88.

Keywords: *High strength concretes, *Design, *Cements, Construction materials, Reprints, Fracture mechanics.

The first of three articles describes aspects of high strength cement-based materials with a view towards establishing relationships between microstructure and properties. Part I describes aspects of the theory.

001,131
PB90-152679 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Ceramics Div.
Cyclic Fatigue Behavior of an Alumina Ceramic with Crack-Resistance Characteristics.
 Final rept.
 S. Lathabai, Y. W. Mai, and B. R. Lawn. 1989, 4p
 Pub. in Jnl. of the American Ceramic Society 72, n9
 p1760-1763 1989.

Keywords: *Cyclic loads, *Fatigue life, *Aluminum oxide, *Ceramics, *Crack propagation, Bridging, Reprints.

The behavior under cyclic tension-tension loading of an alumina ceramic with pronounced crack-bridging (R-curve) characteristics is studied. Tests on disk specimens with indentation cracks reveal no failures below the static fatigue limit. Theoretical predictions of the stress-lifetime response, based on the premise that environmentally assisted slow crack growth is the sole factor determining lifetime, are consistent (within experimental scatter) with the data. The results indicate that there is no significant cyclic degradation from potential damage to the bridges, at least in the short-crack region pertinent to strength properties.

001,132
PB90-152786 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Failure of Fused Silica Fibers with Subthreshold Flaws.
 Final rept.
 K. Jakus, J. E. Ritter, S. R. Choi, T. Lardner, and B. R. Lawn. 1988, 6p
 Sponsored by Office of Naval Research, Arlington, VA.
 Pub. in Jnl. of Non-Crystalline Solids 102, n1-3 p82-87 1988.

Keywords: *Glass fibers, *Silicon dioxide, *Failure, *Silica glass, Vickers hardness, Defects, Residual stress, Reliability, Indentation hardness tests, Reprints, Fracture mechanics.

It is well established that subthreshold Vickers indentations closely simulate the response of naturally occurring flaws in high quality glass fibers. Accordingly, the inert strength of bare fused silica fibers with Vickers

ers subthreshold flaws is studied as a function of indentation load. The strengths are significantly higher than the strengths predicted by simple extrapolation of data from postthreshold indentation flaws. A simplistic fracture mechanics model, incorporating residual stresses associated with the contact impression is developed to explain the results. The residual contact stresses are shown to control the flaw instability. The model gives relations for the subthreshold inert strength as a function of load and for the threshold indentation size. The relations are shown to be consistent with both present and earlier silica glass data.

001,133
PB90-152836 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Laser-Induced Vaporization Mass Spectrometry of Refractory Materials: Apparatus and the BN System.

Final rept.
J. W. Hastie, D. W. Bonnell, and P. K. Schenck. 1988, 26p
Pub. in High Temperature Science 25, n2 p117-142 Apr 88.

Keywords: *Vaporizing, *Mass spectrometry, *Refractory materials, Equipment, *Boron nitrides, Thermochemistry, High temperature tests, Thermodynamic equilibrium, Gas sampling, High pressure tests, Reprints, *Laser heating.

Thermochemical vaporization data for refractory materials at temperatures beyond about 2000 K are virtually non-existent. Such data are especially lacking under conditions where the gas or vapor pressure exceeds the experimental collision-free regime of about 10(sup-4) atm. The main measurement limitations of material containment, temperature attainment and control, gas-dynamic sampling, and species specificity can, in principle, be overcome through a coupling of laser vaporization with high temperature, high pressure-sampling mass spectrometry. Such a coupled approach has been developed and demonstrated on the BN system at temperatures around 2900 K and pressures in the vicinity of an atmosphere. The results obtained support the extrapolation of the thermodynamic functions provided by the JANAF Thermochemical Tables for the observed vapor species, BN, B₂, B₃, and N₂, referenced to BN solid. The species also appear to be in local thermodynamic equilibrium, even for relatively short laser pulse times of 7 ns. However, no evidence was found for the expected equilibrium phase of liquid boron. As a consequence, the decomposition temperature of BN appears to be much higher under the rapid laser heating conditions used than the JANAF prediction for a completely equilibrated system.

001,134
PB90-153438 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Effects of Chemical Inhomogeneities on Grain Growth and Microstructure in Al(sub 2)O(sub 3).

Final rept.
C. A. Handwerker, P. A. Morris, and R. L. Coble. 1989, 7p
Pub. in Jnl. of the American Ceramic Society 72, n1 p130-136 1989.

Keywords: *Grain growth, *Microstructure, *Aluminum oxide, Single crystals, Crystal defects, Heterogeneity, Impurities, Magnesium oxides, Additives, Sintering, Ceramics, Chemical composition, Clean rooms, Concentration(Composition), Grain boundaries, Calcium, Solubility, Silicon, Gradients, Reprints, Scanning electron microscopy, Doped materials.

Effects of chemical inhomogeneities and single crystal seeds on grain normal and discontinuous grain growth were investigated in both undoped and MgO-doped Al₂O₃. The chemical impurities in the samples were evolved at a lower temperature than the sintering temperature and measured by SEM/EDS to determine the correlation between the distribution of impurity and the microstructure in Al₂O₃. A feature of the study was the use of clean room processing and firing procedures to maintain sample composition. As the local concentrations of chemical impurities (i.e., Si, Ca) increased, the grain boundary-grain boundary dihedral angle distribution widened, with many angles of 180 degrees, the grain-size distribution widened, and pore-boundary separation was enhanced. Discontinuous grain growth was observed in regions of undoped Al₂O₃ containing the largest Ca and Si concentrations. It is suggested that doping with MgO solute reduces

the effects of impurities on grain growth by increasing the bulk solubility of impurities, especially Si, and by narrowing the distribution of grain boundary-grain boundary dihedral angles.

001,135
PB90-153503 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Ceramic Thermochemistry and Kinetics from Laser-Induced Vaporization Mass Spectrometry.

Final rept.
J. W. Hastie, D. W. Bonnell, and P. K. Schenck. 1987, 1p
Pub. in Jnl. of the Electrochemical Society 134, n8B pC470 1987.

Keywords: *Mass spectrometry, *Ceramics, *Thermochemistry, *Vaporizing, *Kinetics, *Laser beams, Graphite, Boron nitrides, Thermodynamic equilibrium, Reprints, Pulsed lasers, Laser heating.

Use of high powered pulsed lasers as a heat source, together with time-resolved mass spectrometric detection, for ceramic vaporization studies is described. Two example cases, graphite at temperatures in the region of 4100 K and boron nitride at 2900 K are considered in detail. In both cases, the total species pressures were found to be in the region of an atmosphere. Under conditions where post-vaporization modifications, such as cluster formation and photolysis are essentially absent, the species distributions agree with a local equilibrium model using the JANAF thermodynamic functions. Measured velocity distribution profiles are used to determine the significance of electron impact fragmentation, impurities, and plume-expansion dynamics on the results.

001,136
PB90-163254 PC A05/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Determination of Fiber/Matrix Interfacial Properties of Ceramic and Glass Matrix Composites.

Interim rept. 1 Jan 86-1 Jan 88.
D. C. Cranmer. Feb 90, 76p NISTIR-89/4079
Contracts N00014-86-F-0096, N00014-C-0096
Sponsored by Strategic Defense Initiative Organization, Washington, DC. Innovative Science and Technology.

Keywords: *Ceramics, *Borosilicate glass, Crack propagation, Surface properties, Silicon carbides, Toughness, Compression tests, Indentation, *Matrix materials, *Ceramic matrix composites, *Fiber reinforced composites, *Interface stability.

The work described is primarily related to the development and use of several techniques for determining the fiber/matrix interfacial properties of ceramic and glass matrix composites. The specific techniques utilized are the double cleavage drilled compression (DCDC), indentation push-in, indentation push-out, and single fiber pull-out tests. The DCDC test provides direct experimental observation of the crack-fiber interactions. The indentation techniques and the pull-out test provide information on the debond strength of the fibers from the matrix and interfacial frictional stress required to pull the fibers out of the matrix. The emphasis has been on understanding what happens at the interface, and has focused on several model systems including SiC monofilament reinforced glasses (borosilicate, soda-lime-silica), and SiC fiber reinforced glass-ceramic. Measurements have been made of the interface properties as well as on the increase in toughness as a crack approaches the reinforcing fibers. Some of the effects of interface chemistry on the properties have also been considered.

001,137
PB90-163981 PC A08/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Institute for Materials Science and Engineering, Ceramics: Technical Activities 1989.

S. M. Hsu, and S. J. Dapkunas. Dec 89, 156p
NISTIR-89/4148
See also report for 1988, PB89-148381.

Keywords: *Research management, *Ceramics, Powder(Particles), Cost engineering, Wear, Superconductivity, Thin films, Diamonds, Optical materials, Electronics, Graphs(Charts), *National Institute of Standards and Technology.

The primary impediments to the growth of the advanced ceramics industry are lack of reliability and

high cost of ceramic components and devices. Fine powders from which advanced ceramics are made are crucial in determining the cost and final properties of a product. For this reason, the Division has developed a strong capability in the synthesis, characterization and processing of powders. Improvements in the reliability of advanced ceramics, whether for structural or functional applications, require a mechanistic understanding of the modes of failure to which a ceramic is susceptible. To further the impact in this area the Division has focused their efforts on the understanding of microstructural features which control brittle fracture and high temperature creep. Efforts in the functional ceramic field have included, for electronic applications, the continuation of processing-property studies on piezoelectric materials as well as a major effort on high T (sub c) superconducting ceramics. The microstructural features which limit the application of high temperature superconductors have been addressed as part of the NIST superconductivity initiative. Research in the optical materials area has included the development of techniques of deposition and analysis of diamond films which are expected to find application as protective coatings on a variety of detector windows.

001,138
PB90-170093 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Porosity in Spinel Compacts Using Small-Angle Neutron Scattering.

Final rept.
K. G. Frase, and K. A. Hardman-Rhyne. 1988, 16p
Pub. in Jnl. of the American Ceramic Society 71, n1 p1-16 Jan 88.

Keywords: *Spinel, *Porosity, *Neutron scattering, *Compacting, *Sintering, Densification, Agglomerates, Voids, Nondestructive tests, Green strength, Reprints.

Unfired Spinel (MgAl₂O₄) compacts and sintered materials with small hard agglomerates (<5 micrometers) were studied using small angle neutron scattering (SANS) techniques. The SANS results were compared with those from mercury porosimetry and gas adsorption. The results from green state samples are consistent with interconnected 'ink-bottle' type porosity. In the latter stages of densification the average void size is significantly larger than that found in the unfired compact. The presence of the hard agglomerates affect the observed SANS scattering much more in the partially densified samples than in the unfired compacts. It is demonstrated that the use of multiple SANS techniques to study large voids (>0.1 micrometers) and large pore fractions (45%) is a sensitive, nondestructive diagnostic probe for the evaluation of porosity during sintering.

001,139
PB90-170119 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Photoelastic Characteristics of Fluorozirconate and Transition-Metal Fluoride Glasses.

Final rept.
A. Feldman, E. Fuller, B. Bendow, and K. Levin. 1987, 4p
Pub. in Materials Science Forum 19-20, pt2 p681-684 1987.

Keywords: *Photoelasticity, *Glass, *Transition metals, Piezoelectric materials, Stress analysis, Birefringence, Reprints, *Metallic glasses, *Fluorozirconate glass, *Fluoride glass.

All of the piezo-optic coefficients of two fluorozirconate glasses and the coefficient for stress-induced birefringence of a heavy metal fluoride glass have been determined. All of the glasses exhibit extremely small coefficients for stress-induced birefringence.

001,140
PB90-170267 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Neutron Powder Diffraction Study of Orthorhombic Ba(sub 2)YCu(sub 3)O(sub 6.5).

Final rept.
S. Miraglia, F. Beech, A. Santoro, D. Tran Qui, and S. A. Sunshine. 1987, 8p
Pub. in Materials Research Bulletin 22, n12 p1733-1740 Dec 87.

Ceramics, Refractories, & Glass

Keywords: *Neutron diffraction, *Powder(Particles), *Orthorhombic lattices, *Barium oxides, *Yttrium oxides, *Copper oxides, *Crystal structure, Reprints.

The structure of orthorhombic Ba₂YCu₃O_{6.5} has been refined with neutron diffraction profile analysis. The space group of the compound is Pmmm, and the lattice parameters are a = 3.8468(1), b = 3.8747(1), and c = 11.7466(5) Å. The oxygen sites at (0,0,z), (1/2,0,z), and (0,1/2,z) are fully occupied, while the sites at (0,1/2,0) are 50% full and the sites at (1/2,0,0) are vacant. A comparison of bond distances in this sample and in other compositions in the system Ba₂YCu₃O (6.0 < or = delta < or = 7.0) shows that the environment of the Ba atoms and of the Cu atoms at (0,0,0) and (0,0,z) change significantly with the amount of oxygen in the unit cell.

001,141
PB90-170317 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Theory of Chemically Induced Kink Formation on Cracks in Silica. 2. Force Law Calculations.
 Final rept.
 K. Masuda-Jindo, V. K. Tewary, and R. M. Thomson. 1987, 7p
 Pub. in Jnl. of Materials Research 2, n5 p631-637 Sep/Oct 87.

Keywords: *Silicon dioxide, *Ceramics, *Crack propagation, *Chemical reactions, Mathematical models, Hydrolysis, Computation, Loads(Forces), Chemical bonds, Molecular orbitals, Reprints, *Fracture mechanics, *Lines of force.

The paper is the second of a pair on a theory of chemically assisted fracture. In it, a simple bond orbital model of the force laws to be used in fracture is developed. In the bond orbital model, only a few of the atoms in the vicinity of the bond to be broken are considered. Interactions with the rest of the system, which is assumed to be Newtonian, are not included. Numerical accuracy is not required, but qualitative features of the force laws are believed to be valid. The silica bond is shown to rise quickly to a high peak, after which it develops a relatively long tail. When the bond is attacked by water, modeling by the same technique indicates that the bond has a 'snapping' characteristic which is important in the theory developed in the first paper. For bonds with smooth 'back sides' the barriers to crack motion are shown to be low, but barriers are expected to be observable when the bond snaps. A tight binding treatment of a one dimensional chain has also been included to investigate the effect of including band effects in the force law. The effects are found to be small compared to the simple bond breaking of the bond orbital calculation.

001,142
PB90-188418 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD.
Chosun Refractories Co. Ltd.
 Final rept.
 S. J. Schneider. 1988, 1p
 Pub. in Ceramic Bulletin 67, n9 p1552 1988.

Keywords: *Ceramics, *Refractory metals, *Refractories, Metal working, Foundry practice, Korea, Reprints, *Chosun Refractories Co Ltd.

A delegation from the American Ceramic Society visited a major plant of the Chosun Refractories Co., founded in 1947 and located in Pohang, Korea. The company operates four production plants and a research center. The company's product lines serve Korea's metal commodity producers of iron, steel, aluminum, and copper, as well as the cement and glass industries. The research center functions as both a quality-control laboratory and a product-development facility.

001,143
PB90-192543 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Phase Equilibria and Crystal Chemistry in the System Ba-Y-Cu-O.
 Final rept.
 R. S. Roth, K. L. Davis, and J. R. Dennis. 1987, 10p
 Pub. in Advanced Ceramic Materials 2, n3B p303-312 1987.

Keywords: *Crystal structure, *Yttrium oxides, *Barium oxides, *Copper oxides, Superconductivity, Melting, X

ray diffraction, Chemical equilibrium, Phase diagrams, Ceramics, Reprints, High temperature superconductors, Yttrium barium cuprates, Barium yttrium cuprates.

Preliminary phase equilibria diagrams are constructed for the 'binary' systems BaO-0.5Y₂O₃, BaO-CuOx, 0.5Y₂O₃-CuOx and the 'ternary' system BaO-0.5Y₂O₃-CuOx. Some melting data are used to outline an approximate primary field for the phase responsible for high temperature superconductivity in the system, Ba₂YCu₃O(7-x). A discussion is given of the crystal chemistry of the phases(s) near the composition Ba₃YCu₂Ox.

001,144
PB90-192550 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Phase Diagrams for Ceramists Volume 6.
 Final rept.
 R. S. Roth, J. R. Dennis, and H. F. McMurdie. 1987, 515p
 Sponsored by American Ceramic Society, Inc., Westerville, OH.
 Pub. in Phase Diagrams for Ceramists Volume 6, 515p 1987.

Keywords: *Ceramics, *Phase diagrams, Oxides, Reviews, Reprints.

The volume supplements the five previous collections entitled 'Phase diagrams for ceramists.' The sixth compilation contains 697 commentaries and 1084 diagrams on oxides, mainly from literature published since 1975. Approximately 5,000 references, known to contain ceramic phase diagrams and published between 1975 and 1983, were collected by the staff of the Ceramics Division at the National Bureau of Standards. The diagrams pertaining to oxide systems were segregated for publication in the current volume, and the chemical systems assigned. The large number of diagrams, and the length of the commentaries, prevented the inclusion of all diagrams of appropriate chemistry in the current volume. Those which are not included will be published in future volumes.

001,145
PB90-193285 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD.
Theory of Chemically Induced Kink Formation on Cracks in Silica. I. 3-D Crack Green's Functions.
 Final rept.
 R. M. Thomson, V. K. Tewary, and K. Masuda-Jindo. 1987, 12p
 Pub. in Jnl. of Materials Research 2, n5 p619-630 Sep/Oct 87.

Keywords: *Silicon dioxide, *Chemical attack, *Crack propagation, Greens function, Activation energy, Atomic energy levels, Water, Corrosion, Atomic theory, Reprints, Fracture mechanics.

The paper is the first of a pair on a theory of chemically assisted fracture. It includes the Green's function analysis for a three dimensional crack with a kink on it. Equations are developed for the activation energy for the motion and nucleation of such kinks using information to be found in the second paper regarding the force laws appropriate for water attack of silica. The most general conclusion is that lattice trapping barriers to crack motion (including chemical effects) are associated with a narrow core region of the crack, which is in turn connected to the nature of the interatomic force laws of the material (including modifications of the force laws induced by chemical reactions). Further, it was found that the force law must have a severely 'snapping' characteristic in order to assure a narrow core, a feature not to be expected except under certain types of external chemical attack of the crack. Additional results are that the energy to nucleate a kink pair in silica under water attack is in the neighborhood of 2 ev., and that the motion energy is of order 0.01 ev. Motion energies are expected to be considerably smaller than formation energies, in general.

001,146
PB90-193319 Not available NTIS
 National Bureau of Standards, Gaithersburg, MD. Ceramics Div.
Corrosion Reactions in SiC Ceramics.
 Final rept.
 N. J. Tighe, J. Sun, and R. M. Hu. 1987, 7p
 Contract DE-AI05-85OR21569
 Sponsored by Department of Energy, Oak Ridge, TN.

Pub. in Ceramic Engineering and Science Proceedings 8, n7-8 p805-811 Jul/Aug 87.

Keywords: *Corrosion, *Chemical reactions, *Silicon carbides, Ceramics, Surface chemistry, Sodium carbonates, Fused salts, Thin films, Interfaces, Silicon dioxide, Silica glass, Foils(Materials), Reprints, Scanning electron microscopy, Transmission electron microscopy.

Corrosion reactions between SiC ceramics and molten sodium carbonate were studied using analytical scanning transmission electron microscopy. Thin film studies were used to identify interfacial reactions and compositions of corrosion scales. Thin foils were made from SiC samples before and after corrosion in Na₂CO₃ at 1000 C for exposure times of 5 min to 48 h. Sodium silicate glass and clusters of silica platelets were found near the corrosion interfaces.

001,147
PB90-193566 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Damage Enhanced Creep in a Siliconized Carbide: Phenomenology.
 Final rept.
 S. M. Wiederhorn, D. E. Roberts, T. J. Chuang, and L. Chuck. 1988, 7p
 Contract DE-AI05-85OR21569
 Sponsored by Department of Energy, Oak Ridge, TN.
 Pub. in Jnl. of the American Ceramic Society 71, n7 p602-608 Jul 88.

Keywords: *Silicon carbides, *Creep properties, Damage, Cavitation, Tension, Stress analysis, Ceramics, Reprints, Reaction bonding, Compression.

The creep behavior of a commercial grade of reaction bonded silicon carbide was characterized at a temperature of 1300 C. Creep occurred more easily in tension than in compression. At a given applied stress, the steady state creep rate in tension was found to be at least twenty times that obtained in compression. In both tension and compression, the stress exponent for steady state creep was found to increase with increasing applied stresses. At low applied stresses, the stress exponent was approximately equal to 4, suggesting some kind of dislocation mechanisms are operating in the two-phase composite. At high stresses, the stress exponent was approximately equal to 11. In tension, the increase in the stress exponent was attributed to damage accumulation in the form of cavities. An effective threshold stress for cavitation of less than 100 MPa was suggested. In compression, however, the cause of the increase of stress exponent with stress cannot be attributed to cavitation. A simple mechanistic model is proposed which is capable of describing all major features of the asymmetric creep.

001,148
PB90-205774 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Is Y(sub 1)Ba(sub 2)Cu(sub 3)O(sub 7) Stiff or Soft.
 Final rept.
 H. Ledbetter, and M. Lei. 1990, 4p
 Pub. in Jnl. of Materials Research 5, n2 p241-244 Feb 90.

Keywords: *Yttrium oxides, *Barium oxides, *Superconductors, X ray diffraction, Bulk modulus, Elastic properties, Compressibility, High pressure tests, Ceramics, Transition temperature, Barium titanates, Strontium titanates, Reprints, *Cuprates.

Using several measured and calculated physical properties, it is argued that the high-Tc metal-oxide superconductor Y₁Ba₂Cu₃O₇ is elastically soft compared with BaTiO₃ or SrTiO₃. It is concluded that the bulk modulus equals approximately 107 GPa, despite several high-pressure x-ray diffraction studies that report values up to approximately 200 GPa. Part of the argument uses an ionic-crystal-model calculation of the bulk modulus.

001,149
PB90-206061 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

X-ray Powder Characterization of Ba(sub 2)YCu(sub 3)O(sub 7-x).

Final rept.
W. Wong-Ng, R. S. Roth, L. J. Swartzendruber, L. H. Bennett, C. K. Chiang, F. Beech, and C. R. Hubbard. 1987, 12p
Pub. in *Advanced Ceramic Materials* 2, n3B p565-576 1987.

Keywords: *Barium oxides, *Yttrium oxides, *Superconductors, X ray diffraction, Transition temperature, Powder(Particles), Ceramics, Lattice parameters, Oxygen, Reprints, *Cuprates, High temperature, Characterization, Diffraction patterns.

X-ray powder diffraction technique has been used to characterize the high T_c superconductor phase Ba₂YCu₃O₇ at different oxygen content and were prepared under different conditions. High quality reference powder patterns for three compositions are presented. An attempt to correlate the differences of lattice parameters with oxygen contents and superconductivity will be described.

001,150
PB90-206079 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

X-ray Powder Study of 2BaO:CuO.

Final rept.
W. Wong-Ng, K. L. Davis, and R. S. Roth. 1988, 4p
Pub. in *Jnl. of the American Ceramic Society* 71, n2 pC64-C67 1988.

Keywords: *Barium oxides, X ray diffraction, Phase diagrams, Chemical equilibrium, Lattice parameters, Strontium, Calcium, Crystal symmetry, Ceramics, Reprints, *Cuprates, Synthesis(Chemistry), Diffraction patterns.

A compound of composition 2BaO:CuO was synthesized during the phase equilibria study of the BaO-Y₂O₃-CuOx system. Phase characterization has been carried out by using X-ray powder diffraction. The crystal symmetry was found to be compatible with that of Ca₂CuO₃ and Sr₂CuO₃. It is orthorhombic with space group Immm and lattice parameters a = 12.9655(14), b = 4.1007(3), c = 3.9069(5) Å, V = 207.72(3) Å³. The experimental pattern shows good agreement, in general, with the intensity values calculated by assuming it to be isostructural with Sr₂CuO₃. Some intensity discrepancy for the HOO reflections might be due to preferred orientation.

001,151
PB90-206152 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

X-ray Study of the Barium Oxide-Yttrium Sesquioxide-Copper Oxide (CuOx) System.

Final rept.
W. Wong-Ng, R. S. Roth, F. Beech, and K. L. Davis. 1988, 12p
Pub. in *Advances in X-ray Analysis* 31, p359-370 1988.

Keywords: *Barium oxides, *Yttrium oxides, *Superconductors, X ray analysis, Phase diagrams, Chemical equilibrium, Lattice parameters, Crystal symmetry, Ceramics, Reprints, *Cuprates, High temperature, Diffraction patterns.

Ten compounds are found in the BaO-Y₂O₃-CuOx system. High temperature (approximately 950-1000 C) phases identified as Ba₄Y₂O₇, Ba₂Y₂O₅, Ba₃Y₄O₉, BaY₂O₄, Y₂Cu₂O₅, BaCuO(2+x), Ba₃YCu₂O_z, Ba₂YCuO₅ and Ba₂YCu₃O(6+x) are formed in the temperature range. In addition, a new compound with composition of 2BaO:CuO, which possibly has a melting point below 950 C, was prepared at 940 C. A summary of the crystallographic data of the 10 phases is given. In particular, results of x-ray studies pertaining to four compounds, Ba₂YCu₃O(6+x), which is currently the most promising high T_c superconductor material, Ba₂CuO₃, Ba₂Y₂O₅, and Ba₃YCu₂O_z are reviewed.

001,152
PB90-206160 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Standard X-ray Diffraction Powder Patterns of Fifteen Ceramic Phases.

Final rept.
W. Wong-Ng, H. F. McMurdie, B. Paretzkin, M. A. Kuchinski, and A. L. Dragoo. 1989, 16p
Sponsored by JCPDS-International Centre for Diffraction Data, Swarthmore, PA.

Pub. in *Powder Diffraction*, 4, n2 p106-121 1989.

Keywords: *Ceramics, Standards, X ray diffraction, Powder(Particles), Phase diagrams, Borides, Silicides, Oxides, Crystal symmetry, Lattice parameters, Reprints, Synthesis(Chemistry), Diffraction patterns.

Fifteen high quality x-ray powder diffraction standard reference patterns are presented. The phases of study are advanced ceramic phases of borides, silicides and oxides. The powder patterns were obtained by using an automated x-ray diffractometer, calibrated with internal standards and analyzed with internationally recognized procedures. The reported data include crystal data, density, d-spacings, relative intensities, figures-of-merit and information concerning preparation and chemistry, purity and color of sample. Literature references are also included.

001,153
PB90-206178 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Standard X-ray Diffraction Powder Patterns of Sixteen Ceramic Phases.

Quarterly rept.
W. Wong-Ng, H. F. McMurdie, B. Paretzkin, Y. Zhang, K. L. Davis, C. R. Hubbard, A. L. Dragoo, and J. M. Stewart. 1987, 11p
Sponsored by JCPDS-International Centre for Diffraction Data, Swarthmore, PA.
Pub. in *Powder Diffraction*, 2, n3 p191-201 1987.

Keywords: *Ceramics, X ray diffraction, Standards, Powder(Particles), Borides, Silicides, Oxides, Crystal symmetry, Lattice parameters, Phase diagrams, Reprints, Diffraction patterns.

Sixteen high quality x-ray powder diffraction standard reference patterns are presented. The phases of study are advanced ceramic phases of borides, silicides and oxides. The powder patterns were obtained by using an automated x-ray diffractometer calibrated with internal standards and analyzed with internationally recognized procedures. The reported data include crystal data, density, d-spacings, relative intensities, figures-of-merit and information concerning preparation and chemistry, purity and color of sample. Literature references are also included.

001,154
PB90-206186 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Standard X-ray Diffraction Powder Patterns of Fifteen Ceramic Phases.

Quarterly rept.
W. Wong-Ng, H. F. McMurdie, B. Paretzkin, Y. Zhang, C. R. Hubbard, A. L. Dragoo, and J. M. Stewart. 1988, 10p
Sponsored by JCPDS-International Centre for Diffraction Data, Swarthmore, PA.
Pub. in *Powder Diffraction*, 3, n1 p47-56 1988.

Keywords: *Ceramics, X ray diffraction, Powder(Particles), Standards, Borides, Silicides, Oxides, Tellurides, Selenides, Crystal symmetry, Lattice parameters, Reprints, Diffraction patterns.

Fifteen high quality x-ray powder diffraction standard reference patterns are presented. The phases of study are advanced ceramic phases of borides, silicides, telluride, selenides and oxides. The powder patterns were obtained by using internationally recognized procedures. The reported data include crystal data, density, d-spacings, relative intensities, figures-of-merit and information concerning preparation and chemistry, purity and color of sample. Literature references are also included.

001,155
PB90-206699 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

X-ray Studies of Helium Quenched Ba(sub 2)YCu(sub 3)O(sub 7-x).

Final rept.
W. Wong-Ng, and L. P. Cook. 1987, 8p
Pub. in *Adv. Ceram. Mater.* 2, n3B p624-631 1987.

Keywords: *Barium oxides, *Yttrium oxides, *Superconductors, Liquid helium, Ceramics, Crystal symmetry, Lattice parameters, X ray diffraction, Powder(Particles), Quenching(Cooling), Reprints, *Cuprates, Temperature dependence.

A series of eleven samples of the superconductor Ba₂YCu₃O₇(8-x) (x approximately equals 0 to 1) were

prepared from a single orthorhombic phase with x approximately equals 0.2 by using a quench furnace annealing at different temperatures. All quenches were carried out into a liquid nitrogen-cooled copper cold well through which helium was passed. Crystallographic data were obtained for the materials by using x-ray powder diffraction method in an attempt to obtain temperature dependence of crystal symmetry and cell volumes.

001,156
PB90-206962 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Low Temperature Chemical Approaches to Superconductive Materials: A Challenge in Chemical Synthesis.

Final rept.
J. J. Ritter. 1988, 6p
Pub. in *Ceram. Trans.* 1, n2 pA79-84 1988.

Keywords: *Superconductors, *Ceramics, Copper oxides, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Synthesis(Chemistry), Precursor.

The synthesis of Ba-Y-Cu oxide ceramic powders is an essential factor in the development of superconductive devices. While the major effort in the superconductor research is supported with powders synthesized by conventional high temperature techniques, the problem of generating precursors to these materials by low temperature routes presents a significant challenge. Results from four different chemical approaches ranging from the precipitation of Y-Ba-Cu hydroxycarbonates to reactions between Y-Ba alkoxides with Cu(OH)₂ are given. All of these systems progress through an intermediate triphasic mixture of BaCO₃, CuO and Y₂O₃ before being converted to YBa₂Cu₃O(6+x) between 800 and 950 deg. Superconductive behavior is measured in each case after annealing the specimens in O₂ at about 600 deg. The benefits of ideal and practical low temperature processing are discussed.

001,157
PB90-215807 PC A04/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Standard Reference Materials: Glasses for Microanalysis: SRM's 1871-1875.

Special pub. (Final).
R. B. Marinenko, D. H. Blackburn, and J. B. Bodkin. Feb 90, 62p NIST/SP-260/112
Also available from Supt. of Docs. as SN003-003-02996-3. Prepared in cooperation with Pennsylvania State Univ., University Park.

Keywords: *Glass, Microanalysis, Vitrification, Homogeneity, Quantitative analysis, Lead glass, Germanium oxides, Phosphate glass, Electron probes, Tables(Data), Silica glass, Barium oxides, Zinc oxides, Borosilicate glass, Lithium, Aluminum, Magnesium, *Standard Reference Materials, Synthesis(Chemistry), Wavelength dispersive analysis.

The preparation, homogeneity tests, and the quantitative analyses of the glasses for microanalysis, SRMs 1871-1875, are described. Each Standard Reference Material (SRM) represents a different glass matrix; they are lead-silicate (SRM 1871), lead-germanate (SRM 1872), barium-zinc silicate (SRM 1873), lithium-aluminum-borate (SRM 1874), and aluminum-magnesium-phosphate (SRM 1875). There are three glasses in each SRM, one composed only of the matrix oxides and the other two having small additions (less than 2%) of several other elements in oxide form.

001,158
PB90-217928 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Building Materials Div.

Quantitative Characterization of the Microstructure of Hardened Tricalcium Silicate Paste Using Computer Image Analysis.

Final rept.
D. P. Bentz, and H. M. Jennings. 1987, 8p
Pub. in *Pore Structure and Construction Materials Properties*, v1 p49-56 1987.

Keywords: *Cements, Calcium silicates, Microstructure, Curing, Computerized simulation, Mathematical models, Construction materials, Phase diagrams, Microporosity, Epoxy resins, Reprints, Tricalcium silicate,

Image analysis, Scanning electron microscopy, Pastes.

Quantitative characterization of the microstructure of cement paste is necessary in relating physical properties to microstructure and verifying simulation models. Such quantification can be achieved using computer image analysis. Digitized images of micrographs of polished sections of epoxy-impregnated hardened tricalcium silicate paste obtained using a SEM backscatter electron detector are divided into four phases (pores, calcium hydroxide, calcium silicate hydrate, and anhydrous material) based on the level of grayness of each phase. Discrete phases (e.g. calcium hydroxide and anhydrous material) traditionally have been characterized by their number, location, and size distribution. Conversely, the numerical description of phases that are continuous across large portions of a micrograph (e.g. pores and calcium silicate hydrate) is much less developed. New techniques are presented for evaluating the connectivity of a complex pore structure and the ability of different sized particles to move through it. The analytical procedures developed here for tricalcium silicate paste should be applicable to other multiphase materials.

001,159
PB90-242264 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Structural Phase Transition Study of Ba₂YCu₃O₇(sub 6+x) in Air.
Final rept.
W. Wong-Ng, L. P. Cook, C. K. Chiang, L. J. Swartzendruber, L. H. Bennett, J. Blendell, and D. Minor. 1988, 8p
Pub. in Jnl. of Materials Research 3, n5 p832-839 Sep/Oct 88.

Keywords: *Ceramics, *Barium oxides, *Yttrium oxides, *Copper oxides, Phase transformations, Quenching(Cooling), Crystal structure, Order disorder transformations, Air, Superconductivity, Orthorhombic lattices, Tetragonal lattices, X-ray diffraction, Liquid helium, Meissner effect, Reprints, Barium yttrium cuprates, Scanning electron microscopy.

A structural phase transition study of Ba₂YCu₃O₇(6+x) (x equals 0 to 1) has been conducted on a series of 13 quenched samples. The samples were prepared from an orthorhombic material by annealing at temperatures from 400 to 1000 C in air, followed by rapid quenching. All quenches were performed by using a liquid nitrogen cooled copper cold well with a continuous flow of cooled helium gas. Various measurements including x-ray diffraction, thermogravimetric analysis, Meissner effect, and scanning electron microscopy were carried out in order to correlate the nature of the phase transition with crystallographic data, superconductivity, and annealing temperature. The phase transition from Ba₂YCu₃O₇ to Ba₂YCu₃O₆ appears to involve two orthorhombic regions: region A with a less than b approximately equals c/3 below approximately 600 C and region B with cell parameters of a less than b less than c/3 from approximately equals 600 to 708-720 C. The transformation from orthorhombic to tetragonal takes place in the temperature range of 708-720 C. The transition appears to be second-order, order-disorder type.

001,160
PB90-271156 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Pressure Sintering and Transformation Toughening of Zinc Sulfide.
Final rept.
S. Block, G. J. Piermarini, V. Bean, and A. Raynes. 1990, 6p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Materials Science and Engineering A127, p99-104 1990.

Keywords: *Sintering, *Ceramics, *Zinc sulfides, *Fracture strength, Toughness, Pressure, Bonding, Phase transformations, Thin films, Diamonds, Hardness, Vapor deposition, Cadmium compounds, Yttrium compounds, Gallium compounds, Phosphides, Selenides, Iodides, Compacting, Nickel compounds, Thallium compounds, Reprints.

Several techniques to increase the fracture toughness of ZnS, including pressure sintering, transformation toughening and pressure bonding to a diamond film, were evaluated. The primary method used was pressure sintering, i.e. room temperature compaction fol-

lowed by sintering at a relatively low temperature (less than Tm/2 where Tm is the melting point). Pressure sintering produces superior ZnS compacts with a hardness of 2.89 GPa and a fracture toughness of 1.59 MPa m^{1/2} compared with 2.17 GPa and 0.87 MPa m^{1/2} for conventionally produced chemical-vapor-deposited material. The hardness and fracture toughness of CdY₂S₄, GaP-doped zinc sulfide and selenide compacts processed by pressure sintering were also evaluated. The mineral form of NiS (millerite) significantly toughens ZnS, but the ZnS-NiS compact is no longer transparent in the infrared region.

001,161
PB90-271651 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Diffraction Study of the 'Brown Phase' BaNd₂CuO₅.
Final rept.
J. K. Stalick, and W. Wong-Ng. 1990, 4p
Sponsored by Electric Power Research Inst., Palo Alto, CA.
Pub. in Materials Letters 9, n10 p401-404 Jun 90.

Keywords: *Crystal structure, *Ceramics, Neutron diffraction, Phase diagrams, Barium oxides, Neodymium oxides, Copper oxides, Yttrium oxides, Lanthanum oxides, Tetragonal lattices, Solid solutions, Reprints.

A neutron Rietveld refinement study of the 'brown phase' BaNd₂CuO₅ shows that the material is isostructural with the La analog, but adopts a totally different structure from that of the 'green phase' BaR₂CuO₅ formed for R=Y and most lanthanide elements. BaNd₂CuO₅ is tetragonal, space group P4/mbm(126), with Z=2 and refined cell parameters a=6.7015(1) and c=5.8211(1)Å. The BaNd₂CuO₅ framework is built from edge- and face-sharing BaO₁₀ and NdO₈ polyhedra, while in the green phase structure the smaller R(sup 3+) ion is surrounded by seven oxygen atoms. The square-planar CuO₄ groups are isolated in the structure.

001,162
PB90-504218 CP D99
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Ceramics Div.
Overview of the Structural Ceramics Database (Release No. 1)(for Microcomputers).
Model-Simulation.
30 Apr 90, 1 diskette NIST/SP-787, NIST/SW/DK-90/013
System: IBM PC and compatibles; MS DOS 2.1 or higher operating system, 640K. Language: Runtime Demo. The software is contained on one 360K, 5 1/4 inch diskette, double density. File format: ASCII. Documentation is on diskette.

Keywords: *Models-simulation, *Software, *Ceramics, *Mechanical properties, *Thermodynamics properties, Silicon carbides, Diskettes, Man computer interface, Interactive systems.

The National Institute of Science and Technology (NIST) Structural Ceramics Database (SCD) is a computerized, user-friendly database of materials properties for advanced ceramics intended for high temperature structural applications. Version 1.0 contains thermal and mechanical property data for silicon carbides and silicon nitrides. A computerized overview of the user-friendly features has developed to illustrate the capability of the SCD and their use in a typical interactive application. The overview allows the user either to participate actively in the overview by pressing the appropriate keys or to view the overview passively as the program proceeds automatically. In either case, the overview is designed to proceed in the correct sequence regardless of what keys the user presses.

001,163
PB91-101147 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Role of Grain Size in the Strength and R-Curve Properties of Alumina.
Final rept.
P. Chantikul, S. J. Bennison, and B. R. Lawn. 1990, 9p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Jnl. of the American Ceramic Society 73, n8 p2419-2427 Aug 90.

Keywords: *Aluminum oxide, *Ceramics, Grain size, Microstructure, Strength, Indentation hardness tests,

Toughness, Mathematical models, Interfaces, Mechanical properties, Crack propagation, Reprints, Fracture mechanics, R-curve.

An investigation of the interrelationships between strength, crack-resistance (R-curve) characteristics, and grain size for alumina ceramics has been carried out. Results of indentation-strength measurements on high-density aluminas with uniform grain structures in the size range 2 to 80 micrometers are presented. The primary role of grain size in the toughness characteristic is to determine the scale of grain pullout at the bridged interface. It is shown that the strength properties are a complex function of the bridged microstructure. The analysis confirms the usual negative dependence of strength on grain size for natural flaws that are small relative to the grain size, but the dependence does not conform exactly to the -1/2 power predicted on the basis of classical 'Griffith-Orowan' flaws. The analysis provides a self-consistent account of the well-documented transition from 'Orowan' to 'Petch' behavior.

001,164
PB91-112052 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Flexural Behavior of Strain-Softening Solids.
Final rept.
T. J. Chuang, and Y. W. Mai. 1989, 17p
Pub. in International Jnl. of Solids Structures 25, n12 p1427-1443 1989.

Keywords: *Flexural strength, *Beams(Supports), Solids, Ceramics, Crack propagation, Tensile properties, Bending, Concretes, Rocks, Reprints, *Strain softening, Performance prediction, Fracture mechanics.

The flexural behavior of a beam is investigated in an attempt to establish a correlation between the tensile and bending properties of strain-softening solids. Given the complete uniaxial stress-strain relations, including the post-peak tension-softening portion, it is possible to predict the flexural behavior in moment-curvature and load-deflection relations. The results indicate that strain-softening gives rise to enhanced bending strength in agreement with experimental data. Conversely, given the bending responses together with the softening characteristics the complete tensile behavior can be determined. Since bending experiments are easier to perform than uniaxial tensile tests, this well-defined correlation provides a feasible means to obtain the entire tensile behavior of strain-softening solids such as concrete, rocks and ceramics.

001,165
PB91-112557 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Creating a Materials Data Base Builder and Producing Publications for Ceramic Phase Diagrams.
Final rept.
H. M. Ondik, and C. G. Messina. 1989, 11p
Pub. in Computerization and Networking of Materials Data Bases, ASTM STP 1017, p304-314 1989.

Keywords: *Ceramics, *Phase diagrams, Reprints, *Data base management.

The Ceramics Phase Diagrams Data Center faced several problems in the early stages of developing a computer data base to distribute to the ceramics user community. The Data Center had to create and store data files containing full scientific notation, provide for transferring data to undesignated computer(s) from the computer on which the files were created, and provide for installation of the data on undetermined Data Base Management System(s) for user access. The solution was incorporated in programs developed in the National Institute for Standards and Technology (NIST) Office of Standard Reference Data and expanded under the support of the American Ceramic Society. All information is expressed using only printable ASCII characters and is stored in dynamic arrays with all fixed length parameters encoded as program variables. Bibliographic and some chemical data for the next several volumes of Phase Diagrams for Ceramics are currently being stored in this form. The data are being manipulated to produce material in typeset form for the published volumes. They have also been transferred with no loss of information to a prototype data base for rapid retrieval.

001, 166

PB91-134007 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.

Fracture of Polycrystalline Ceramics.

Final rept.
S. W. Freiman, and P. L. Swanson. 1990, 12p
Pub. in Deformation Processes in Minerals, Ceramics
and Rocks, Chapter 3, p72-83 1990.

Keywords: *Ceramics, *Crack propagation, Failure,
Polycrystalline, Stresses, Microstructure, Fracture
strength, Reprints, *Fracture mechanics, Performance
prediction.

Catastrophic failure in polycrystalline ceramics results from stressed cracks growing to critical dimensions which can span a range of size scales. As critical flaw dimensions increase in size from a scale less than characteristic microstructure dimensions to a size which encompasses many grain diameters, the resistance to fracture increases, in certain polycrystals, by a factor of 5 to 10. This increase represents the difference between the fracture resistance of the polycrystal and that of its individual constituent single crystals. The paper (1) briefly reviews several microstructural mechanisms suggested to be responsible for both the high fracture energy of polycrystals and the rising resistance to fracture with crack extension (R-curve behavior), (2) shows how relatively small variations in grain size and shape affect the R-curve, or fracture toughness - crack size relationship, (3) presents the results of in-situ microscopy observations of subcritically-propagating cracks which lend support to crack-interface traction as an important fracture resistance mechanism, and (4) examines the complicating influence that the traction mechanism has on prediction of time-dependent failure from flaws propagating under the influence of stress-enhanced chemical reactions.

001, 167

PB91-134197 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Ceramics Div.

Fracture Toughness Behavior of a Silicon Carbide Whisker-Reinforced Alumina Ceramic at Selected Porosities.

Final rept.
R. F. Krause, and E. R. Fuller. 1987, 18p
Sponsored by Department of Energy, Washington, DC.
Pub. in Proceedings of Fossil Energy Materials Program
Conference, Oak Ridge, TN., May 19-21, 1987,
p38-55.

Keywords: *Fracture strength, *Silicon carbides, *Ceramics, *Aluminum oxide, Toughness, Whisker composites, Porosity, Mathematical models, Crack propagation, Indentation, Flexural strength, Reprints, *Fracture mechanics, *Ceramic matrix composites.

The fracture roughness behavior of a silicon carbide whisker-reinforced alumina ceramic has been characterized at porosities ranging from 0.6 to 11.5%. The composite material consisted of alumina that was hot pressed with 25 weight percent silicon carbide whiskers. Controlled flaws of increasing size were produced on polished surfaces of specimens by Vickers indentation loading from 2 to 200 N. The flexural strength measured as a function of indentation load indicates that the resistance to fracture of these materials increases as a function of crack extension. The results are analyzed in terms of a fracture model containing ligamentary tractions in the wake of the crack.

001, 168

PB91-134890 Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Ceramics Div.

Crack Velocity Functions Thresholds in Brittle Solids.

Final rept.
K. T. Wan, S. Lathabai, and B. R. Lawn. 1990, 10p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of the European Ceramic Society 6, p259-268 1990.

Keywords: *Environmental tests, *Ceramics, *Crack propagation, Velocity measurement, Mica, Glass, Sapphire, Humidity, Equations, Mass transfer, Partial pressure, Reprints, *Brittle materials, *Fracture mechanics, Crack closure, Temperature dependence, Thermal energy.

A unifying treatment of environment-sensitive crack velocity functions for intrinsically brittle solids is pre-

sented. The formalism is soundly based on the concept of thermal activation barriers, but is phenomenological in that it does not attempt to identify the explicit underlying physical and chemical processes responsible for these barriers. Equations prescribing the v-G (crack velocity versus mechanical energy release rate) characteristics at specified chemical concentrations (partial pressures) and temperatures are thereby presented. The equations incorporate the familiar three velocity regions into a composite function: region 1, chemically assisted fluctuations over stress-enhanced energy barriers; region III, similar but in the absence of environmental species; region II, a connecting flow-limited transport branch. Data for selected brittle solids, principally mica but also glass and sapphire, in moist environments are used to illustrate the formalism.

Coatings, Colorants, & Finishes

001, 169

N89-13657/6
(Order as N89-13642/8, PC A10/MF A01)
National Bureau of Standards, Gaithersburg, MD.

Aluminum Oxide Barriers in Metal CrAlY Superalloy Systems.

K. G. Kreider. 1985, 4p
In NASA, Lewis Research Center, Thermal Barrier Coatings. Abstracts and Figures p 167-170.

Keywords: *Aluminum oxides, *Barrier layers, *Diffusion, *Heat resistant alloys, *Turbine blades, *Vaness, Gas turbines, Heat treatment, Sputtering, *X ray analysis, Thermal barrier coatings, Ceramics.

An investigation was made of sputtered aluminum oxide diffusion barriers to protect gas turbine engine blade and vane alloys from their coatings. MAR M200 + Hf coated with sputtered NiCoCrAlY and MAR M509 coated with sputtered FeCrAlY were obtained both with and without 1 and 2 micron sputtered Al₂O₃ barrier layers. Electron dispersive X-ray analysis was used to determine the concentration profiles of as-received and heat treated samples.

001, 170

PB90-136433 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Radiation Physics Div.

Characterization of Epitaxial Fe on GaAs(110) By Scanning Tunneling Microscopy.

Final rept.
R. A. Dragoset, P. N. First, J. A. Stroschio, D. T. Pierce, and R. J. Celotta. 1989, 6p
Pub. in Materials Research Society Symposia Proceedings 151, p193-198 1989.

Keywords: *Epitaxy, *Iron, *Gallium arsenides, *Microscopy, Magnetic properties, Metal films, Body centered cubic lattices, Thickness, Surface roughness, Temperature, Clustering, Reprints, Characterization, Scanning tunneling microscopy.

Iron on GaAs(110) comprises an interesting system not only due to small lattice mismatch, 1.4%, but also because of the magnetic properties of the overlayer. In the present work, scanning tunneling microscopy (STM) was used to investigate bcc Fe films in the 0.1 Angstroms to 20 Angstroms thickness range, grown at 300 K and 450 K substrate temperatures. STM images show Volmer-Weber growth with the formation of 3-D Fe islands 20-30 Angstroms in diameter for 0.1-1 Angstroms deposition at 300 K, increasing to 40-50 Angstroms for thicker films. Iron island sizes at low coverage and thin film roughness at higher coverages both show significant dependence upon growth temperature.

001, 171

PB90-149188 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Ceramics Div.

Thermal Wave Inspection of Heat Resistant Ceramic Coatings.

Final rept.
H. Frederikse, and A. Feldman. 1987, 6p
Pub. in Nondest. Test. High-Perf. Ceram., p177-182 1987.

Keywords: *Ceramic coating, *Thermal diffusivity, *Radiometry, *Thermal measurements, Chromium oxides, Zirconium oxides, Reprints.

Photo-thermal radiometry is being evaluated as a non-contact method for on-line monitoring of the thermal resistance of ceramic coatings. Measurements have been made on plasma sprayed coatings of chromia and zirconia. Thermal conductivities appear to be two to five times smaller than bulk values.

001, 172

PB90-156985 PC A06/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Methods for Measuring Lead Concentrations in Paint Films.

M. E. McKnight, W. E. Byrd, W. E. Roberts, and E. S. Lagergren. Dec 89, 123p NISTIR-89/4209
Sponsored by Department of Housing and Urban Development, Washington, DC.

Keywords: *Quantitative analysis, *Lead(Metal), *Paints, Methodology, Test equipment, X ray fluorescence, Accuracy, Precision, Field tests, Sampling, Microscopy, Atomic spectroscopy, Tables(Data), Interlaboratory comparisons.

Recent legislation required the U.S. Department of Housing and Urban Development (HUD) to establish procedures to abate lead-based paint in existing HUD-assisted housing. The legislation also required HUD to assess the accuracy, precision, reliability, and safety of methods for measuring lead content of paint films and to investigate the availability of testers and samplers. The National Institute of Standards and Technology was requested to carry out the assessment. With regard to accuracy and precision of field measurements, it was concluded that: chemical spot tests when carried out by an experienced analytical chemistry technician can detect the presence of lead in paint films having concentrations in excess of 1 mg/sq cm about 90% of the time; the estimate of the precision of a field measurement procedure using lead-specific portable X-ray fluorescence (XRF) analyzers for lead concentrations near 1 mg/sq cm is + or - 0.6 mg/sq cm and the estimate of the bias is 0.2 mg/sq cm; this results in a 95% confidence interval of + or - 1.4 mg/sq cm; and based upon very preliminary measurements using the latest version of the spectrum analyzer portable XRF, the 95% confidence interval for field measurements is estimated to be + or - 0.5 mg/sq cm. In addition to field methods, standard laboratory procedures can be used to measure the lead content of paint samples to within a few percent of the quantity present over a wide range extending from less than 0.1 to over 10 mg/sq cm. Sample collection and sample dissolution procedures were also investigated.

001, 173

PB90-162082 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Building Materials Div.

Screening Procedures for Detecting Lead in Existing Paint Films: A Literature Review.

M. E. McKnight, and W. E. Byrd. Jan 90, 24p
NISTIR-89/4044

Keywords: *Nondestructive tests, *Lead(Metal), *Paints, Detection, Measurement(Materials), Residential buildings, Thin films, Chemical analysis, X ray analysis, X ray fluorescence.

Recent legislation required the U.S. Department of Housing and Urban Development (HUD) to establish procedures to eliminate, as far as practicable, the hazards of lead-based paint poisoning in any existing HUD-controlled housing. Thus, HUD promulgated a regulation which requires abatement to eliminate lead-based paint poisoning hazards in housing in which the concentration of lead in paint equals or exceeds 1 mg/sq cm. The legislation also required HUD to review test methods for measuring lead in paint. The National Institute of Standards and Technology was tasked with the requirement. The first phase of the task, the subject of the report, was to review the literature for screening methods for measuring or detecting lead in paint. To facilitate the review, criteria were developed for potential test methods. A test method must be: capable of detecting lead concentrations of 1 mg/sq cm but not concentrations less than 0.06%, non-hazardous, suitable for use as a nondestructive field method suitable for use by non-technical personnel, and sufficiently reliable and precise. No method reported in the reviewed literature met all of the requirements.

001, 174

PB90-162124 PC A03/MF A01

Coatings, Colorants, & Finishes

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology. **Potential Methods for Measuring and Detecting Lead in Existing Paint Films: A Literature Review.** W. E. Byrd, and M. E. McKnight. Jan 90, 46p NISTIR-89/4205

Keywords: *Nondestructive tests, *Paints, *Lead(Metal), Detection, Measurement, Coatings(Materials), Residential buildings, Thin films, Chemical analysis.

Recent legislation required the U.S. Department of Housing and Urban Development (HUD) to establish procedures to eliminate, as far as practicable, the hazards of lead-based paint poisoning in any existing HUD-controlled housing. Thus, HUD promulgated a regulation which requires abatement to eliminate lead-based paint poisoning hazards in housing in which the concentration of lead in paint equals or exceeds 1 mg/sq cm. The legislation also required HUD to review test methods for measuring lead in paint. The National Institute of Standards and Technology was tasked with the requirement. The review is the subject of the report. Test methods were evaluated based on the following criteria: safety, reliability, accuracy, precision, detection limit, ease of use, and technical skill required to make a measurement, nondestructive, and cost of an analysis. Methods were separated into two categories: field test methods and laboratory test methods. The laboratory test methods were also separated by whether the sample needed to be in solution or could be analyzed as a solid. None of the potential test methods met all of the desired criteria.

001,175
PB90-164278 PC A03/MF A01
 National Inst. of Standards and Technology, Gaithersburg, MD.
Comparison of the NIST (National Institute of Standards and Technology) and European Gold Coating Standards.
 C. R. Beauchamp, H. G. Brown, and D. S. Lashmore. Jan 90, 12p NISTIR-89/4162

Keywords: *Gold coatings, *Standards, *Europe, *United States, Measurement, Thickness, X ray fluorescence, Electrodeposited coatings, Sputtering, Tables(Data).

Gold coating standards produced by the National Institute of Standards and Technology (NIST) are compared with those produced by the Community Bureau of Reference (BCR) of the Commission of the European Communities. The nominal mass per unit area for the standards produced at NIST are 1.5, 3, 6, 14 mg/sq cm and the BCR standards are 1, 1.5, 6, 10 mg/sq cm. The comparison is in response to questions raised by BCR regarding the accuracy of NIST standards, especially in the range of 14 mg/sq cm. The reproduction of NIST certified thicknesses has been accomplished well within claimed deviation of 5%. The surfaces of both NIST's and BCR's standards are scratched due to extensive handling. Sputtered BCR samples become rough and develop large pits as they become thicker. It appears that difficulties arise when using energy dispersive instruments incorporating a requirement for the measurement of an infinitely thick standard. The deviations for the BCR samples were reproduced within 1.3% when using NIST standards. It should not be interpreted as meaning the BCR standards are this accurate since actual certified values were not provided for the comparison. Deviations of the measurements are generally larger when using energy dispersive measuring techniques. All NIST standards are certified using wavelength dispersive measuring techniques.

001,176
PB90-205881 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Materials Div.
Simulation of Diffusion in Pigmented Coatings on Metals Using Monte-Carlo Methods.
 Final rept.
 D. P. Bentz, and T. Nguyen. 1990, 7p
 Pub. in Jnl. of Coatings Technology 62, n783 p57-63 Apr 90.

Keywords: *Coatings(Materials), Corrosion, Metals, Pigments, Protective coatings, Coating processes, Mathematical models, Diffusion theory, Monte Carlo method, Random walk, Organic compounds, Water, Oxygen, Computerized simulation, Reprints, Solid-solid interfaces.

The degradation of many organic coating systems is controlled by processes occurring at the coating-substrate interface. The degradation processes require that species, such as H₂O, O₂, or ions, diffuse from the atmosphere, through the coating, to the interfacial region. The paper presents a two-dimensional model for the diffusion of the species through a pigmented coating. The model is implemented via digitized Monte-Carlo simulations of the random walk behavior of individual species within the coating layer. The model has been developed to include a variety of parameters such as coating thickness, pigmentation (pigment volume concentration, pigment particle geometry, pigment absorption characteristics, etc.), and pinholes at the coating-atmosphere interface.

001,177
PB90-219825 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Quality Assurance Tests for Adhesion of Paint on Tactical Rigid Wall Shelters.
 H. Watanabe, L. W. Masters, and J. F. Seiler. Apr 90, 47p NISTIR-90-4276
 Sponsored by Army Natick Research Development and Engineering Center, MA.

Keywords: *Paints, *Aluminum, *Adhesion, Tactical warfare, Military facilities, Sandwich panels, Structural forms, Shelters, Rigid frames, Quality assurance, Tests, Bond strength, Portable equipment, Pull-off tests.

The document was prepared at the request of the U.S. Army Natick Research, Development and Engineering Center to provide assistance in identifying or developing a better method(s) for assuring the adequacy of paint adhesion on aluminum-faced sandwich panels of portable rigid wall shelters. The preferred requirements developed for the quality assurance tests are that the tests be quantitative, reliable, suitable for in-situ testing, low cost, and non-destructive. Currently available methods were surveyed. Both destructive and non-destructive techniques were examined. Among them, a button pull-off test was found to be most advantageous. Preliminary laboratory experiments using a button pull-off test to measure the bond strength of painted specimens provided by a shelter manufacturer showed the average bond strength of the exterior and the interior paints to be 7.27 Mpa (1050 psi) and 9.29 Mpa (1350 psi), respectively.

001,178
PB90-221839 PC A06/MF A01
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Electrodeposition of Wear Resistant Coatings.
 Final rept.
 C. E. Johnson, D. S. Lashmore, D. R. Kelley, and J. L. Mullen. Apr 90, 105p NISTIR-4301
 Sponsored by Bureau of Engraving and Printing, Washington, DC.

Keywords: *Coatings(Materials), *Electrodeposited coatings, Wear tests, Metal coatings, Printing plates, Accelerated tests, Chromium, Nickel, Phosphorus, Silicon carbides, Abrasion tests, Electrochemistry, Cobalt.

Analysis of premature plate failure resulted in a number of recommendations to address a series of problems that were identified in the plating process of printing plates. An accelerated wear tester was developed and applied to rank electrodeposited coatings for wear. Composite coatings of nickel-phosphorus-silicon carbide exhibited a factor of 10 increase in wear performance over the current chromium technology. Various chromium coatings exhibited a factor of 1.2 to 2 increase in abrasive wear performance. A new pulse plated duplex chromium coating exhibited the factor of two increase over the presently used chromium coating. In situ wear testing of chromium plated wiper blades exhibited a factor of two increase over the presently used chromium coatings. In situ wear testing of chromium plated wiper blades exhibited a 10 to 15 fold increase in the blade life compared to the currently used unplated blades.

001,179
PB90-241266 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.

Using the Computer to Analyze Coating Defects.
 Final rept.
 D. P. Bentz, and J. W. Martin. 1987, 8p
 Sponsored by Tri-Services Building Materials Committee, Washington, DC.
 Pub. in Jnl. of Protective Coatings and Linings 4, n5 p38-45 May 87.

Keywords: *Coatings(Materials), *Nondestructive tests, Defects, Protective coatings, Construction materials, Pattern recognition devices, Paints, Corrosion, Surface properties, Blistering, Finishes, Reprints, *Computer aided mapping, Computer vision, Image processing, Building materials.

The application of computer image processing as a non-destructive technique for quantifying the condition of painted surfaces in both the laboratory and field is demonstrated. Visual images obtained using a video or infrared thermographic camera were used to depict the condition of coated surfaces. Existing visual standard photographs were evaluated to demonstrate that computer image processing can image and quantify a wide variety of defects including blisters, corrosion, cracking, chalking, and flaking. Laboratory specimens were imaged to demonstrate the method's ability to detect early coating failure, to evaluate coating system performance, and to provide fundamental information useful in predicting the service life of coating systems. Defects on the exterior envelop of buildings were quantified to demonstrate the ability of the method to perform condition assessments and to provide information which should prove useful in scheduling maintenance and in evaluating the field performance of building materials.

001,180
PB90-254376 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Mathematical Modeling of the Deposition of Alloys Onto Moving Fibers.
 Final rept.
 C. R. Beauchamp. 1987, 10p
 Pub. in Proceedings of AESF Annu. Tech. Conf. (74th), 10p 1987.

Keywords: *Electrodeposited coatings, *Metalized fibers, Metal coatings, Liquid metals, Alloys, Meetings, Mathematical models, Compositions, Forecasting, Electric potential, Electric current, Surface chemistry, Differential equations, Coating processes, Motion, Chemical analysis, Reprints, Liquid-solid interfaces.

A mathematical model that ties the alloy deposition parameters into a single tool that enables the prediction of the composition of an alloy deposited onto a moving fiber is to be presented. Potential distribution on the resistive fiber and in the solution are computed enabling the current distribution to be predicted. The differential equations are coupled at the fiber-solution interface by heterogeneous reactions. Integration of the partial currents with respect to residence time enables the calculation of the composition of the deposit.

001,181
PB91-118406 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Duplex Nickel Step Test Standards.
 Final rept.
 D. S. Lashmore, H. J. Brown, and D. R. Kelley. 1987, 4p
 Pub. in Plating and Surface Finishing 74, n1 p62-65 1987.

Keywords: *Nickel coatings, *Standards, Corrosion prevention, Automotive industry, Electric potential, Thickness, Reprints.

Standards for measuring potential difference and thickness between multilayer nickel coatings have been developed. The paper describes the techniques used to fabricate and certify these standards and the effect of various operating parameters on the accuracy of both thickness and potential measurements. This Standard Reference Material is intended for use by the automotive industry to verify their step test measurements.

Composite Materials

001,182

PATENT-4 972 720

Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.**Thermal Technique for Determining Interface and/or Interply Strength in Composites.**

Patent.

W. Wu. Filed 20 Sep 89, patented 27 Nov 90, 10p
PB91-119610, PAT-APPL-7-409 854

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Composite materials, *Bonding strength, *Interfaces, *Patents, Thermal stresses, *Polymer matrix composites, *Thermal testing, PAT-CL-73-801.

A method and apparatus for characterizing bonding properties in composites use thermal energy to cause controlled debonding of interface and/or interply bonds. Debonding events resulting from the controlled debonding are detected and used to characterize the interface and/or interply properties of the composition.

001,183

PB90-170143

Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.**Phase Velocity and Attenuation of Plane Elastic Waves in a Particle-Reinforced Composite Medium.**

Final rept.

S. K. Datta, H. M. Ledbetter, Y. Shindo, and A. H. Shah. 1988, 12p

Sponsored by Office of Naval Research, Arlington, VA., and Natural Sciences and Engineering Research Council of Canada, Ottawa (Ontario).
Pub. in Wave Motion 10, p171-182 1988.

Keywords: *Wave propagation, *Attenuation, *Elastic waves, *Composite materials, *Reinforcing materials, *Phase velocity, Particles, Inclusions, Interfaces, Ultrasonic tests, Lead(Metal), Epoxy resins, Silicon carbides, Aluminum, Quantum theory, Plane waves, Reprints.

The study considered effective-plane-wave propagation, both longitudinal and shear, through a medium containing a random distribution of spherical inclusions. It was assumed that the particles and matrix are separated by a thin layer of elastic material with different properties. For some systems, measurable effects for the thin layers were predicted. Especially considered were Pb-epoxy and SiC-Al.

001,184

PB90-188483

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.**Ultrasonic Methods for Characterizing the Interface in Composites.**

Final rept.

J. A. Simmons, E. Drescher-Krasicka, H. N. G. Wadley, M. Rosen, and T. M. Hsieh. 1988, 9p

Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7B, p893-901 1988.

Keywords: *Composite materials, *Interfaces, *Ultrasonic tests, Titanium, Wave propagation, Nondestructive tests, Steels, Aluminum, Reprints, Solid-solid interfaces, Characterization, Poynting theorem.

The current status of a SDIO/ONR Research program directed at developing experimental techniques for characterizing the interface zone on composites through the use of ultrasonic interface waves is reported. The theoretical framework, using one-dimensional scattering through viscoelastic media, is summarized. Energy flow and group velocity are described in terms of the Poynting vector fields. The experimental confirmation of the existence of leaky, Stoneley, and possibly divergent waves are given for the titanium/steel system with planar interface. The detection of energy emitted by a leaky wave running along a cylindrical interface is described for the aluminum/steel system. A new shift in apparent leaky wave position due to surface curvature is presented.

001,185

PB90-260985

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.**Comparison of Methods for Determining Fiber/Matrix Interface Frictional Stresses in Ceramic Matrix Composites.**

Final rept.

D. C. Cranmer, U. V. Deshmukh, and T. W. Coyle.

1990, 13p

Contract N00014-86-F-0096

Sponsored by Strategic Defense Initiative Organization, Washington, DC. Innovative Science and Technology.

Pub. in Thermal and Mechanical Behavior of Metal Matrix and Ceramic Matrix Composites, ASTM STP 1080, p124-135 1990.

Keywords: *Composite materials, *Silicon carbides, *Borosilicate glass, Fibers, Comparison, Friction tests, Stress analysis, Methodology, Measurement, Indentation, Fiber composites, Reprints, *Ceramic matrix composites, Solid-solid interfaces, Fiber pull-out test, Indentation push-out test.

Several experimental methods including indentation push-in, indentation push-out, and single-fiber pull-out tests were employed to measure the strength of the fiber/matrix bond in two continuous fiber reinforced ceramic matrix composites. The composite systems examined were a silicon carbide (SiC) monofilament reinforced borosilicate glass matrix and a SiC fiber tow reinforced glass-ceramic matrix. Single-fiber pull-out test results gave debond strengths (Tau sub d) of 11.1 + or - 3.2 MPa and interface frictional stresses (Tau sub f) of 3.6 + or - 0.7 MPa for the SiC/borosilicate system. In the push-out test, Tau sub d for the SiC/borosilicate system appears to be about 10 MPa while (taus) between 1 and 55 MPa were obtained in the SiC/glass-ceramic composite. The push-in test gave values of Tau sub f between 2 and 34 MPa for the SiC/glass-ceramic system. Variability in tau within a specimen is due to differences in bonding between the fibers and matrix at various locations. The discrepancies in tau both within a test and between test methods are explained in terms of fiber/matrix bonding and test geometry. The most versatile test method appears to be the indentation push-out test.

001,186

PB90-261215

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.**Fracture Resistance Behavior of Silicon Carbide Whisker-Reinforced Alumina Composites with Different Porosities.**

Final rept.

R. F. Krause, E. R. Fuller, and J. R. Rhodes. 1990, 9p

Pub. in Jnl. of American Ceramic Society 73, n3 p559-566 Mar 90.

Keywords: *Whisker composites, *Composite materials, *Ceramics, *Silicon carbides, *Aluminum oxide, Porosity, Fracture strength, Crack propagation, Defects, Indentation, Reprints, *Ceramic matrix composites.

Fracture resistance behavior was characterized for SiC-whisker-reinforced alumina composites with porosities ranging from 0.6% to 11.5%. The composites were hot-pressed from an Al₂O₃ powder with 25 wt% SiC whiskers. Strengths of individual specimens were measured in four-point flexure either for natural flaws or for Vickers-indentation flaws as a function of radial crack size. Indentation crack sizes were controlled with indentation loads which varied between 2 and 200 N. A novel method of analysis of the measurements indicates that the fracture resistance of the composites increases as a function of crack extension, a rising R curve. This behavior is interpreted in terms of tractions from both crack-bridging whiskers and interlocking grains, which develop in the wake of the crack tip as it extends. A decrease in porosity raises the level of fracture resistance, but has a negligible effect on the relative steepness of the R curve. The sizes of natural flaws which causes failure in flexure testing were also estimated from analysis of the data.

001,187

PB91-107078

Not available NTIS
Delaware Univ., Newark. Center for Composite Materials.**Opportunities for Innovation: Polymer Composites.**

Final rept.

S. H. Munson-McGee. Aug 90, 188p NIST/GCR-90/577-1

Grant 60NANB9D0965

Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Office of Technology Evaluation and Assessment.

Available from National Institute of Standards and Technology, Gaithersburg, MD. 20899. Diana Snouffer. Phone: (301) 975-3579.

Keywords: *Composite materials, *Molding techniques, Fabrication, Injection molding, Manufacturing, Contact molding, Bag molding, Compression molding, Thermoplastic resins, Filament winding, Sheets, Pultrusion process, Transfer molding, *Polymer matrix composites, *Resin matrix composites.

The monograph deals with a spectrum of composites processing technologies that represent a wide range of technological maturity. Some of the processes (contact/vacuum bag molding, compression molding, and injection molding) have been used for many decades. Others (thermoplastic sheetforming) are at the other end of the maturity spectrum and are still in the development stages. Others yet are seeing a revolution in applications as new materials become available (thermoplastic filament winding and pultrusion) or as new concepts in design are realized (RTM, S-RIM). The objective of the monograph is to encourage industrial competitiveness of small companies by pointing out potentials for invention, a wide range of opportunities from improving existing technologies to developing entirely new ones.

001,188

PB91-107425

Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.**Internal Strain (Stress) in a SiC-Al Particle-Reinforced Composite: An X-ray Diffraction Study.**

Final rept.

H. M. Ledbetter, and M. W. Austin. 1987, 9p

See also PB86-238417.

Pub. in Materials Science and Engineering 89, p53-61 1987.

Keywords: *Composite materials, *Dissimilar materials bonding, *Silicon carbides, *Ceramic fibers, Residual stress, Thermal expansion, X ray diffraction, Particles, Thermal stresses, Reprints, *Metal matrix composites, *Aluminum alloy 6061.

SiC and aluminum alloy 6061 possess very different thermal expansion coefficients: 3.3 x 10 sup 6/K and 22.5 x 10 sup 6/K respectively. Thus, large internal strains and stresses in composites are expected because the two constituents form interfacial bonds at high temperatures and are cooled to ambient temperatures. From a simple elastic model, a hydrostatic tensile stress in the aluminum matrix and a hydrostatic compressive stress in the SiC particles were expected. Using conventional back-reflection diffraction geometry with Cu K alpha radiation, the unit-cell dimensions for two situations were determined in the final composite.

001,189

PB91-118158

Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.**Guided Interface Waves.**

Final rept.

E. Drescher-Krasicka, J. A. Simmons, and H. N. G. Wadley. 1987, 8p

Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v68 p1129-1136 1987.

Keywords: *Metal fibers, *Boundary layer, Ultrasonic radiation, Mechanical tests, Stainless steels, Aluminum, Phase velocity, Reprints, *Metal matrix composites, *Solid-solid interfaces, Ultrasonic interface waves.

It is well understood that the crucial factor controlling the mechanical properties in fiber reinforced composites is the quality of the interface between the matrix and the fibers. As opposed to polymer matrix composites, interfaces in metal matrix composites cannot be tested by optical methods. One of the few possibilities for direct characterization in this case arises from the propagation of guided ultrasonic interface waves of Stoneley or leaky type along the interface. The paper

Composite Materials

presents a study of ultrasonic interface waves along cylindrical interfaces of differing radii in a model metal matrix composite system using aluminum as the matrix material and stainless steel for the fibers. Velocity changes as a function of curvature are compared with theory and used as an indicator of the quality of the bond between the matrix and the fibers.

001,190
PB91-133884 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Measurement of Fiber Fracture and Fiber-Matrix Interface Shear Strengths in Metal Matrix Composites.
 Final rept.
 R. B. Clough, F. S. Biancaniello, and H. N. G. Wadley. 1987, 12p
 Pub. in Proceedings of Conference on Nondestructive Testing and Evaluation of Advanced Materials and Composites, Colorado Springs, CO., 12p 1987.

Keywords: *Fiber composites, *Aluminum, Ceramic fibers, Silicon carbides, Measurement, Single crystals, Crack propagation, Shear strength, Crystal growth, Nondestructive tests, Reprints, *Acoustic emission, *Metal matrix composites, Solid-solid interfaces, Fracture mechanics.

Single crystals of aluminum which contain a single axial fiber of SiC were fabricated and tested. Different solidification times were used to vary the interfacial (and fiber) properties, as SiC is known to react with molten Al to produce interfacial Al₄C₃. Specimens without fibers were also made. Comparison of the number of acoustic emission (AE) events to the number of fractures indicates that in the rapidly grown material all AE was due to fiber fractures whilst only half the events in the slowly grown samples were due to fiber fracture. The other half correspond to interfacial fracture since the room temperature ductility of polycrystalline Al₄C₃ is presumably quite limited. Thus there is a change from the single mode of (axial fiber) fracture in the rapidly grown material to bimodal (axial and interfacial) fracture in the slowly grown material. Composite properties and failure mechanisms thus depend significantly on processing conditions and acoustic emission is an important tool for determining the modes of failure.

001,191
PB91-133926 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Fiber-Reinforced Composites: Models for Macroscopic Elastic Constants.
 Final rept.
 S. K. Datta, and H. M. Ledbetter. 1990, 15p
 Sponsored by Office of Naval Research, Arlington, VA. Pub. in Dynamic Elastic Modulus Measurements in Materials, ASTM STP 1045, p120-134 1990.

Keywords: *Fiber composites, *Elastic theory, Ultrasonic tests, Mathematical models, Boron, Aluminum, Chromium, Magnesium, Anisotropy, Stiffness, Reprints, Metal matrix composites.

Considering uniaxial-fiber-reinforced composites, selected models for calculating macroscopic elastic constants from the constituent elastic constants (fiber and matrix) and the phase geometry are reviewed. Especially, the transverse-isotropic case with five independent elastic-stiffness constants, C_(ij) is the focus. Also, wave-scattering ensemble-average methods developed by Bose and Mal (1974) and by Datta and Ledbetter (1983, 1984) are discussed. The model results are compared with measurements made by pulse-echo dynamic (MHz) methods. As examples, B/Al and Cr/Mg are considered; the latter fibers possess high elastic anisotropy.

Corrosion & Corrosion Inhibition

001,192
PB90-149485 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Environmentally Induced Cracking.
 Final rept.
 B. Craig. 1987, 1p
 Pub. in Metals Handbook: Corrosion, v13 p145 1987.

Keywords: *Environmental tests, *Cracking(Fracturing), *Metals, Hydrogen embrittlement, Corrosion mechanisms, Liquid metals, Stress corrosion, Reprints.

The different forms of environmentally induced fracture are reviewed including hydrogen embrittlement, liquid metal embrittlement and stress corrosion cracking. The basic phenomena of each form is discussed with examples and the current theories for the mechanism(s) of environmental induced fracture are discussed.

001,193
PB90-195033 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Measuring the Extent of Rust on Steel After Abrasive Blasting: A Feasibility Study.
 M. E. McKnight, D. P. Bentz, and W. Roberts. Mar 90, 21p NISTIR-90/4257
 Sponsored by Tri-Service Building Materials Committee, Washington, DC.

Keywords: *Rust, *Steels, *Abrasive blasting, Feasibility, Measurement, Corrosion, Service life, Coatings, Surface finishing, Surface roughness, Emissivity, Graphs(Charts), Iron oxides, Metal cleaning, Video tapes, Imaging techniques, Thermography, Infrared imagery.

The service life of a coating on steel is known to depend upon the condition of the surface prior to painting. Factors used to assess surface preparation include extent of rust remaining on the surface, roughness, and concentration of inorganic contaminants. The report is only concerned with assessing the extent of rust. Presently, the extent of rust is determined using standard definitions and visual standards, a subjective procedure. Since a more objective procedure is desirable, video imaging and infrared thermographic techniques were assessed. It was concluded that infrared thermography does not provide the basis for a simple, sensitive method for assessing the extent of rust but the video imaging shows promise to meet the need.

001,194
PB90-206970 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Effect of Aqueous Environments on the Fracture Behavior of Ductile Nickel Aluminide.
 Final rept.
 R. E. Ricker, D. E. Hall, and J. L. Fink. 1990, 6p
 Pub. in Scripta Metallurgica et Materialia 24, n2 p291-296 1990.

Keywords: *Nickel alloys, *Aluminum containing alloys, *Intermetallics, Corrosion resistance, Ductility, Crack propagation, Polycrystalline, Fracture properties, Stress corrosion, Reprints, Aqueous solutions, Boron additions, Fracture mechanics.

Polycrystalline nickel aluminide, Ni₃Al, can be made ductile through microalloying additions of boron. The resulting intermetallic alloy offers high strength and ductility, making it a promising structural material for both high and low temperature applications. While ductile Ni₃Al was developed primarily for high temperature applications, it is also being considered for many low temperature applications such as forging dies, pump impellers and metal matrix composites. Before ductile nickel aluminide can be used in many of the applications, the corrosion and stress corrosion cracking characteristics of the materials must be understood. However, published information on the corrosion of Ni₃Al is limited. As a result an investigation into the aqueous corrosion and stress corrosion cracking behavior of ductile Ni₃Al was initiated.

001,195
PB90-218140 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Imaging and Assessment of Corrosion on Coated and Uncoated Steel Using Thermal-Wave Electron Microscopy.
 Final rept.
 T. Nguyen. 1987, 3p
 Pub. in Combining Materials: Design, Production and Properties, v2 p737-739 1987.

Keywords: *Steels, Corrosion, Coatings(Materials), Surface finishing, Protective coatings, Reprints, Image analysis, Thermal wave microscopy.

The poster will present the effects of various instrumental and surface preparation parameters on the contrasts and imaging of corrosion on uncoated and coated steel obtained by thermal-wave microscopy.

001,196
PB90-218355 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Degradation of Organic Protective Coatings on Steel in Corrosive Environments.
 Final rept.
 T. Nguyen, and W. E. Byrd. 1987, 8p
 Pub. in Durability of Construction Materials, v3 p1091-1098 1987.

Keywords: *Protective coatings, *Steels, Organic coatings, Degradation, Corrosion resistance, Infrared spectroscopy, Polymers, Polyurethane resins, Polybutadiene, Fourier transformation, Curing, Crosslinking, Elastomers, Reprints.

Organic coatings are widely used as a means of prolonging the service life of steel substrates. Although highly polymeric, the coatings are frequently susceptible to degradation that reduces their effectiveness as a protective barrier. The degradation in corrosive environments of one-component polyurethane and polybutadiene coatings on polished, cold-rolled steel was studied using reflection/absorption FTIR microscopy (FTIR-RA). Coatings of approximately 2 micrometers were applied uniformly to the substrates using a spin coater. After curing at ambient conditions, the coated specimens were exposed to an aerated 40 C and 80% RH environment. FTIR/RA spectra were taken at times up to 30 weeks. The results show considerable changes in the structure of the coatings. For polyurethane, besides changes in intensities of the amino, carbonyl and isocyanate groups, some of the hydrogen-bonded amino groups became dissociated. On the other hand, polybutadiene degraded extensively with the formation of various oxidized products and loss of material. Polybutadiene also crosslinked during exposure, which resulted in extensive crazing and cracking of the coating.

001,197
PB90-241225 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Corrosion Data for Materials Performance Characterization.
 Final rept.
 D. B. Anderson, and G. J. Laverty. 1989, 5p
 Pub. in Computerization and Networking of Materials Data Bases, ASTM STP 1017, p317-321 1989.

Keywords: *Corrosion, Materials tests, Metals, Performance, Surveys, Reprints, *Data bases, US NBS, US NIST, National Association of Corrosion Engineers.

A corrosion data program sponsored by the National Association of Corrosion Engineers and the National Institute of Standards and Technology includes computer data base development to characterize the corrosion performance of engineering materials over a wide variety of environments and exposure conditions. The important features of corrosion data are reviewed from both the data source and the user standpoints. Guidelines are provided for data input format development, multiple source data compilation, data validation and evaluation, and interpretive data output schemes.

001,198
PB90-260936 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Passivity and Passivity Breakdown in Nickel Aluminide.
 Final rept.
 U. Bertocci, J. L. Fink, D. E. Hall, P. V. Madsen, and R. E. Ricker. 1990, 9p
 Pub. in Corrosion Science 31, p471-478 1990.

Keywords: *Corrosion resistance, *Nickel alloys, *Aluminum alloys, Electrochemical corrosion, Passivity, Pitting tests, Chlorides, Sulfuric acid, Reprints.

The electrochemical behavior of ductile nickel aluminide has been examined in alkaline, acidic and neutral solutions. Conditions for passive behavior, as well as for passivity breakdown, have been defined. The experimental results are compared with those obtained with the pure constituent metals, Ni and Al. Pitting has been observed not only in chloride-containing solu-

tions, but in sulfuric acid in a certain potential range. The pitting is believed to be caused by a potential-dependent transition from the passive to the active state. The corrosion resistance of nickel aluminate appears to be similar to that of pure nickel.

001,199
PB90-271198 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Mechanisms of Deterioration in Cement-Based Materials and in Lime Mortar.
 Final rept.
 P. W. Brown. 1988, 12p.
 Pub. in Durability of Building Materials 5, n3-4 p409-420 1988.

Keywords: *Portland cements, *Lime cements, *Mortars(Material), *Air pollution, Weathering, Deterioration, Chemical reactions, Carbon dioxide, Sulfur dioxide, Nitrogen oxides, Durability, Corrosion, Reaction kinetics, Calcium oxides, Artificial weathering tests, Reprints.

The possible deterioration processes in lime mortar and in portland cement-based materials are analyzed in terms of the responses of the constituents of the materials to air pollutants. The air pollutants considered are CO₂, SO₂, and NO_x. The nature of possible chemical reactions between the pollutants and lime or cement are discussed. The factors which may limit the rate of deterioration are appraised. The effects of the reactions on durability are considered.

001,200
PB91-107292 PC A03/MF A01
 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Effect of Oxygen Transport and Resistivity of the Environment on the Corrosion of Steel.
 Final rept.
 E. Escalante, T. Oka, and U. Bertocci. Sep 90, 39p
 NISTIR-90/4266
 Sponsored by Nuclear Regulatory Commission, Washington, DC.

Keywords: *Corrosion, *Containers, *Packaging, *Stainless steels, Mass transfer, Oxygen transport mechanisms, Electrical resistivity, Graphs(Charts), Diffusion coefficients, *Radioactive waste management, Yucca Mountain, High level radioactive wastes, Spent nuclear fuels.

The study is directed at investigating the rate of corrosion and its spatial distribution, that develop under conditions where transport of oxygen and conductivity of the environment are controlled over a wide range, including low conductivity as expected in the Yucca Mountain environment. The results indicate that the corrosion rate of steel is directly related to the rate of oxygen transport over several orders of magnitude, and increasing conductivity by one order of magnitude increases corrosion rate by a factor of two or three. Of greater significance is the result that indicates that as conductivity of the environment decreases, and corrosion rate decreases, the degree of localized attack increases.

001,201
PB91-111948 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
NACE-NBS Corrosion Data Program.
 Final rept.
 D. B. Anderson. 1987, 3p
 See also PB88-193792.
 Pub. in Proceedings of Tri-Serv. Conference Corros., Tech. Rep. AFWAL-TR-87-4139, v1 p548-550 1987.

Keywords: *Corrosion, Corrosion environments, Thermodynamics, Reaction kinetics, Economic analysis, Data processing, Reprints, *Data bases.

The National Association of Corrosion Engineers (NACE) and the National Bureau of Standards (NBS) have established a collaborative program to collect, analyze, evaluate and disseminate corrosion data. The multi-faceted effort centers on compilation of computerized materials performance information and corrosion database development. A user friendly computer database combining both rate (kinetic) and stability (thermodynamic) data will be a key component with emphasis on numeric corrosion data for metals and nonmetals exposed to a wide range of industrial and laboratory environments using formats and descriptors compatible with other material property/performance

databases. Output programs include search parameters designed to give the user easy access to the required information in a number of graphical and tabular formats. Expert systems are also being developed to provide interpretive analysis to guide users in critical areas.

001,202
PB91-112011 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Role of the Oxide Film in the Transgranular Stress Corrosion Cracking of Copper.
 Final rept.
 T. B. Cassagne, J. Kruger, and E. N. Pugh. 1990, 17p.
 Contract 60NANB-6-D0601
 Sponsored by Johns Hopkins Univ., Baltimore, MD. Dept. of Materials Science and Engineering.
 Pub. in Environmentally Assisted Cracking: Science and Engineering, ASTM STP 1049, p59-75 1990.

Keywords: *Copper, *Corrosion products, *Stress corrosion, Copper oxides, Crack propagation, Polarimetry, Electrical measurement, Strain rate, Reprints, Fracture mechanics, Transgranular corrosion.

Cyclic voltammetry, ellipsometry, and slow strain rate tests have been carried out on copper monocrystals in 0.1 M sodium acetate and 1 M sodium nitrite. The studies demonstrate that the presence of an oxide film is necessary but not sufficient to induce transgranular stress corrosion cracking, and that the growth rate and other characteristics of the oxide(s) are important factors. The results are discussed in terms of the film-induced cleavage model for cracking.

001,203
PB91-112169 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Effect of Soil Resistivity and Soil Temperature on the Corrosion of Galvanically Coupled Metals in Soil.
 Final rept.
 E. Escalante. 1986, 10p
 Pub. in Galvanic Corrosion, ASTM STP 978, p193-202 1986.

Keywords: *Rusting, *Underground corrosion, *Galvanic corrosion tests, *Zinc, Hydrogen embrittlement, Oxygenation, Electrochemistry, Reprints, *Stainless steel-301, Soil temperature, Soil resistivity.

Galvanic corrosion current measurements carried out on stressed 301 stainless steel coupled to zinc at six underground test sites over a period of four years indicate that the galvanic current is controlled by soil resistivity or oxygen availability in the soil. In well aerated soils, resistivity plays a dominant role, but in poorly aerated soils, oxygen controls the corrosion process. Furthermore, at a depth of approximately 1 meter, soil resistivity is strongly influenced by soil temperature, and only slightly affected by soil moisture. Finally, 301 stainless steel in a half hard or full hard condition is susceptible to hydrogen embrittlement failure in soil when exposed to potentials capable of causing hydrogen evolution.

001,204
PB91-112524 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Building Materials Div.
Application of Thermal-Wave Electron Microscopy to Imaging and Assessment of Corrosion on Rough Steel Surface.
 Final rept.
 T. Nguyen, and C. D. Olson. 1989, 9p
 Pub. in Materials and Structures 22, n127 p71-79 Jan 89.

Keywords: *Corrosion products, *Surface chemistry, *Steels, Electron microscopy, Roughness, Thermal stresses, Humidity, Reprints, Temperature dependence, Image analysis.

Thermal-wave electron microscopy, which employs heat flow to probe variations in the thermal properties of solid materials, can provide micro-level resolutions of surface and subsurface features of opaque samples. The application of the technique to image and assess corrosion on polished and rough steel samples was investigated. Effects of phase detection, modulation frequency, surface roughness and grinding direction on the contrasts and resolutions of thermal-wave electron and SEM images of KHSO₄ and humidity-in-

duced and natural corrosion on steel surfaces were determined. The excellent contrasts between the corrosion products and surface topographic features of the images obtained by the thermal-wave electron microscopy permits the use of image analysis to quantitatively assess the extent of corrosion on rough steel surfaces.

001,205
PB91-134817 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Mechanism of Stress Corrosion Crack Growth Resistance of Al-Li-Cu Alloys: Role of Grain Boundary Precipitates.
 Final rept.
 A. K. Vasudevan, J. Liu, and R. E. Ricker. 1987, 7p
 Contract N00019-80-C-0569
 Sponsored by Naval Air Systems Command, Washington, DC.
 Pub. in Proceedings of International Conference on Environmental Degradation of Engineering Materials (3rd), University Park, PA., April 13-15, 1987, p321-327.

Keywords: *Environmental tests, *Stress corrosion, *Crack propagation, *Aluminum alloys, *Lithium alloys, *Copper alloys, Grain boundaries, Precipitation(Chemistry), Microstructure, Intergranular corrosion, Reprints.

Stress corrosion crack (SCC) growth resistance of Al-Li-Cu alloys was studied. Two alloys (Al-2Li-3Cu and Al-3Li-1Cu), having different (Li/Cu) ratios, were selected for the study to observe the differences in the SCC behavior. The compositional and microstructural differences between these two alloys differ significantly, but the SCC growth behavior are similar. It is described that the mechanistic aspects of the behavior are similar, even though in both the alloy systems the type and morphology of the matrix and grain boundary (gb) microstructures and their subsequent interaction with the environment are different. In both the Al-Li-Cu alloys, the gb precipitates play a significant role in the SCC characteristics. Attempts are made to separate these contributions by using reversion techniques in Al-Li-Cu alloy, where some of the matrix precipitates are dissolved leaving behind the gb precipitates.

Elastomers

001,206
PB90-254574 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Localization Model of Rubber Elasticity. 2.
 Final rept.
 R. J. Gaylord, and J. F. Douglas. 1990, 6p
 Pub. in Polymer Bulletin 23, p529-533 1990.

Keywords: *Elastomers, Elastic properties, Mathematical models, Crosslinking, Polymers, Position(Location), Spatial distribution, Free energy, Statistical mechanics, Vulcanized elastomers, Reprints, Elasticity, Network analysis.

The effect of the spatial localization of a network chain by surrounding chains is incorporated into the chain probability distribution function and the network free energy is then calculated using the statistical mechanical formalism for constrained systems. In addition to a term having the classical 'Gaussian' form, the resulting expression contains another term which depends on both the cross-link density of the network and the plateau modulus of the uncross linked melt.

001,207
PB90-254640 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Microstructure and Isotopic Labeling Effects on the Miscibility of Polybutadiene Blends Studied by the Small-Angle Neutron Scattering Technique, 1990.
 Final rept.
 C. C. Han, H. Hasegawa, T. Hashimoto, I. G. Hargis, and S. L. Aggarwal. 1990, 7p
 See also PB90-192568.

Elastomers

Pub. in Proceedings of Materials Research Society Symposium, Boston, MA., November 27-December 2, 1989, p469-474 1990.

Keywords: *Polybutadiene, *Elastomers, Polymers, Deuterium, Isotopic labeling, Microstructure, Meetings, Hydrogen, Neutron scattering, Solubility, Binary systems(Materials), Reprints, *Polymer blends, Small angle scattering.

Deuterated polybutadiene and protonated polybutadiene (PBD/PBH) blends with various microstructures have been studied by the small-angle neutron scattering experiments. Correlation length, zero-wavenumber structure factor, and interaction parameter have been obtained. All PBD/PBH blends exhibit UCST behavior. With the use of random copolymer theory, the interaction parameter, has been successfully separated into interaction parameters between the same isotope labeled 1,2-unit and 1,4-unit, opposite isotope labeled 1,2-unit and 1,4-unit, and opposite isotope labeled 1,2-unit with 1,2-unit or 1,4-unit with 1,4-unit, respectively.

Fibers & Textiles

001,208
PB90-153487 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Small-Angle Neutron Scattering Study for Characterizing the Water Sorbed in High Speed Spun Poly(Ethylene Terephthalate) Filaments.

Final rept.
H. Hasegawa, T. Hashimoto, M. Fukuda, H. Kawai, and C. C. Han. 1989, 8p
Pub. in Jnl. of the Society of Fiber Science and Technology 45, n11 p447-454 1989.

Keywords: *Neutron scattering, *Moisture content, *Adsorptivity, *Monofilaments, *Spun yarns, *Polyethylene terephthalate, Surface properties, Vapor pressure, Reprints, *Small angle scattering, Characterization, High speed.

Small-angle neutron scattering (SANS) from a particular specimen of high-speed spun poly(ethylene terephthalate) (PET) filaments at a spinning rate of 9000 m/min was investigated under three different conditions, i.e., dried in vacuum, or moistened with D2O or H2O at saturated vapor pressure at 30 C. The results of the SANS experiments strongly suggests that there must be specific regions where the sorbed moisture is condensed to form clusters. The results did not necessarily deny the existence of the moisture sorbed in the amorphous region of PET with less interaction than in the liquid state, as suggested from a good linear relationship between the degree of non-crystallinity and the moisture up-take obeying the Henry's solution law for a series of high-speed spun filaments. The SANS from such a phase of moisture dissolved uniformly in the amorphous region is too weak in its contrast to be consistent with the detected scattering intensities. Moisture sorption in the particular specimen may be described as follows: with increase in the vapor pressure, at first the moisture is uniformly dissolved in the amorphous region of PET to a certain extent (solution component), and then the moisture is condensed in localized regions such as voids to form the water clusters (condensation component).

Iron & Iron Alloys

001,209
PB90-136789 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Noncontact Ultrasonic Sensors for High Temperature Process Control.

Final rept.
G. A. Alers, and H. N. G. Wadley. 1987, 17p
Pub. in Proceedings of Conference on Intelligent Processing of Materials and Advanced Sensors, Orlando, FL., October 5-9, 1986, p85-101 1987.

Keywords: *Ultrasonic tests, *Detectors, *High temperature tests, *Process control, *Steel making, Microstructure, Stainless steels, Nondestructive tests, Switched lasers, Magnetic transducers, Electroacoustic transducers.

Ultrasound has been used to infer much about the internal condition of materials (temperature, grain size, texture, porosity, defects, residual stress etc.). To date, the determination has been confined to studies under laboratory conditions. If ultrasonic techniques could be developed that could survive the high temperature aggressive environment of a materials processing facility, the possibility exists of developing a family of process control sensors to directly probe microstructure and process variables. The paper reports on the results of a joint AISI/NBS/Magnasonics program to investigate the feasibility of using a Q-switched laser as a source of ultrasound and an Electromagnetic Acoustic Transducer (EMAT) for its detection on hot steel bodies. A variety of permanent magnet EMAT designs have been evaluated. Direct transmission experiments on both plain carbon and austenitic stainless steels heated to as high as 980 C (1800F) confirmed for several of the EMATs, adequate signal-to-noise ratios and bandwidths for sensor purposes.

001,210
PB90-146549 PC A03/MF A01
Carnegie-Mellon Univ., Pittsburgh, PA.

Intelligent Processing for Primary Metals.

Special pub. (Final).
A. Cramb, W. E. Eckhart, D. Watanapongse, J. Early, J. Kor, R. Sussman, and A. V. Clark. Nov 89, 48p
NIST/SP-772

Also available from Supt. of Docs. as SN003-003-02981-5. Library of Congress catalog card no. 89-600773. Report on a workshop held in Gaithersburg, MD, on August 29-30, 1989. Prepared in cooperation with Department of Energy, Washington, DC., American Iron and Steel Inst., Washington, DC., Inland Steel Co., East Chicago, IN., Timken Co., Canton, OH., and ARMCO, Inc., Middletown, OH.

Keywords: *Steels, *Aluminum, *Copper, *Meetings, Processing, Process control, Mathematical models, Detectors, Research projects.

The industry-led workshop highlighted the recent important advances in sensing, modeling, and process control, identified areas of application in primary metals production, and developed a strategy for implementation of research results. Industry, university, and government participants assessed information provided by researchers and operating staff from industry and developed a research agenda for coupling the advancing state of materials processing in the primary metals industries.

001,211
PB90-170671 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Ultrasonic Method for Measuring Internal Temperature Distributions in Steel or Aluminum.

Final rept.
H. N. G. Wadley, S. J. Norton, F. A. Mauer, and B. E. Droney. 1986, 18p

Sponsored by American Iron and Steel Inst., Washington, DC.

Pub. in Proceedings of the Aluminum Association Workshop on Sensors, May 13-14, 1986, p73-90.

Keywords: *Ultrasonic waves, *Nondestructive tests, *Steels, *Aluminum, *Temperature distribution, *Heat measurement, Cooperation, Process control, Detectors, Algorithms, Thermal analysis, Reprints, American Iron and Steel Institute, National Institute of Standards and Technology, Temperature dependence, Time-of-flight spectrometers.

The temperature dependence of ultrasonic velocity is being used for sensing the internal temperature distribution in steel as a part of a collaborative effort between the National Bureau of Standards (NBS) and the American Iron and Steel Institute (AISI) to develop advanced process control sensors. Reconstructions of the temperature distribution are based on non-contacting measurements using a Q-switched Nd:YAG laser to generate an ultrasonic pulse and an electromagnetic acoustic transducer (EMAT) to detect its arrival. Time-of-flight (TOF) measurements are made for a number of paths sampling a cross section of the body. It was found that in order to minimize the number of measurements required it is important to incorporate a priori heat flow information into the tomographic algorithms used to reconstruct the temperature. To date, manual measurements have been used to demonstrate the feasibility of the method. Full automation of the measurements using a laboratory microcomputer is underway and will permit data for reconstructing a temperature profile to be obtained in a few seconds.

001,212
PB90-170689 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Process Control Sensors: Status of AISI (American Iron and Steel Institute) Collaborative Programs.

Final rept.
H. N. G. Wadley. 1986, 12p
Pub. in Proceedings of the Vacuum Metallurgy Conference, p195-206 1986.

Keywords: *Process control, *Steel making, *Detectors, Cooperation, Research projects, Liquid metals, Porosity, Pipes(Tubes), Surface defects, Reprints, American Iron and Steel Institute, Interlaboratory comparisons.

The American Iron and Steel Institute (AISI) is engaged in several collaborative research programs whose objective is the development of process control sensors. The multi-disciplinary research programs feature an unusual level of cooperation between individual AISI member companies, other metals industries, federal laboratories, universities and vendor companies. The paper discusses the factors that led to the conception, the development and their present status and also addresses the future directions the programs may take.

001,213
PB90-187816 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Fracture and Deformation Div.

Low-Temperature Magnetic-Elastic Anomalies in FCC (Face-Centered-Cubic) Fe-Cr-Ni Alloys.

Final rept.
H. Ledbetter. 1989, 5p
Pub. in Physica B 161, p91-95 1989.

Keywords: *Austenitic stainless steels, Magnetic permeability, Face centered cubic lattices, Low temperature tests, Ultrasonic tests, Measurement, Cryogenics, Phase transformations, Neel temperature, Interstitials, Abnormalities, Elastic properties, Reprints, *Chromium-Nickel steels, Carbon additions, Nitrogen additions, Temperature dependence, Ducastelle model, Magnetic susceptibility.

Using ultrasonic methods, the complete elastic constants of several polycrystalline face-centered-cubic Fe-Cr-Ni alloys were measured at low temperatures: 4-295 K. The alloys represent nine interstitial (carbon-plus-nitrogen) compositions. Dc magnetic susceptibility was also measured. Upon cooling, a paramagnetic-antiferromagnetic (Neel) phase transition occurs. The Neel transition temperature depends strongly on interstitial content. Both composition and temperature effects were fitted to Ducastelle's 3d-electron model, which contains two terms, band-structure and repulsive energies.

001,214
PB90-206111 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

X-ray Diffraction Studies of Amorphous (Fe(sub 1-x)Ni(sub x))(sub 77)Si(sub 10)B(sub 13) Alloys.

Final rept.
S. C. Yu, J. W. Lynn, and B. W. Lau. 1987, 6p
Pub. in Jnl. of Non-Crystalline Solids 94, n2 p203-208 Nov 87.

Keywords: *Nickel steels, *Iron alloys, Atomic structure, X ray diffraction, Reprints, Amorphous state, Silicon additions, Boron additions, Diffraction patterns.

The atomic structures of single roll-quenched amorphous (Fe_(1-x)Ni_x)₇₇Si₁₀B₁₃ (atomic fraction, 0 LT or = x LT or = 1) alloys have been studied by X-ray diffraction. Interference functions, atomic distribution functions, and radial distribution functions were calculated from the data. The nearest neighbor distance decreases from 2.540 + or - 0.005 A for x = 0 (Fe₇₇Si₁₀B₁₃) to 2.490 + or - 0.005 A for x=1 (Ni₇₇Si₁₀B₁₃), while the average coordination number of 12.50 + or - 0.15 is independent of x. The results are consistent with the measured densities of the sample, which are found to increase with increasing Ni content.

001,215
PB90-206871 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.

Weld Cracking in Massive Steel Forgings.

Final rept.
T. A. Siewert, R. P. Reed, D. A. Shepherd, and S. P. Sobczynski. 1989, 8p
Sponsored by Fermi National Accelerator Lab., Batavia, IL.
Pub. in *Welding Jnl.* 68, n10 p23-30 Oct 89.

Keywords: *Steels, *Forgings, *Weldments, Crack propagation, Hydrogen, Failure, Structural analysis, Toroids, Reprints, Fracture mechanics, Fermilab accelerator.

The National Institute of Standards and Technology received a request to assist in the evaluation of intermittent weld cracking problems during the construction of a massive steel toroid at Fermilab. The report describes the toroid, a first-hand inspection of the cracking in the structure, an analysis of the cracking, and an appropriate solution.

001,216
PB90-207796 PC A03/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Mechanical Properties and Fracture Toughness of AAR (Association of American Railroads) TC128 Grade B Steel and a Micro-Alloyed, Control-Rolled Steel, A 8XX Grade B, from -80F to +73F.
G. E. Hicho, and J. H. Smith. Apr 90, 45p NISTIR-90/4289, REPT-19
Sponsored by Federal Railroad Administration, Washington, DC. Office of Research and Development.

Keywords: *Steels, Mechanical properties, Toughness, Crack propagation, Tank cars, Microscopy, Charpy, Notch strength, Impact tests, Low temperature tests, Tables(Data), Tensile strength, Ductility, Microstructure, Grain size, Fracture mechanics, J integral.

Mechanical property and fracture toughness tests were conducted on two steels from -80 F to +73 F. The two steels examined were normalized and inclusion shape controlled AAR (Association of American Railroads) TC128 grade B steel and control-rolled and inclusion shape controlled A 8XX grade B steel. The tensile properties of the A 8XX steel were better than a A 8XX steel. However, the notch toughness, as determined by Charpy V-notch, NDT temperature, and J-integral tests, of the AAR TC 128 grade B steel was better than that of the A 8XX grade B steel. Unstable cleavage fracture was the predominate mode of failure of the A 8XX steel at low test temperatures. Metallographic investigations also showed that the ferrite/pearlite grain size of the AAR TC128 steel was more uniform and finer than that of the A 8XX steel.

001,217
PB90-207804 PC A03/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Determination of the NDT (Nil-Ductility Transition) Temperature and Charpy V-Notch Impact Properties of AAR (American Association of Railroads) TC128 Grades B Steel and A 8XX Grade B Steel.
G. E. Hicho, and J. H. Smith. Apr 90, 31p NISTIR-4300, REPT-20
Sponsored by Federal Railroad Administration, Washington, DC. Office of Research and Development.

Keywords: *Steels, Impact tests, Ductility, Tank cars, Nondestructive tests, Transition temperature, Grain size, Microstructure, Graphs(Charts), Tables(Data).

Charpy V-notch impact tests and the nil-ductility transition (NDT) temperature were redetermined for two steels. The two steels examined were normalized and inclusion shape controlled AAR (American Association of Railroads) TC128 grade B steel and control-rolled and inclusion shape controlled A 8XX grade B steel. The notch toughness, as determined by Charpy V-notch impact test, and the NDT temperature of the AAR TC128 grade B steel was found again to be better than that of the A8XX grade B steel. Metallographic investigations showed that the ferrite/pearlite grain size of the AAR TC128 grade B steel was more uniform and finer than that of the A 8XX grade B steel. Charpy V-notch impact results and NDT temperatures, presented in an earlier report were confirmed. Plate chemistry and test specimen orientation were also confirmed.

001,218
PB90-218462 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO.
Fracture and Deformation Div.

Austenitic Stainless Steels with Emphasis on Strength at Low Temperatures.

Final rept.
R. P. Reed. 1988, 33p
Pub. in *Alloying*, p225-256 1988.

Keywords: *Austenitic stainless steels, Low temperature tests, Strength, Phase transformations, Martensite, Reprints, Nitrogen additions.

The structure and properties of austenitic stainless steels are reviewed, with emphasis on their low-temperature behavior. Austenite, ferrite, body-centered cubic and hexagonal closed-packed martensite, stacking-fault energy, carbides, and sigma phase are described. Recent international development of higher strength, tougher austenitic stainless steels is summarized. The chapter also includes discussions of the effect of martensite phase transformations on the stress-strain characteristics, nitrogen strengthening, and strengthening theory based on lattice-parameter and elastic-property data, all at low temperatures.

001,219
PB90-219619 PC A05/MF A01
National Inst. of Standards and Technology, Boulder, CO.
Guidelines for Pressure Vessel Safety Assessment.
Special pub. (Final).
S. Yukawa. Apr 90, 77p NIST/SP-780
Sponsored by Occupational Safety and Health Administration, Washington, DC.

Keywords: *Storage tanks, *Pressure vessels, *Steels, Regulations, Safety engineering, Design criteria, Crack propagation, Visual inspection, Nondestructive tests, Tanks(Containers), Fracture mechanics, Recommendations.

The document presents a technical overview and information on metallic pressure containment vessels and tanks. The intent of the document is to provide OSHA (Occupational Safety and Health Administration) personnel and other persons with information to assist in the evaluation of the safety of operating pressure vessels and low pressure storage tanks. The scope is limited to general industrial application vessels and tanks constructed of carbon or low alloy steels and used at temperatures between -75 and 315 C (-100 and 600 F). Information on design codes, materials, fabrication processes, inspection and testing applicable to the vessels and tanks are presented. The majority of the vessels and tanks are made to the rules and requirements of ASME Code Section VIII or API Standard 620. The causes of deterioration and damage in operation are described and methods and capabilities of detecting serious damage and cracking are discussed. Guidelines and recommendations formulated by various groups to inspect for the damages being found and to mitigate the causes and effects of the problems are presented.

001,220
PB91-112607 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.
Low-Temperature Properties of High-Manganese Austenitic Steels.
Final rept.
R. P. Reed, P. T. Purtscher, and L. A. Delgado.
1987, 10p
Pub. in *High Manganese Austenitic Steels*, p13-22 1987.

Keywords: *Manganese steels, *Austenitic stainless steels, *Cryogenics, Superconducting magnets, Toughness, Strength, Mechanical properties, Japan, Reviews, Phase transformations, Reprints.

The low-temperature properties of high-Mn austenitic steels are reviewed. Emphasis is placed on strength, toughness, elastic properties, thermal expansion, and magnetic properties, those properties most critical for materials used in cryogenic structures. Strength and toughness parameters and mechanisms are discussed, including alloying, martensitic transformations, twinning, and grain size. Information is included from many recent studies, particularly Japanese studies, of alloy development for superconducting magnet applications at 4 K.

Lubricants & Hydraulic Fluids

001,221
PATENT-4 919 829 Not available NTIS
Department of Commerce, Washington, DC.
Aluminum Hydroxides as Solid Lubricants.
Patent.
R. S. Gates, and S. M. Hsu. Filed 30 Dec 88, patented 24 Apr 90, 1p PB91-167734, PAT-APPL-7-292 176

Keywords: *Patents, *Aluminum hydroxides, *Lubricants, PAT-CL-252-25, PAT-CL-252-18, PAT-CL-423-625.

Aluminum hydroxides are used as solid lubricants for aluminum oxides, ceramics and other materials having oxide surfaces. Aluminum oxide hydroxides and aluminum trihydroxides are preferred compositions for such lubricating purposes. In particular, the use of boehmite in an aqueous solution significantly reduces frictional coefficients between contacting surfaces.

001,222
PB90-169921 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
High Temperature Lubricants from Biodeuterated Materials Produced by Algae.
Final rept.
R. A. Neihof, R. G. Munro, and M. M. Ross. 1987, 1p
Pub. in *Abstracts of Papers of the American Chemical Society* 194, n8 Aug 87.

Keywords: *Deuteration, *Biological products, *High temperature lubricants, *Algae, Stabilization, Lubricating oils, Performance evaluation, Hydrocarbons, Reprints.

Biodeuteration has been shown to be an effective means of enhancing the oxidation stability and antiwear performance of a lubricating hydrocarbon base oil. Substitution of deuterium for hydrogen in a compound results in a kinetic isotope effect which has been shown to be responsible for increasing the oxidation resistance of lubricant base stocks. In the investigation a biotechnological approach was applied to the production of deuterated compounds suitable for lubricant synthesis. From algae grown in heavy water (D sub 0) and supplied only with mineral salts, carbon dioxide, and light, it was possible to isolate fatty acids which were over 98% deuterated and constituted 50-60% of the dry weight of the organisms. By appropriate choices of organism and growth conditions, fatty acids could be obtained with suitable deuterocarbon chain length and double bond density for the synthesis of a variety of lubricants. Performance of the deuterated base oil relative to the undeuterated oil was evaluated using a set of tests.

Materials Degradation & Fouling

001,223
PATENT-4 830 917 Not available NTIS
National Inst. of Standards and Technology, Gaithersburg, MD.

Production of Microporous Finely Divided Matrix Material with Nuclear Tracks from an Isotropic Source and Product Thereof.

Patent.
B. S. Carpenter, C. Horvath, and C. R. Vogt. Filed 22 May 86, patented 16 May 89, 6p PB90-145855, PAT-APPL-6-866 334
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Patents, *Porosity, *Neutron irradiation, *Physical radiation effects, Composite materials, Polymers, Glass, Dielectric properties, Fission products, Isotropy, Uranium 235, Etching, Powder(Particles), Oxides, *Microporosity, *Fission tracks, *Matrix materials, Uranium 238, Thorium 232, Lithium 7, Boron 10, Particle tracks.

The present invention relates to the production of a finely divided matrix material having substantially uniform porosity about the surface thereof and having micropores of controlled size and number density. The

microporous matrix material is produced with charged particle tracks resulting from an isotropic source, a portion of which tracks break the surface of the matrix material, followed by etching the latent tracks to produce pores of the desired size. The isotropic source must be selected such that it emits charged particles capable of leaving a damage track in the matrix material and includes selected nuclides which emit protons, tritons, alphas and fission fragments such as U-235, U-238, Th-232, L-7, B-10 and the like. Neutrons are selected as the irradiation source to trigger the isotropic source because of their high penetrability such that bulk quantities of matrix material can be subjected to very uniform radiation.

001,224
PB90-170077 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD, Metallurgy Div.
Initial Frictional Behavior during the Wear of Steel, Aluminum, and Poly(Methyl Methacrylate) on Abrasive Papers.
 Final rept.
 P. J. Blau, E. P. Whitenon, and A. Shapiro. 1988, 20p
 Pub. in *Wear* 124, p1-20, 16 May 88.

Keywords: *Sliding friction, *Wear tests, *Steels, *Aluminum, *Polymethyl methacrylate, *Abrasive papers, Mathematical models, Polishing, Reprints, Reciprocation, Stainless steel-521, Aluminum 2014-T4.

A series of experiments was conducted to investigate and model the friction break-in behavior for unlubricated reciprocating sliding of AISI 52100 steel, 2014-T4 A1, and poly(methyl methacrylate) on metallographic polishing papers. A ball-on-flat arrangement was used. Two representations of an analytical model were used, one of which had the capability to account for longer term friction transitions due to paper loading. Basic shapes of friction vs. cycle number curves were similar; however, the poly(methyl methacrylate) and A1 had larger changes during break-in and displayed longer term effects of paper loading.

001,225
PB90-185570 PC A25/MF A04
 National Inst. of Standards and Technology, Boulder, CO.
Laser Induced Damage in Optical Materials: 1988.
 Special pub.
 H. E. Bennet, A. H. Guenther, B. E. Newnam, and M. J. Soileau. Oct 89, 577p NIST/SP-775
 Also available from Supt. of Docs. as SN003-003-02999-8. See also PB89-221162. Proceedings of Symposium on 'Optical Materials for High-Power Lasers', Boulder, CO, Oct. 26-28, 1988. Library of Congress catalog card no. 89-600878. Prepared in coop. with American Society for Testing and Materials, Philadelphia, PA., Defense Advanced Research Projects Agency, Arlington, VA., Department of Energy.

Keywords: *Optical materials, *Meetings, Thin films, Surface properties, Irradiation, Laser beams, Physical radiation effects, *Laser damage.

The Twentieth Annual Symposium on Optical Materials for High Power Lasers (Boulder Damage Symposium) was held at the National Institute of Standards and Technology in Boulder, Colorado, October 26-28, 1988. The Symposium was held under the auspices of the ASTM Committee F-1, Subcommittee on Laser Standards, with the joint sponsorship of NIST, the Defense Advanced Research Project Agency, and the Department of Energy. Particular emphasis was given to materials for high-power apparatus. The wavelength range of prime interest was from 10.6 micrometers to the uv region. Highlights included surface characterization, thin film-substrate boundaries, and advances in fundamental laser-matter threshold interactions and mechanisms.

001,226
PB90-187618 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Materials Characterization Using Neutrons.
 Final rept.
 R. F. Fleming. 1986, 4p
 Pub. in Proceedings of NCSL Workshop and Symposium on 25 Years of Measurement Progress, Gaithersburg, MD., October 6-9, 1986, p35-1-35-4.

Keywords: *Materials, *Neutron irradiation, Radioactivation analysis, Neutron reactions, Neutron absorption,

Neutron activation analysis, Nondestructive tests, Physical radiation effects, Gamma rays, Reprints, Characterization.

Neutrons offer unique advantages for materials characterization in that they interact with only the nuclei in a sample and so are completely insensitive to the details of the electron distribution. The use of neutrons to measure the total number of atoms of a particular element in a sample by radioactivation (neutron activation analysis) has been available for fifty years. An analogous method exploiting the instantaneous radiation emitted when the nucleus absorbs a neutron (prompt gamma activation analysis) has become widely available during the last ten years. More recently, techniques have been developed which use neutron induced reactions to map the distribution of atoms within the sample nondestructively. Some advantages and disadvantages of each of the approaches are discussed. The impact on these techniques of the advent of intense beams of cold neutrons is presented.

001,227
PB90-193558 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD, Metallurgy Div.
Comparison of Methods for Determining Wear Volumes and Surface Parameters of Spherically Tipped Sliders.
 Final rept.
 E. P. Whitenon, and P. J. Blau. 1988, 19p
 Pub. in *Wear* 124, n3 p291-309, 15 Jun 88.

Keywords: *Wear, *Sliding, *Surface properties, *Surface defects, *Dimensional analysis, Sliding friction, Measurement, Surfaces, Friction, Reprints.

The purpose of the paper is to investigate some of the methods of determining the wear volume and geometric surface parameters of a scar resulting from sliding either a sphere or spherically tipped pin on a nominally flat surface. There are several broad classes of methods for making this type of measurement. In the paper the authors briefly describe these classes in general and then use abrasive wear data to illustrate three specific techniques in detail: two dimensional analysis done either manually or with an image analyzer, three dimensional analysis where the X,Y,Z points came from a stylus type profiling instrument, and three dimensional analysis where the X,Y,Z points were estimated from a two dimensional projection obtained from a specially programmed image analyzer.

001,228
PB90-222720 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Study of Meteorological Processes Important in the Degradation of Materials through Surface Temperature.
 Technical note (Final).
 S. C. Saunders, M. A. Jensen, and J. W. Martin. Apr 90, 47p NIST/TN-1275
 Also available from Supt. of Docs. Prepared in cooperation with Scientific Consulting Services, Pullman, WA.

Keywords: *Service life, *Mathematical models, *Protective coatings, Degradation, Weathering, Materials, Surface temperature, Meteorological data, Statistical analysis, Diurnal variations, Computer programs, Fourier analysis, Stochastic processes, Exposure, Environmental tests, SIMUL computer program, Energy balance.

One of the greatest impediments in forecasting the service life of a material exposed outdoors is the uncontrolled and non-predictable nature of the ambient factors comprising its environment. This contributes to the difficulty of establishing the cause-and-effect relationship between these factors and the rate of material degradation. To surmount these difficulties it is necessary to characterize quantitatively each of the factors comprising the exposure environment which are thought to be important in the material's degradation. The selection and quantification of these factors must accommodate not only the periodicity of the diurnal cycle but its statistical fluctuation. The objective of the research is to develop a general mathematical model, through Fourier analysis, characterizing the diurnal variation in the primary factor, material temperature. This factor is felt to be important in the degradation of a wide range of materials and protective systems, including coated steel panels. The steps taken and problems encountered in developing such a model are outlined. It is concluded that the simulated data generated

from the model display virtually the same stochastic behavior as does the real data and that, if appropriate meteorological records are available, it will be possible to characterize and reproduce the statistical behavior for any locality, season and panel orientation.

001,229
PB91-112318 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD, Metallurgy Div.
Mechanisms of Galling and Abrasive Wear.
 Final rept.
 L. K. Ives, M. B. Peterson, and E. P. Whitenon. 1987, 25p
 Sponsored by Oak Ridge National Lab., TN.
 Pub. in Proceedings of Fossil Energy Materials Program Conference, Oak Ridge, TN., May 19, 1987, p397-421.

Keywords: *Galling, *Abrasion, *Copper aluminum alloys, Crystal structure, Fossil fuels, Sliding friction, Crystal defects, Valves, Reprints, Energy conversion, Stacking faults, Laboratory tests.

Galling is a severe form of wear which has been recognized as a serious problem affecting the operation of control valves and other components used in fossil energy conversion systems. Recent results obtained in a program of research aimed at advancing the basic understanding of the process of galling are presented. The galling test method and a method which has been developed to measure quantitatively the amount and character of galling damage are described. Data on the galling behavior of pure metals, experimental alloys, and commercial alloys are presented. The influence of hardness, crystal structure, stacking fault energy and other materials properties are discussed.

001,230
PB91-117994 Not available NTIS
 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Metallurgy Div.
Environment-Induced Cracking of Copper Alloys.
 Final rept.
 U. Bertocci, E. N. Pugh, and R. E. Ricker. 1989, 13p
 Pub. in Environment-Induced Cracking of Metals Proceedings, p273-285 1989.

Keywords: *Stress corrosion, *Copper zinc alloys, Cracking(Fracturing), Ammonia, Brasses, Reprints, Aqueous solutions.

The path of stress corrosion cracking (SCC) in alpha-phase copper alloys can be intergranular (IGSCC) or transgranular (TGSCC), but there is no consensus as to whether these correspond to two different mechanisms. Since research into the mechanism(s) of environment-induced cracking of copper alloys has focused overwhelmingly on alpha-brass in aqueous ammonia and since both forms of cracking are observed in this system, the paper deals primarily with this system. The characteristics of IGSCC in brass are consistent with cracking occurring by the film-rupture (or slip-dissolution) mechanism. TGSCC, on the other hand, is thought to proceed by discontinuous cleavage, with an average crack velocity on (110) planes of, typically, 10 to the 7th power m/s. The mechanism by which the environment induces brittle failure in the ductile face-centered cubic metal has not been established, but several have been proposed. Hydrogen embrittlement is an attractive mechanism in that it can account for the kinetics of propagation and for the repeated crack arrests. However, modeling of the chemistry within the crack indicates that hydrogen discharge is unlikely for copper-zinc in aqueous ammonia and impossible for copper-gold in ferric chloride. An alternative mechanism for TGSCC proposes that a thin epitaxial film, such as an oxide or dealloyed layer, forms at the crack tip and triggers brittle fracture.

001,231
PB91-118448 Not available NTIS
 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD, Metallurgy Div.
Hydrogen Embrittlement of Ductile Nickel Aluminum during Corrosion in Aqueous Solutions.
 Final rept.
 R. E. Ricker, M. R. Stoudt, and J. L. Fink. 1990, 8p
 Pub. in Hydrogen Effects on Materials Behavior, p499-506 1990.

Keywords: *Hydrogen embrittlement, Ductility, Stress corrosion, Cracking(Fracturing), Acidity, Alkalinity,

Nickel alloys, Reprints, *Intermetallic compounds, Nickel aluminate, Aqueous solutions.

Ductile nickel aluminate, Ni₃Al+B, is an intermetallic alloy with high strength and ductility making it a promising structural material for both high and low temperature applications. However, the susceptibility of this material to embrittlement by hydrogen absorbed during normal corrosion processes in aqueous environments may limit the application of this material. As a result, a study was undertaken which was focused on evaluating the possibility that hydrogen could be absorbed into Ni₃Al from aqueous solutions during corrosion and cause embrittlement (stress corrosion cracking). The results demonstrate that ductile nickel aluminate can absorb hydrogen during free corrosion in low pH solutions and during polarization in neutral and alkaline solutions. Absorbed hydrogen was found to significantly reduce ductility and to promote intergranular fracture.

Miscellaneous Materials

001,232
PB90-152562 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Thermophysics Div.

Measurement and Formulation of the Thermodynamic Properties of Refrigerants 134a (1,1,1,2-Tetrafluoroethane) and 123 (1,1-Dichloro-2,2,2-Trifluoroethane).

Final rept.
M. O. McLinden, J. S. Gallagher, L. A. Weber, G. Morrison, D. Ward, A. R. H. Goodwin, M. R. Moldover, J. A. Schmidt, H. B. Chae, T. J. Bruno, J. F. Ely, and M. L. Huber. 1989, 21p
Sponsored by Department of Energy, Washington, DC., Environmental Protection Agency, Washington, DC., and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.
Pub. in ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Transactions 95, pt2 p263-283 1989.

Keywords: *Refrigerants, *Thermodynamic properties, Equations of state, Liquid saturation, Vapor pressure, Specific heat, Measurement, Temperature, Critical point, Interfacial tension, Reprints.

The thermodynamic properties of R134a and R123 are formulated using a modified Benedict-Webb-Rubin (MBWR) equation of state fit to experimental measurements of the critical point, vapor pressure, saturated liquid and vapor volumes, superheated pressure-volume-temperature (p-V-T) behavior, and second virial coefficients derived from p-V-T and sound speed measurements. The heat capacity of the ideal gas reference state is determined from sound speed measurements on the low density vapor. Surface tensions are also presented. The experimental methods and results are summarized, compared to the property formulation and, where possible, compared to other sources in the literature. Tables and diagrams of the thermodynamic properties of R134a and R123, prepared using the MBWR equation of state, are presented.

001,233
PB90-217795 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Thermophysics Div.
Surface Tension of Refrigerants R123 and R134a.
Final rept.
H. B. Chae, J. W. Schmidt, and M. R. Moldover.
1990, 3p
Pub. in Jnl. of Chemical and Engineering Data 35, n1 p6-8 Jan 90.

Keywords: *Refrigerants, Interfacial tension, Measurement, Chlorohydrocarbons, Capillarity, Fluorohydrocarbons, Reprints.

The surface tensions of two environmentally acceptable refrigerants (R123, 2,2-dichloro-1,1,1-trifluoroethane; and R134a, 1,1,1,2-tetrafluoroethane) were measured with a differential capillary rise technique. Measurements span the temperature range -25 to +140 C for R123 and -10 to +95 C for R134a.

001,234
PB90-235003 PC A04/MF A01

National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Building Environment Div.
Experimental Evaluation of Two Nonazeotropic Refrigerant Mixtures in a Water-to-Water, Breadboard Heat Pump.

M. Kauffeld, W. Mulroy, M. McLinden, and D. Didion.
Jun 90, 64p NISTIR-90/4290
Prepared in cooperation with Oak Ridge National Lab., TN., and Martin Marietta Energy Systems, Inc., Oak Ridge, TN. Sponsored by Department of Energy, Washington, DC.

Keywords: *Refrigerants, *Mixtures, *Heat pumps, Heat exchangers, Thermodynamic properties, Enthalpy, Air conditioning, Refrigerating, Refrigerating machinery, Temperature, Test facilities.

An experimental, water-to-water, breadboard heat pump apparatus, that is one which could easily be re-configured, was constructed for comparison of pure R22 to the mixture R22/R114 and R13/R12. Three evaporator configurations were extensively studied. In all cases, the best mixture outperformed R22. The best efficiency with R22/R114 was 32% higher and with R13/R12 was 16% higher than the best efficiency measured with R22. Other observations were, first, mixtures can take advantage of heat exchanger efficiency that, in a gliding temperature application, a pure refrigerant is incapable of utilizing. Secondly, heat exchange between the condensed and evaporating refrigerant is beneficial to some mixed refrigerants. Finally, mixtures exhibit nonlinearity of enthalpy versus temperature in the two phase region which has significant impact on both heat exchanger and cycle design.

001,235
PB90-241290 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Automated Production Technology Div.

Pulsed Ultrasonic Velocity Method for Determining Material Dynamic Elastic Moduli.

Final rept.
G. V. Blessing. 1990, 11p
Pub. in Dynamic Elastic Modulus Measurements in Materials, ASTM STP 1045, p47-57 May 90.

Keywords: *Ultrasonic tests, *Nondestructive tests, *Dynamic modulus of elasticity, Velocity measurement, Sonic tests, Materials, Precision, Steels, Grain size, Reprints, Elastodynamics, Pulse techniques.

Material dynamic elastic moduli can be readily obtained from a knowledge of the material's sound velocity(s) and density. One well-established ultrasonic technique for making the velocity measurements is the pulsed-wave transit-time technique. It is a versatile and potentially very accurate technique that can also assess the material elastic homogeneity and anisotropy. Here the many measurement and material factors affecting the precision of the method are addressed. A specific example of the effect of grain size on measurements in steel is presented in some detail.

001,236
PB91-101568 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD.

Materials Research Laboratories: Reviewing the First Twenty-Five Years.

Final rept.
L. H. Schwartz. 1987, 14p
Sponsored by National Science Foundation, Washington, DC. Materials Research Labs.
Pub. in Advancing Materials Research, p35-48 1987.

Keywords: *Research projects, *Materials tests, *Laboratories, Reprints, National Science Foundation.

The Materials Research Laboratories (MRLs) originally established by Advanced Research Projects Agency and now a program of the National Science Foundation, mark their twenty-fifth anniversary in 1985. The article reviews the history of the MRLs, discusses strengths and weaknesses, catalogs some of their extensive accomplishments, and speculates about the impact on the field of materials research and on the university research environment.

001,237
PB91-112193 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

Inception and Structure of Prebreakdown Streamers in Perfluorinated Polyethers.

Final rept.
C. Fenimore, K. L. Stricklett, H. Yamashita, H. Kawai, and E. O. Forster. 1990, 6p
Sponsored by Department of Energy, Washington, DC. Pub. in Conference Record of the International Conference on Conduction and Breakdown in Dielectric Liquids (10th), Grenoble, France, September 10-14, 1990, p430-435.

Keywords: *Polyethers, *Fluorine organic compounds, *Dielectric breakdown, Liquids, Measurement, High voltage, Gases, Electric discharges, Reprints, *Dielectric materials.

The perfluorinated polyethers are subjected to electrical measurements to determine suitability as liquid dielectrics. Measures of the breakdown strength and streamer inception voltage are obtained under electrical impulse stress. The breakdown strength is nearly independent of polarity. Under high magnification photography the cathode-originated streamers are seen to have a subsonic mode of growth. The transition to fast growth occurs on time and spatial scales shorter than those reported in liquid hydrocarbons. The gas phase electrical properties and the high heat of vaporization of this material are considered as mechanisms for this behavior.

001,238
PB91-112722 Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Ceramics Div.

Surface Forces at Crack Interfaces in Mica in the Presence of Capillary Condensation.

Final rept.
K. T. Wan, and B. R. Lawn. 1990, 11p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Acta Metall. Mater. 38, n11 p2073-2083 1990.

Keywords: *Mica, Crack propagation, Brittleness, Adhesion, Mathematical models, Capillarity, Condensates, Coherence, Interfacial tension, Humidity, Reprints, *Fracture mechanics, Performance prediction, Liquid-solid interfaces.

A fracture mechanics model for brittle cracks with capillary condensation is developed. The model is based on an integration of intersurface forces, comprising solid-liquid-solid forces within the capillary and solid-vapor-solid forces without. The work of adhesion thus contains terms from the two regions of the adhesion zone, plus a term from the surface tension of the meniscus. Three interface types are considered: virgin, corresponding to first propagation of the crack through the bulk solid; healed-matched, corresponding to repropagation after crack retraction of a partial cleavage; and healed-misoriented, where the cleavage halves are first fully separated and rotated before closure. Notwithstanding the possibility that a layer of environmental molecules may become trapped on interfacial closure, thereby reducing the intrinsic cohesion, it is predicted that the work of separation for healed-matched interfaces has the same dependence on partial pressure of interactive environmental species as for virgin interfaces, provided lattice coherence is maintained between the matching surfaces. A different dependence is predicted for healed-misoriented surfaces, because of the loss of such coherence, in which case the greater part of the adhesion comes from the liquid surface tension. Results of equilibrium cleavage experiments on mica in water vapor confirm the predictions. The strongly increasing work of adhesion observed for virgin and healed-matched surfaces with diminishing relative humidity is indicative of a long-range, Coulombic component of bonding in the pristine mica structure. Implications of the results in the general description of brittle fracture, and of contact adhesion, are discussed.

001,239
PB91-134452 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Thermophysics Div.

Optimum Refrigerants for Non-Ideal Cycles: An Analysis Employing Corresponding States.

Final rept.
M. O. McLinden. 1990, 11p
Pub. in Proceedings of ASHRAE-Purdue CFC and IIR-Purdue Refrigeration Conference, West Lafayette, IN., July 17-20, 1990, p1-11.

Keywords: *Refrigerants, *Thermodynamic cycles, Refrigerators, Specific heat, Thermodynamic proper-

ties, Compressors, Thermal efficiency, Heat transfer, Ideal gas, Reprints, Vapor compression refrigeration cycle, Working fluids.

The principle of corresponding states is used to evaluate the effects of the thermodynamic characteristics of the working fluid on the performance of refrigeration cycles. The desired characteristics, expressed in terms of the critical temperature and ideal gas heat capacity using propane as the reference fluid, are examined for various departures from the theoretical (ideal) vapor compression cycle. These departures from the ideal cycle approximate a refrigerator. Cycle performance and the resulting conclusions regarding the optimum refrigerant are strong functions of the assumptions made in modeling the cycle. The baseline cycle for the comparisons includes compressor efficiency and heat transfer limitations in the condenser and evaporator. These results indicate that modifications to the basic vapor compression cycle should be considered for more complex refrigerants such as the two-carbon HFCs and HCFCs.

Nonferrous Metals & Alloys

001,240
AD-A210 550/0 PC A04/MF A01
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Development of Metastable Processing Paths for High Temperature Alloys.
 Semi-Annual technical rept. 1 Oct 88-31 Mar 89.
 W. J. Boettinger. 31 Mar 89, 62p
 ARPA Order-6065

Keywords: Control, Crack propagation, *Creep strength, *Heat resistant alloys, Molecule molecule interactions, Decomposition, Heat treatment, High temperature, Interactions, *Intermetallic compounds, Low temperature, Materials, *Metal compounds, *Metastable state, *Microstructure, Models, Molecules, Particles, Paths, Phase diagrams, Physical properties, Predictions, Processing, Quenching, Quick reaction, *Reaction kinetics, *Solidification, Solubility, Strategy, Toughness.

The development of acceptable toughness and creep strength in high temperature intermetallic alloys is closely related to the formation of proper distributions of second phase particles. Phases are needed both to arrest crack growth at low temperatures and to resist creep at high temperatures. The possibility of developing new processing strategies for high temperature intermetallic compounds is being investigated. In particular rapid solidification and/or rapid solid state quenching followed by controlled heat treatment may provide new and unusual microstructures of multiphase materials. This report describes research performed in the Metallurgy Division at NIST to: (a) develop predictive models for solubility extension and metastable phase formation of intermetallic compounds by rapid solidification, (b) analyze the kinetics of decomposition of metastable phases involving ordering and (c) improve the phase diagram modeling of systems involving ordered phases. Keywords: Physical properties; Reaction kinetics; Molecule molecule interaction; Metal alloys. (KT)

001,241
AD-A223 144/7 PC A07/MF A01
 National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Metallurgy Div.
Development of Metastable Processing Paths for High Temperature Alloys.
 Final technical rept.
 W. J. Boettinger, L. A. Bendersky, J. W. Cahn, U. R. Kattner, and B. A. Burton. 31 Dec 89, 137p ARPA Order-6065

Keywords: *Intermetallics, Ti/Nb Aluminides, Phase diagram, Rapid solidification, Ternary alloys, Solid state quenching.

The development of acceptable toughness and creep strength in high temperature intermetallic alloy matrices is closely related to the formation of proper distributions of second phase particles. Phases are needed both to arrest crack growth at low temperatures and to resist creep at high temperature intermetallic compounds has been investigated. In particular rapid solidification and/or rapid solid state quenching followed by controlled heat treatment can provide new and un-

usual microstructures of multiphase materials. This report describes research to: (a) develop an experimental basis and predictive models for solubility extension and metastable phase formation of intermetallic compounds by rapid solidification, (b) analyze the kinetics of decomposition of metastable phases involving ordering and (c) improve the phase diagram modeling of systems involving ordered phases.

001,242
DE86002932 PC A02/MF A01
 Brookhaven National Lab., Upton, NY.
Quasicrystalline Structures of Transition Metal/Metalloid Glasses.
 R. E. Watson, and L. H. Bennett. 1985, 9p BNL-37168, CONF-850890-24
 Contract AC02-76CH00016
 International conference on magnetism, San Francisco, CA, USA, 26 Aug 1985.

Keywords: *Boron Alloys, *Chromium Alloys, *Cobalt Alloys, *Iron Alloys, *Manganese Alloys, *Metallic Glasses, *Nickel Alloys, *Phosphorus Additions, *Silicon Alloys, Crystal Structure, ERDA/360102.

The Wigner-Seitz method has been used to specify the "near-neighbor" environments in glass-forming TM crystalline phases, where T = Cr, Mn, Fe, Cu, Ni and M = P, B, Si. The crystal structures fall into different topological classes which may well account for the polymorphism in the glasses. (ERA citation 11.007433)

001,243
PB90-135799 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Patterson Fourier Analysis of the Icosahedral (Al,Si)-Mn Alloy.
 Final rept.
 J. W. Cahn, D. Gratias, and B. Mozer. 1988, 5p
 Pub. in Physical Review B, Condensed Matter 38, n3 p1638-1642, 15 Jul 88.

Keywords: *Fourier analysis, *Aluminum alloys, *Manganese alloys, *Silicon, Crystallography, X-ray diffraction, Neutron diffraction, Reprints, *Patterson method, *Icosahedrons, Rapid quenching(Metallurgy).

A Patterson analysis for icosahedral quasicrystals was developed using x-ray and neutron diffraction results obtained from rapidly quenched Al-Mn-Si alloys obtained from two sources. The indexing method was used to provide the directional information observed by the spherical averaging. The Patterson functions match those of the cubic alpha phase near the origin, confirming the validity of the method and the conjecture that the local atomic arrangement of crystalline and quasicrystalline alloys are similar.

001,244
PB90-135815 Not available NTIS
 National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Standard Flaws for Eddy Current Probe Characterizations.
 Final rept.
 T. E. Capobianco, S. J. Ciciora, and J. C. Moulder. 1989, 5p
 Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v8A p985-989 1989.

Keywords: *Aluminum, *Flaw detection, *Eddy current tests, Nondestructive tests, Electromagnetic testing, Cracking(Fracturing), Fatigue(Materials), Inspection, *Calibration standards.

Calibration procedures for eddy current inspections often involve the use of artifact standards containing manufactured flaws. The manufactured flaw is assumed to be a good approximation of the type of flaw being sought during the inspection. These manufactured flaws are most often produced by electrical discharge machining (EDM), milling or the controlled growth of fatigue cracks. With simple amplitude display inspection equipment this type of artifact is usually sufficient, but as more sophisticated inspection equipment is developed some drawbacks to the commonly accepted practice are becoming evident. Instruments that are sensitive to eddy current signal phase as well as amplitude can show considerable differences in phase between a relatively wide EDM notch or milled slot and a real fatigue crack. The use of controlled growth fatigue cracks can also cause problems when forces at the crack's tip drive the crack faces together, making electrical contact.

001,245

PB90-135948 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Ultrasonic Methods of Texture Monitoring for Characterization of Formability of Rolled Aluminum Sheet.
 Final rept.
 A. V. Clark, G. V. Blessing, R. B. Thompson, and J. F. Smith. 1988, 9p
 Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7B, p1365-1373 1988.

Keywords: *Ultrasonic tests, *Texture, *Roll forming, *Aluminum, *Metal sheets, Nondestructive tests, Formability, Monitors, Reprints, Characterization, Orientation distribution coefficients.

Texture is an important process variable which is known to influence properties such as formability. Texture can be quantified by determining the orientation distribution coefficients (ODC). For rolled steel and aluminum alloy sheet, three ODC influence ultrasonic velocity. One ODC, omega 400, relates to the average formability on deep drawing, whereas the ODC omega 420, and omega 400, relate to the tendency to form two and four 'ears' on deep-drawing. Consequently, ultrasonic measurements offer the promise of both off-line and on-line texture monitoring. Results of off-line ultrasonic measurements on sheets of an aluminum alloy used for can manufacture are reported. Measurements of omega 420 and omega 440 were made with several ultrasonic systems. Measurements of ODC made with different methods are in good agreement. In addition, a good correlation between ODC and a measure of formability was obtained. Extension of the technique to on-line texture monitoring will also be discussed.

001,246

PB90-135955 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Acoustic Emission Studies of Electron Beam Surface Modification of Aluminum.
 Final rept.
 R. B. Clough, H. N. G. Wadley, and R. Mehrabian. 1988, 11p
 Pub. in Metallurgical Transactions B-Process Metallurgy 19, n3 p493-503 1988.

Keywords: *Surface finishing, *Aluminum alloys, *Electron beams, *Irradiation, Copper containing alloys, Solidification, Thermal cycling tests, Crack propagation, Aging tests(Materials), Nondestructive tests, Reprints, *Acoustic emission.

Acoustic emission from carefully designed stationary pulsed electron beam heating experiments has been monitored in pure Al and a binary Al-4.5 wt % Cu alloy to explore the use of the technique for in-situ characterization. A three-fold correlation was made between heat flow theory, acoustic emission, and post solidification metallographic observations. By calibrating the acoustic emission system it has been possible to deduce the dipole strength of the sources responsible for acoustic emission. Comparison with estimated values for candidate sources during surface modification indicate only slip (in course grained material) and microfracture are detectable. The incidence of these during a thermal cycle reflects the evolution of thermal and solidification stresses accompanying surface modification. It has been found that cracking in Al-4.5 wt. % Cu alloys is a significant source of acoustic emission. The incidence of cracking has been found to depend upon the substrate properties. Soft underaged material cracks much less than peak-aged material, suggesting that the contraction stresses can be accommodated by adjacent matrix slip.

001,247

PB90-136656 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Plate-Like Rigid Inclusions and the Ductile-Brittle Transition.
 Final rept.
 I. H. Lin. 1988, 5p
 Pub. in Proceedings of ASM (American Society for Metals) International Conference on Inclusions and Their Influence on Material Behavior, Chicago, IL., September 25-30, 1988, p173-177.

Keywords: *Ductile brittle transition, *Inclusions, *Metals, Mathematical models, Crack propagation, Embrittlement, Dislocations(Materials), Fractures(Materials).

A simple dislocation-crack-inclusion model is proposed to study inclusion embrittlement. Previously, the elastic interaction among screw dislocations, a plate-like rigid inclusion, and a crack under antiplane shear strain was derived. The results of the previous work are applied to dislocation emission and crack-tip breakaway. When an inclusion is very close to the crack tip, the total image force on a dislocation is enlarged and a ductile-to-brittle crossover of the intrinsic character of cracks may be induced. The breakaway of a shielded crack, triggered by void nucleation at the inclusion, is discussed.

001,248
PB90-149147 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Six-Dimensional Fourier Analysis of Icosahedral Al(sub 73)Mn(sub 21)Si(sub 6) Alloy.

Final rept.
D. Gratias, J. W. Cahn, and B. Mozer. 1988, 4p
Pub. in Physical Review B-Condensed Matter 38, n3 p1643-1646 1988.

Keywords: *Aluminum manganese alloys, *Fourier analysis, *Crystal structure, X ray diffraction, Neutron diffraction, Powder alloys, Reprints, Silicon additions, Icosahedrons, Patterson method.

Fourier analysis of x-ray and neutron diffraction data of an icosahedral alloy are displayed both as a 3D quasi-periodic function and as a 6D periodic function. The 6D analysis leads to a simpler description that contains the same information as the 3D analysis: the 6D function has only two elongated peaks in the unit cell, but each peak contains much chemical detail.

001,249
PB90-152497 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.

Tensile Strength and Ductility of Indium.

Final rept.
R. P. Reed, C. N. McCowan, R. P. Walsh, L. A. Delgado, and J. D. McColskey. 1988, 10p
Pub. in Materials Science and Engineering A 102, p227-236 1988.

Keywords: *Tensile strength, *Ductility, *Indium, Cryogenics, Deformation, Twinning, Strain hardening, Microscopy, Stress strain diagrams, Reprints, Temperature dependence.

The tensile properties of indium were measured at temperatures ranging from 4 to 295 K. Indium recrystallizes during deformation at room temperature and twins during deformation at low temperatures. Strain-hardening characteristics were assessed, using true stress-strain curves, and were found to be similar to soft f.c.c. metals. The logarithm of the flow strength was dependent on temperature. Photomicrographs depicting deformation twinning and slip of indium at 76 and 295 K are discussed.

001,250
PB90-169830 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Nonplanar Interface Morphologies during Unidirectional Solidification of a Binary Alloy. 2. Three-Dimensional Computations.

Final rept.
G. B. McFadden, R. F. Boisvert, and S. R. Coriell. 1987, 8p
Pub. in Jnl. of Crystal Growth 84, n3 p371-388 Sep 87.

Keywords: *Crystal growth, Aluminum alloys, Chromium alloys, Finite difference theory, Interfaces, Reprints, *Directional Solidification(Crystals), Three-dimensional calculations, Numerical solution, Binary alloys.

Three-dimensional steady-state solutions for non-planar interface morphologies are computed numerically using finite differences. A linear temperature field is assumed, corresponding to the case of equal thermal properties in the crystal and melt, with no latent heat release. The solute field in the melt and the unknown crystal-melt interface position are obtained self-consistently. The stability of the computed steady-state solutions is suggested by the behavior of the it-

erative scheme used in the calculation: successive iterates may be viewed as evolving in a time-like manner as determined by an artificially time-chromium alloy with distribution coefficient greater than one, steady-state solutions corresponding to two-dimensional bands and three-dimensional nodes are obtained, as well as solutions with rectangular interface planforms. The results are compared to qualitative predictions from weakly nonlinear expansion results.

001,251
PB90-170853 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Mesh Monitor Casting of Ni-Cr Alloys: Element Effects.

Final rept.
O. Okuno, J. A. Tesk, and R. Penn. 1989, 7p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Dental Materials 5, p294-300 Sep 89.

Keywords: *Casting, *Chemical composition, *Elements, *Nickel chromium alloys, Dental materials, Equations, Reprints, *Mesh monitor, *Mesh generation, Molybdenum additions, Silicon additions, Niobium additions, Boron additions, Aluminum additions, Beryllium additions.

A mesh monitor has previously been used for quantitative evaluation of the casting of dental alloys. A castability value, C_v , was defined. For curve-fitting, a transformed castability value, C_v, t , was used. A series of alloys was selected so that effects of major elements on C_v, t and, hence, on C_v could be determined. Compositions were chosen so that correlated effects would be avoided. Assuming a linear dependence on the concentrations of individual elements, the following equation may be used to describe C_v, t : $C_v, t = K_0(Ni/Cr) + K_1(Mo) + K_2(Si) + K_3(Nb) + K_4(B) + K_5(A1) + K_6(Be) + K_7(Be \times Si)$ where each term employs an elemental concentration in weight percent (Ei), and a coefficient, K_i , for the i th term. Because E_i 's are constant for each alloy, $K_i = f_i(TA, TM) = g_i(TC, TM)$. The temperature-dependent coefficients, K_i , were determined for seven elements and for the (Ni/Cr) ratio. It was also found that Si and Be produce a synergistic effect. The results help to understand the casting behavior of Ni-Cr dental alloys; the approach may be useful in the design of dental alloys.

001,252
PB90-188509 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Electrodeposition of an Aluminum-Manganese Metallic Glass from Molten Salts.

Final rept.
G. R. Stafford. 1989, 5p
Pub. in Jnl. of the Electrochemical Society 136, n3 p635-639 Mar 89.

Keywords: *Electrodeposition, *Aluminum manganese alloys, *Metals, *Fused salts, Aluminates, Chlorine inorganic compounds, Electric potential, Chemical composition, Intermetallics, Phase diagrams, Reprints, Manganese ions, Metallic glasses.

The electrodeposition of binary aluminum-manganese alloys from chloroaluminate molten salts is reported. The manganese content of the electrodeposit varies from 7 to 30 wt% and is dependent upon deposition potential and the relative concentrations of $Al_2Cl_7(-1)$ and $Mn(+2)$ in the melt. At low cathodic overpotentials the deposition process, with respect to alloy composition, is kinetically controlled. At more cathodic potentials, it becomes mass transport limited in $Mn(+2)$ and then $Al_2Cl_7(-1)$. The most uniform and brightest deposits are obtained at a constant potential of -0.3 V/Al. The potential dependence of alloy composition allows one to create homogeneous, graded and modulated structures from a single electrolyte. The structure of the as-deposited alloy appears to be that of a metallic glass above 27 wt% manganese and a mixture of glass and supersaturated aluminum below 27 wt%. Upon heating to 400 C, the glass structure converts to the orthorhombic Al_6Mn intermetallic while the supersaturated phase converts to Al_6Mn and aluminum. The ability to electrodeposit intermetallic compounds on a near atomic scale presents interesting possibilities for high temperature alloys.

001,253
PB90-192485 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Fracture and Deformation Div.

Crystallographic Texture in Rolled Aluminum Plates: Neutron Pole Figure Measurements.

Final rept.
R. C. Reno, R. J. Fields, and A. V. Clark. 1988, 7p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7B, p1439-1445 1988.

Keywords: *Crystal structure, *Aluminum, *Metal plates, Neutron diffraction, Ultrasonic tests, Nondestructive tests, Orientation, Polarization(Waves), Texture, Microstructure, Reprints, Neutron pole figures, On-line measurement systems.

Neutron pole figures have been used to determine the crystallographic texture in rolled aluminum plates that were characterized with ultrasonic techniques. The orientation distribution coefficients determined by neutron diffraction are in good agreement with the ones derived from ultrasound measurements, thus confirming the efficacy of ultrasound as an on-line monitoring technique.

001,254
PB90-193392 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Interfaces: The Next NDE Challenge.

Final rept.
H. N. G. Wadley. 1988, 12p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7B, p881-892 1988.

Keywords: *Interfaces, *Nondestructive tests, Measurement, Test equipment, Metals, Ceramics, Composite materials, Thin films, Grain boundaries, Gallium arsenides, Low alloy steels, Reprints, Metal matrix composites.

Interfaces play a central role in controlling the properties of structural and electronic materials. As the performance of materials is extended, it becomes increasingly important to be able to measure and then optimize local properties of interfaces. The measurement techniques needed do not exist today, though the basis for new ones has emerged from the QNDE research of the past decade. As expertise in bulk materials characterization matures, the next challenge for QNDE will come from the need to measure interface properties.

001,255
PB90-193400 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Eddy Current Measurement of Density during Hot Isostatic Pressing.

Final rept.
H. N. G. Wadley, A. H. Kahn, Y. Geffen, and M. Mester. 1988, 10p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation 7B, p1589-1598 1988.

Keywords: *Eddy current tests, *Hot pressing, *Isostatic pressing, *Dimensional measurement, Nondestructive tests, Density(Mass/volume), Process control, Copper, Powder metallurgy, Creep properties, Feedback control, Reprints.

An eddy current technique has been developed for measuring dimensional changes during HIPing. The dimensional changes can be used to follow densification and thus conserve the role of a sensor in a controlled loop feedback control system for HIPing.

001,256
PB90-193541 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Effect of an Electric Field on the Morphological Stability of the Crystal-Melt Interface on a Binary Alloy.

Final rept.
A. A. Wheeler, S. R. Coriell, G. B. McFadden, and D. T. J. Hurle. 1988, 15p
Pub. in Jnl. of Crystal Growth 88, p1-15 1988.

Keywords: *Electric fields, Supercooling, Electrical resistivity, Epitaxy, Stability, Reprints, *Binary alloys, *Liquid-solid interfaces, *Crystal-melt interface, Directional solidification(Crystals), Molecular models, Morphology.

A fully time-dependent linear stability analysis of the morphological stability of a planar interface during directional solidification of a binary alloy at constant ve-

Nonferrous Metals & Alloys

locity in the presence of an electric field was performed. The work takes into account the electromigration of solute and the differing electrical conductivities of solid and liquid for a model in which the temperature gradient is constant. Results are compared with the constitutional supercooling criterion and show possible substantial differences. A modified constitutional supercooling criterion is derived which is valid over a large range of conditions. Under certain conditions, the onset of instability may be time dependent.

001,257

PB90-193574

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

High Spatial Resolution Secondary Ion Imaging and Secondary Ion Mass Spectrometry of Aluminum-Lithium Alloys.

Final rept.

D. B. Williams, R. Levi-Setti, J. M. Chabala, and D.

Newbury. 1987, 12p

Pub. in Jnl. of Microscopy 148, n3 p241-252 1987.

Keywords: *Aluminum alloys, *Lithium alloys, Microstructure, Microanalysis, Reprints, Ion microprobe analysis, Secondary ion mass spectroscopy, High resolution.

Samples of aluminum-lithium alloys have been observed by scanning ion microscopy and analyzed by secondary ion mass spectrometry. The high signal to noise ratio of the positive secondary lithium ion opens up the possibility of both high resolution imaging and microanalysis of lithium distributions in aluminum and other materials. Some of the problems encountered due to sample preparation are discussed and ion images of both the artifacts and the true lithium distribution are shown.

001,258

PB90-193616

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD.

Molecular Wedge in Brittle Cracks.

Final rept.

R. M. Thomson. 1988, 4p

Pub. in Scripta Metallurgica 22, n3 p385-388 1988.

Keywords: *Crack propagation, *Brittleness, Metals, Interfacial tension, Chemical attack, Penetration, Environmental tests, Reprints, *Fracture mechanics, Molecular models, Crack tips.

When external atmospheres compound 'large molecules' interact with a crack tip, the molecules are drawn into the tip region by surface tension. An opposite force on the molecules due to the elastic interaction with the crack walls tends to eject the molecules from the crack. The molecules will penetrate to that point where the forces balance. Estimates are made for penetration for a variety of materials.

001,259

PB90-196528

PC A04/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Effect of Interstitial Elements on Phase Relationships in the Titanium-Aluminum System.

Technical rept. Nov 81-Sep 87.

R. M. Waterstrat. Oct 88, 59p NISTIR-88/3856

Contracts N00014-82-C-0061, N00014-86-K-0476

Prepared in cooperation with American Dental Association Health Foundation, Chicago, IL. Sponsored by Office of Naval Research, Arlington, VA.

Keywords: *Titanium alloys, *Aluminum alloys, *Phase diagrams, *Interstitials, *Trace elements, Neutron diffraction, High temperature tests, Test equipment, Order disorder transformations, Oxygen additions.

An apparatus has been designed and constructed for neutron diffraction studies on polycrystalline samples in a high vacuum at temperatures up to approximately 1500 C or higher. Neutron diffraction data have been obtained from titanium-aluminum alloys containing 12 to 45 atomic percent aluminum at temperatures ranging from 900 C to over 1300 C. Unusually high background intensities were observed in single-phase alpha-Ti alloys containing 14 and 16 atomic percent aluminum between 900 C and 1000 C. It suggests the existence of atomic short-range order as reported by previous investigators. Addition of 1 atomic percent oxygen to such alloys was found to eliminate the short-range ordering behavior and replace it with an extended alpha-Ti plus alpha 2-Ti3Al two-phase region.

001,260

PB90-271271

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Effect of Anisotropic Thermal Conductivity on the Morphological Stability of a Binary Alloy.

Final rept.

S. R. Coriell, G. B. McFadden, and R. F. Sekerka.

1990, 8p

Sponsored by National Aeronautics and Space Administration, Washington, DC., and National Science Foundation, Washington, DC.

Pub. in Jnl. of Crystal Growth 100, p459-466 1990.

Keywords: *Crystal growth, *Tin alloys, Orientation, Thermal conductivity, Anisotropy, Microstructure, Morphology, Solidification, Interfaces, Stability, Dispersions, Perturbation theory, Reprints, *Binary alloys, *Bismuth additions.

A linear morphological stability analysis of a planar interface during unidirectional solidification of a binary alloy for the case of a crystal having an anisotropic thermal conductivity was performed. A dispersion relation was calculated and shows that the onset of instability depends on the orientation of the growth direction with respect to principal crystallographic axes and on the orientation of the wavevector of the perturbation. The onset of instability can be either oscillatory (travelling waves) or non-oscillatory in time. For growth along a principal axis of the crystal there is an exchange of stabilities, and the onset of instability is non-oscillatory. For a uniaxial crystal, the dispersion relation in detail was explained and numerical results given for the case of an alloy of 0.78 at% bismuth in tin. For low growth velocities the onset of instability is non-oscillatory and occurs for perturbations having a wavevector that lies along a principal crystallographic axis.

001,261

PB90-271321

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Simulation of Field-Ion-Microscope Images for the Al-Mn Icosahedral Phase.

Final rept.

H. A. Fowler, A. J. Melmed, and H. B. Elswijk. 1990,

18p

Sponsored by Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague (Netherlands). Pub. in Philosophical Magazine B 61, n5 p811-827 1990.

Keywords: *Aluminum manganese alloys, Crystal structure, Ion microscopes, Computerized simulation, Models, Reprints, Field ion microscopy, Icosahedral phase.

Simulations of field-ion-microscope images for the icosahedral phase of Al-Mn, based on new structural models, are presented and compared to the experimentally observed image features. Closest agreement thus far is found for a cubic model having a 3.32 nm unit cell edge and containing a MacKay-icosahedron inner motif, with all of the manganese sublattice and only some of the aluminum atoms contributing to the computed images. An octahedral-motif decoration of a perfect three-dimensional Penrose tiling has also been constructed for comparison.

001,262

PB91-101444

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Mathematical Analysis Div.

Effect of Surface Tension Anisotropy on Cellular Morphologies.

Final rept.

G. B. McFadden, S. R. Coriell, and R. F. Sekerka.

1988, 19p

Pub. in Jnl. of Crystal Growth 91, p180-198 1988.

Keywords: *Crystal growth, *Interfacial tension, *Liquid metals, Anisotropy, Solidification, Microstructure, Theories, Stability criteria, Phase transformations, Reprints, *Binary alloys, Liquid-solid interfaces, Morphology.

Morphological stability theory predicts the conditions for which a planar crystal-melt interface is unstable for directional solidification of a binary alloy at constant velocity. For conditions near the onset of instability, a three-dimensional weakly nonlinear analysis to second order was carried out in the interface deformation, taking into account the effects of latent heat generation and anisotropy of the crystal-melt surface tension.

The growth of a cubic crystal in the (001), (011), and (111) directions was considered. Linear stability theory predicts that, for growth in the (011) direction (two-fold axis), two-dimensional bands are preferred. For growth in the (001) direction (four-fold axis), weakly-nonlinear theory predicts steady-state solutions having six-fold symmetry. For growth in the (111) direction (three-fold axis), steady-state solutions with six-fold symmetry are only possible for a particular alignment of the hexagonal array with respect to the crystal axes; otherwise, the solutions only have three-fold symmetry. In the second-order theory developed here, all small-amplitude solutions are unstable. If the subcritical solution branch regains stability at larger amplitudes, the small-amplitude solutions would indicate whether this branch would correspond to stable cells or nodes. For an alloy with distribution coefficient less than unity, and with the thermal conductivity of the crystal greater than that of the melt, the theory predicts solute patterns with nodes near the onset of instability, except possibly at very high growth velocities.

001,263

PB91-101683

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

X-ray Diffraction Studies of Ni-Cr-Based Amorphous Alloys.

Final rept.

S. C. Yu, and J. W. Lynn. 1990, 3p

Pub. in Japanese Jnl. of Applied Physics 29, n5 p902-904 May 90.

Keywords: *Metals, *X ray diffraction, *Alloys, *Nickel alloys, *Chromium alloys, Crystal structure, Reprints, *Amorphous materials, Phosphorus additions, Carbon additions, Boron additions, Cobalt additions.

The structures of the amorphous alloys with atomic percent compositions Ni64.21Cr14.22P17.22Co.35(MBF 65) and Ni67.33Cr14.31B18.11Co.25(MBF 80), which have similar Ni-Cr-C components, have been studied and compared by X-ray diffraction. The interference functions, atomic distribution functions, and radial distribution functions were calculated from the X-ray diffraction intensity data. The nearest-neighbor distances and coordination numbers were determined to be 2.52 + or - 0.01 A, 12.50 + or - 0.10 for MBF 65, and 2.48 + or - 0.01 A, 12.75 + or - 0.11 for MBF 80, respectively. The observed nearest-neighbor distance is in good agreement with a simple contact-distance packing model using the calculated atomic radii and a coordination number of twelve. The results are compared with the same composition of Ni in amorphous Ni-P and Ni-B alloys.

001,264

PB91-112060

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Morphological Stability during Alloy Solidification.

Final rept.

S. R. Coriell, and G. B. McFadden. 1989, 13p

Pub. in Morphology and Growth Unit of Crystals, p335-347 1989.

Keywords: *Crystal growth, *Metals, Melt, Surface energy, Solides, Interfaces, Aluminum alloys, Silver alloys, Solidification, Segregation process, Microstructure, Convection, Fluid flow, Reprints, Morphology, Liquid-solid interfaces.

A number of topics related to the morphology of crystals growing from the melt and to the resultant solute distribution in the crystal are reviewed. Grain boundary groove shapes in a temperature gradient provide a direct measurement of the crystal-melt surface free energy; recent calculations of groove shapes indicate the role of anisotropic surface free energy. During directional solidification solute inhomogeneities transverse to the growth direction can arise from nonplanar crystal-melt interfaces and from fluid flow in the melt. Cellular interface shapes and solute distributions in the absence of convection have been calculated for aluminum-silver alloys. The effects of thermosolutal convection on solute inhomogeneity in semiconductor and metallic alloys have been determined by numerical computations. Strong coupling between hydrodynamic and morphological instabilities can occur; an example is the traveling helical waves which occur in cylindrical samples of succinonitrile.

001,265

PB91-112581 Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD. Reactor Radiation Div.
Residual Stress Measurements by Means of Neutron Diffraction.
Final rept.
H. J. Prask, and C. S. Choi. 1990, 6p
Pub. in Materials Research Society Symposium Proceedings, v166 p293-298 1990.

Keywords: *Residual stress, *Neutron diffraction, *Steels, Metals, Measurement, Surface energy, Uranium alloys, Titanium alloys, Aluminum alloys, Depth, Triaxial stresses, Reprints.

Energy-dispersive neutron diffraction has been developed at the NIST reactor as a probe of sub- and near-surface residual stresses in technological samples. Application of the technique has been made to a variety of metallurgical specimens which includes the determination of triaxial stresses as a function of depth in a number of uranium-3/4wt%Ti samples with different thermo-mechanical histories, and in two types of 7075-T6 aluminum 'ogives' of interest to the Army. Preliminary results have been obtained for an induction-hardened steel shaft, a fatigue lifetime test specimen for the SAE.

001,266

PB91-118034 Not available NTIS
National Inst. of Standards and Technology (MSEL),
Gaithersburg, MD.
Interfacial Free Energy and Interfacial Stress: The Case of an Internal Interface in a Solid.
Final rept.
J. W. Cahn. 1989, 4p
Pub. in Acta Metallurgica v37, n3 p773-776 1989.

Keywords: *Surface energy, *Interfacial tension, Alloys, Anisotropy, Lattice parameters, Metallography, Reprints.

When the order parameter affects the lattice parameter a stress arises in the antiphase boundary between two domains of an ordered phase. Near the critical point this stress raises the magnitude of the free energy of the interface and narrows its width. It also gives rise to some anisotropy, but does not change the exponents of the critical behavior for energy and width. The interfacial stress on the other hand is much more anisotropic, can be positive or negative with a magnitude that approaches zero with a classical exponent of 0.5 or 0.0 according to modern critical theory. Thus the ratio of stress to free energy diverges.

001,267

PB91-118356 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Metallurgy Div.
Coherent Phase Diagrams.
Final rept.
W. C. Johnson, and P. W. Voorhees. 1988, 8p
Pub. in Bulletin of Alloy Phase Diagrams 9, p208-315 1988.

Keywords: *Phase diagrams, Thermodynamics, Equilibrium, Coherence, Alloys, Reprints, Phase stability.

Phase equilibria in coherent solids is significantly different from that in fluids or incoherent solids. For example, Gibbs' phase rule is not applicable, the field lines on a phase diagram do not correspond with the equilibrium phase compositions, phase compositions in a two-phase field depend on the bulk alloy composition and for a given set of imposed thermodynamic variables, several equilibrium states may exist. These conditions raise serious questions as to the usefulness of coherent phase diagrams. Herein, the authors discuss the use of phase stability diagrams to convey equilibrium information. The importance of phase stability diagrams lies in their ability to display graphically the equilibrium states of a two-phase coherent system in much the same fashion that Gibbs free energy vs. composition curves do for a fluid system.

001,268

PB91-134031 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Technology Div.

Magnetic Susceptibility of Inconel Alloys 718, 625, and 600 at Cryogenic Temperatures.

Final rept.
I. B. Goldberg, M. R. Mitchell, A. R. Murphy, R. B. Goldfarb, and R. J. Loughran. 1990, 8p
Pub. in Advances in Cryogenic Engineering Materials, v36 p755-762 1990.

Keywords: Magnetization, Cryogenics, Reprints, *Inconel 718, *Inconel 625, *Inconel 600, *Magnetic susceptibility, Space shuttles, Spin glass.

In June 1988, the Discovery Space Shuttle mission was delayed because of a malfunctioning hydrogen fuel bleed valve system. The problem was traced to the linear variable differential transformer (LVDT) which produced erroneous readings for the valve position. Near liquid hydrogen temperatures, Inconel 718 used in the armature of the LVDT became strongly magnetic. The AC magnetic susceptibility of three samples of Inconel 718 of slightly different compositions, one sample of Inconel 625, and one sample of Inconel 600 were measured as a function of temperature. Inconel 718 behaves as a spin glass. Its susceptibility reaches a maximum between 15 and 19 K, near the liquid hydrogen boiling point, 20 K. The susceptibility increases by an order of magnitude as the iron content increases by 1.2% and the nickel content decreases by 1.5%. The nominal composition is 12-20% iron and 50-55% nickel. Inconel 625, which contains about 4% iron, was paramagnetic. Inconel 600 exhibited spin glass properties below 6 K, short-range ferromagnetism between 6 and 92K, and paramagnetism above 92K.

Plastics

001,269

PB90-150087 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Polymers Div.
Fracture of Epoxy and Elastomer-Modified Epoxy Polymers.
Final rept.
W. D. Bascom, and D. L. Hunston. 1982, 26p
Pub. in Adhesion 6, p185-210 1982.

Keywords: *Fractures(Materials), *Epoxy resins, *Elastomers, Adhesives, Viscoelasticity, Toughness, Construction materials, Reprints, Resin matrix composites, Matrix materials.

Rubber modified epoxies represent a class of materials that are of interest for both scientific and practical reasons. They have a two phase morphology that gives them fracture energies much higher than normal epoxies but with a minimum sacrifice in other properties relative to epoxy. As a result, they are extensively used in structural adhesives and are increasingly being considered as composite matrix resins. The paper reviews studies conducted over the last 15 years aimed at understanding how and why the materials fail in bulk samples, in adhesively bonded joints, and as matrix resins in composites. The topics covered include the mechanisms of toughening, the viscoelastic aspects of the failure behavior, and the influence of geometric variables such as bond thickness and the fiber-fiber spacing in the composites. The paper outlines both what has been found and what questions remain to be answered.

001,270

PB90-152760 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg,
MD. Fire Measurement and Research Div.
Effects of Initial Molecular Weight on Thermal Degradation of Poly(Methyl Methacrylate) 1 - Model 1.
Final rept.
A. Inaba, T. Kashiwagi, and J. E. Brown. 1988, 20p
Pub. in Polymer Degradation and Stability 21, n1 p1-20 1988.

Keywords: *Molecular weight, *Thermal degradation, *Polymethyl methacrylate, Mathematical models, Polymerization, Plastics, Reaction kinetics, Weight measurement, Activation, Reprints.

The relationship between changes in the degree of polymerization and the conversion was obtained experimentally with three anionically polymerized PMMA samples with different initial degrees of polymerization

(315, 1250 and 5690). Kinetic constants for random scission initiation and average zip length were determined by the combined use of the experimental data with theoretically calculated relationships. The theoretical model is based on the same depropagation rate via beta scission from both primary and tertiary radicals generated from random scission at backbone C-C bonds. Although the theoretically calculated activation energies for global reaction based on weight loss rates agree reasonably well with the experimentally determined data, the theoretical results show inconsistency in the predicted value of average zip length and also do not agree well with the experimentally determined weight loss rates with temperature under dynamic heating conditions. It is suspected that the assumption of the equal reactivity of the two radicals is incorrect.

001,271

PB90-207275 PC A03/MF A01
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Polymers Div.
Studies on the Melt Flow Rate of the SRM 1474, a Polyethylene Resin.
J. R. Maurey, and C. M. Guttman. Mar 90, 15p
NISTIR-90/4239

Keywords: *Polyethylene resins, Polymers, Melt viscosity, Standards, Flow rate, Flow measurement.

The melt flow rate of SRM (Standard Reference Material) 1474, a polyethylene, was determined to be 5.03 gm/10 min at 190C under a load of 2.16 kg using the ASTM method D1238-86. The average results from 30 determinations on samples with a standard deviation of a single measurement of 0.037 gm/10 min. A small but measurable drift from the first timed extrudate to the third timed extrudate was observed.

Refractory Metals & Alloys

001,272

PB90-271560 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Thermophysics Div.
Thermal Expansion of Tungsten in the Range 1500-3600 K by a Transient Interferometric Technique.
Final rept.
A. P. Miller, and A. Cezairiyan. 1990, 11p
Pub. in International Jnl. of thermophysics 11, n4 p619-628 Jul 90.

Keywords: *Tungsten, *Thermal expansion, Temperature measurement, Optical interferometers, Optical measurement, High temperature tests, Reprints, Standard reference materials.

The linear thermal expansion of tungsten has been measured in the temperature range 1500-3600 K by means of a transient (subsecond) interferometric technique. The tungsten selected for these measurements was the standard reference material SRM 737 (a standard for thermal expansion measurements at temperatures up to 1800 K). The basic method involved rapidly heating the specimen from room temperature up to and through the temperature range of interest in less than 1 s by passing an electrical current pulse through it and simultaneously measuring the specimen temperature by means of a high-speed photoelectric pyrometer and the shift in the fringe pattern produced by a Michelson-type interferometer. The linear thermal expansion was determined from the cumulative shift corresponding to each measured temperature.

Wood & Paper Products

001,273

PB90-218223 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg,
MD. Fire Measurement and Research Div.
Forward Smolder Propagation Over Solid Wood.
Final rept.
T. J. Ohlemiller. 1987, 4p
Pub. in Chem. Phys. Processes Combust., p46/1-46/4 1987.

MATERIALS SCIENCES

Wood & Paper Products

Keywords: *Fire tests, *Ignition, *Wood, *Flammability testing, Oak wood, Pine wood, Flame propagation, Air flow, Combustion, Flammability, Combustion products, Reprints.

A series of forward smolder propagation tests with varied air flow rates was performed with red oak and white pine in a configuration which facilitated self-sustained combustion. The gaseous and condensable products are to be compared with those from prior forced gasification tests.

General

001,274
PATENT-4 898 034 Not available NTIS
Department of Labor, Washington, DC.
High Temperature Ultrasonic Testing of Materials for Internal Flaws.
Patent.
D. S. Kupperman, and M. Linzer. Filed 23 Aug 88, patented 6 Feb 90, 6p PB90-214453, PAT-APPL-7-235 078
This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$1.50.

Keywords: *Nondestructive tests, *Ultrasonic tests, *High temperature tests, *Patents, Test equipment, Defects, Metals, Ceramics, Zirconium oxides, Borax, Buffers, Steels, PAT-CL-73-644.

An apparatus is disclosed for nondestructive evaluation of defects in hot materials, such as metals and ceramics, by sonic signals, which includes a zirconia buffer in contact with a hot material being tested, a liquid couplant of borax in contact with the zirconia buffer and the hot material to be tested, a transmitter mounted on the zirconia buffer sending sonic signals through the buffer and couplant into the hot material, and a receiver mounted on the zirconia buffer receiving sonic signals reflected from within the hot material through the couplant and the buffer.

001,275
PB90-160334 PC A06/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.
Mechanism, Measurement, and Influence of Properties on the Galling of Metals.
Final rept.
L. K. Ives, M. B. Peterson, and E. P. Whitenton. Dec 89, 108p NISTIR-89/4064, ORNL/SUB-83/21322/01 Contracts DE-AC05-84OR21400, DE-AI05-83OR132 Sponsored by Oak Ridge National Lab., TN., and Department of Energy, Washington, DC.

Keywords: *Galling, *Metals, Sliding friction, Surface properties, Measurement, Crystal structure, Crystal defects, Damage, Hard surfacing, Wear, Graphs(Charts), Twinning, Silver, Cobalt, Copper, Nickel, Stainless steels.

The report presents the results of an extensive investigation of the process of galling (a form of severe damage at sliding surfaces). Three areas were emphasized: the elucidation of the mechanism of galling, the quantitative characterization and measurement of the amount of damage associated with galling, and the determination of relationship between galling and materials properties. On the basis of a review of the literature and experiments on a variety of different metals it was concluded that the primary event in the process of galling is that of prow or wedge formation. A method based on surface topography was developed to measure quantitatively the amount and character of galling. By studying a range of pure metals and selected experimental alloys it was demonstrated that among the most important properties influencing galling are crystal structure and stacking fault energy. Hardness and strength do not in general correlate with galling severity, but it was shown that hardening steels by heat treatment is an effective means of reducing the damage due to galling. Carburizing and nitriding were also shown to diminish significantly the damage due to galling.

001,276
PB90-161159 PC A07/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Institute for Materials Science and Engineering: Metallurgy Division, Technical Activities 1989.
Annual rept. 1 Oct 88-30 Sep 89.
E. N. Pugh, and J. H. Smith. Dec 89, 134p NISTIR-89/4151
See also report for 1988, PB89-201321.

Keywords: *Metallurgy, *Metals, *Alloys, *Research management, Corrosion, Electrodeposited coatings, Magnetic materials, Process variables, Process control, Mechanical properties, Chemical properties, *National Institute of Standards and Technology.

The report summarizes the FY 1989 activities of the Metallurgy Division of the National Institute of Standards and Technology (NIST). The activities center upon the structure-processing-properties relations of metals and alloys and on methods of measurement; and also include the generation and evaluation of critical materials data. Efforts comprise studies of metals processing and process sensors; advanced materials, including metal matrix composites, intermetallic alloys and superconductors; corrosion and electrodeposition; mechanical properties; magnetic materials; and high temperature reactions. The work described also includes two cooperative programs with professional societies (the Alloy Phase Diagram Program with ASM International, and the Corrosion Data Program with the National Association of Corrosion Engineers); two with trade associations (the Temperature Sensor Program with the Aluminum Association, and the Steel Sensor Program with the American Iron and Steel Institute); and several with industry including the Powder Atomization Consortium with three companies.

001,277
PB90-161704 PC A04/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Office of Standard Reference Data.
Standard Reference Data Publications, 1987-1989.
Special pub. 1987-1989.
J. C. Sauerwein. Dec 89, 54p NIST/SP-708-SUPPL-2 Also available from Supt. of Docs as SN003-003-02982-3. See also PB87-210241. Library of Congress catalog card no. 89-600779.

Keywords: *Information services, *Bibliographies, Physical properties, Chemical properties, Technical information centers, *National Institute of Standards and Technology, *Standard Reference Data Program, *Materials science, Databases.

The National Institute of Standards and Technology's Standard Reference Data Program manages a network of data centers that prepare evaluated databases of physical and chemical properties of substances. Databases are available in printed form, on magnetic tapes, diskettes, and through on-line computer networks. The document provides a comprehensive list of the products available from the National Standard Reference Data System for the years 1987-1989, including indexes qualified by author, material, and property terms. Ordering information and current prices can be found at the end of the document.

001,278
PB90-170390 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Office of Standard Reference Data.
Materials Data: Requirements for the Future.
Final rept.
C. J. M. Northrup, and J. Rumble. 1986, 4p
Pub. in Communications on the Materials Science and Engineering Study, p67-70 1986.

Keywords: *Materials tests, Standards, Forecasting, Mechanical properties, Research management, Reprints, *Data base management systems, *Materials science, Computer applications.

The impact of computers on materials sciences is rapidly increasing. One of the keys to effectively using the new technology is to develop a new system to manage computerized materials property data, to improve the quality, and to make them more accessible and more easily manipulated. In the paper, the computerization of materials data will be discussed from the viewpoints of the benefits to be achieved and of the challenges to be met. Among the foremost challenges is the need to make a substantial national commitment to coordinate the joint development of a private sector/federal computerized materials data system.

001,279
PB90-187527 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Office of Nondestructive Evaluation.

NBS (National Bureau of Standards) NDE (Nondestructive Evaluation) Program.
Final rept.
G. Birnbaum. 1987, 3p
Pub. in Proceedings of Symposium on Nondestructive Evaluation (16th), San Antonio, TX., April 21-23, 1987, p43-45.

Keywords: *Sensors, Ceramics, Light scattering, Reprints, *Process monitoring, Fluorescence spectrometry.

The NBS Nondestructive Evaluation (NDE) Program dealing with sensors for process monitoring is reviewed.

001,280
PB91-133777 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Use of a Statistical Software for Monitoring Material Quality.
Final rept.
G. Adam, and T. A. Siewert. 1989, 7p
Pub. in Intelligent Instruments and Computers, p153-159 Jul/Aug 89.

Keywords: *Materials specifications, *Quality control, Monitoring, Standards, Impact tests, Statistical analysis, Reprints, *Computer applications, Personal computers, Computer software, National Institute of Standards and Technology, Data bases.

A high-level statistically oriented programming language was used to develop a set of quality control programs for a personal computer. These programs are being used to monitor the quality of specimens being qualified as reference materials at the National Institute of Standards and Technology (NIST). The package facilitates data entry and produces a database for statistical analysis and report production.

MATHEMATICAL SCIENCES

Algebra, Analysis, Geometry, & Mathematical Logic

001,281
AD-A178 823/1 PC A02/MF A01
Maryland Univ., Baltimore.
Error Bounds for Polynomial Evaluation and Complex Arithmetic.
F. W. Olver. 1986, 8p ARO-20606.2-MA
Contract DAAG29-84-K-0022
Pub. in IMA Jnl. of Numerical Analysis, v6 p373-379 1986.

Keywords: *Polynomials, Arithmetic, Floating point operation, Reprints, Coefficients, Complex numbers, Errors.

Explicit and computable strict bounds of a posteriori type are constructed for the evaluation of a polynomial and its derivatives by nested multiplication, using floating-point arithmetic. The polynomial may be real or complex, and may contain errors in its coefficients and argument. Some new error bounds for arithmetic operations with complex numbers are included. (Author) (Reprint)

001,282
AD-A178 897/5 PC A02/MF A01
Maryland Univ., College Park. Inst. for Physical Science and Technology.
Unrestricted Algorithms for Reciprocals and Square Roots.
C. W. Clenshaw, and F. W. Olver. 1986, 19p ARO-20606.5-MA
Contract DAAG29-84-K-0022
Pub. in Bit, v26 p476-492 1986.

Keywords: Algorithms, Accuracy, Exponential functions, Arithmetic, *Square roots, Logarithm functions, Numerical analysis, Error analysis, Reprints.

In previous works the authors introduced a new form of computer arithmetic, called level-index arithmetic, the main purpose of which is to eradicate the problems of overflow and underflow associated with the floating-point and fixed-point systems. In order to implement the new arithmetic in multiple precision, unrestricted algorithms are needed to evaluate exponentials and logarithms. By an unrestricted algorithm we mean one in which the user may demand any accuracy in the function values for arguments of any magnitude. An unrestricted algorithm for the exponential function was described previously. This paper we construct an unrestricted algorithm for computing square roots. This is a necessary preliminary in the construction of an unrestricted algorithm for the logarithmic function. At the same time this paper a quite similar algorithm for forming reciprocals: the direct division process that is used for low-precision work is inefficient for multiple-precision calculations.

001,283
PB90-152505 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Defining a Faceted Generalized Cylinder by Projections of Cross Sections.
 Final rept.
 M. Roche. 1989, 6p
 Pub. in Computers and Graphics 13, n3 p349-354 1989.

Keywords: *Cross sections, *Projection, *Cylinders, Models, Coordinates, Reprints.

Traditionally a faceted model of a generalized cylinder has been defined using a three-dimensional curve with local coordinate systems along the curve to position cross sections. The local coordinate systems along the curve are given by the Frenet trihedron which is used to position the given cross section. An alternative to this construction procedure would be a technique that projects cross sections from one construction plane to another. The projection technique could be used in defining many objects in the class of generalized cylinders. The technique uses a mitered development along with a polygonal approximation of the defining axis curve.

001,284
PB90-169657 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
TWODQD: An Adaptive Routine for Two-Dimensional Integration.
 Final rept.
 D. K. Kahaner, and O. W. Rechar. 1987, 20p
 Pub. in Jnl. of Computational and Applied Mathematics 17, n1-2 p215-234 1987.

Keywords: *Numerical integration, *Functions(Mathematics), Subroutines, Integral calculus, Orbits, Reprints, *Computer calculations, Two dimensional models, Quadratures.

The paper presents an adaptive subroutine that computes an approximation to the integral of a function $f(x,y)$ over a two dimensional region made up of triangles. Lyness Jespersen rules form the basis for a local quadrature module that is used to estimate the integral and the error over each triangle. The triangle with the largest error is subdivided and the local quadrature module is applied to each sub triangle to obtain new estimates of the integral and the error. The process is repeated until either an error tolerance is satisfied, the number of triangles exceeds an input parameter MAXTRI, the number of integrand evaluations exceeds an input parameter MEVALS, or the subroutine senses that round off error is beginning to contaminate the result.

001,285
PB90-190661 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.
ODRPACK: Software for Weighted Orthogonal Distance Regression.
 Final rept.
 P. T. Boggs, J. R. Donaldson, R. H. Byrd, and R. B. Schnabel. 1989, 17p
 Pub. in ACM (Association for Computing Machinery) Transactions on Mathematical Software 15, n4 p348-364 Dec 89).

Keywords: *Regression analysis, Errors, Least squares method, Curve fitting, Algorithms, Reprints, *Computer applications, Computer software.

The paper describes ODRPACK, a software package for the weighted orthogonal distance regression problem. The software is an implementation of an algorithm for finding the parameters that minimize the sum of the squared weighted orthogonal distances from a set of observations to curve or surface determined by the parameters. It can also be used to solve the ordinary non-linear least squares problem. The weighted orthogonal distance regression procedure can be applied to curve and surface fitting and to measurement error models in statistics. The algorithm implemented is an efficient and stable trust region (Levenberg-Marquardt) procedure that exploits the structure of the problem so that the computational cost per iteration is equal to that for the same type of algorithm applied to the ordinary non-linear least squares problem. The package allows a general weighting scheme, provides for finite different derivatives, and contains extensive error checking and report generating facilities.

001,286
PB90-190695 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Impulse Response Acquisition as an Inverse Heat Conduction Problem.
 Research rept.
 A. S. Carasso. 1990, 17p
 Grant N00014-88-F-0005
 Sponsored by Office of Naval Research, Arlington, VA. Pub. in SIAM Jnl. on Applied Mathematics 50, n1 p74-90 Feb 90.

Keywords: Conduction, Linear systems, Perturbation theory, Wave propagation, Volterra equations, Reprints, *Impulse response, Time invariant systems, Inverse problems, Deconvolution, Numerical solution.

The impulse response of a linear time-invariant system can be obtained by deconvolution of the response to a physically realizable, smooth approximation to the Dirac delta-function. As shown in (SIAM J. Appl. Math., 47(1987), pp. 892-927), it is advantageous to synthesize infinitely divisible probe waveforms and recover the system's impulse response by solving the related Cauchy problem for a generalized diffusion equation. The present paper is concerned with perturbations of the originally designed pulse shape, caused by amplifiers, transducers, and other interfacing devices, that may destroy infinite divisibility. It is shown that in a large number of cases a simple linear transformation of the noisy output data can be found that converts the deconvolution problem with the perturbed pulse back into one for which the diffusion theory applies. The search for this transformation is accomplished in the Fourier domain by comparing the perturbed pulse with the designed pulse. As a by-product, it is shown how to construct a rich variety of probe shapes, including waveforms with large negative oscillations, that can be related to a diffusion process.

001,287
PB90-192592 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Fast Fourier Transforms for Direct Solution of Poisson's Equation with Staggered Boundary Conditions.
 Final rept.
 U. Schumann, and R. A. Sweet. 1988, 15p
 Pub. in Jnl. of Computational Physics 75, n1 p123-137 1988.

Keywords: Partial differential equations, Finite difference theory, Fourier transformation, Approximation, Algorithms, Reprints, *Poisson equation, Fast Fourier transforms, Computational grids, Matrix decompositions, Computer applications.

The paper describes pre- and postprocessing algorithms used to incorporate the fast Fourier transform (FFT) into the solution of finite difference approximations to multi-dimensional Poisson's equation on a staggered grid where the boundary is located midways between two grid points. All frequently occurring boundary conditions (Neumann, Dirichlet or cyclic) are considered, including the combination of staggered Neumann boundary condition on one side with non-staggered Dirichlet boundary condition on the other side. Experiences from implementing these algorithms in vectorized coding in Fortran subroutines are reported.

001,288
PB90-221862 PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.
Expected Complexity of the 3-Dimensional Voronoi Diagram.
 J. Bernal. May 90, 21p NISTIR-4321
 See also PB89-209332.

Keywords: Euclidean geometry, Cubes(Mathematics), Algorithms, Theorems, *Voronoi diagrams, Computational geometry, Three dimensional.

Let S be a set of n sites chosen independently from a uniform distribution in a cube in 3-dimensional Euclidean space. In the paper, work by Bentley, Weide and Yao is extended to show that the Voronoi diagram for S has an expected $O(n)$ number of faces. A consequence of the proof of this result is that the Voronoi diagram for S can be constructed in expected $O(n)$ time.

001,289
PB90-227984 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.
Expected Linear 3-Dimensional Voronoi Diagram Algorithm.
 J. Bernal. Jun 90, 17p NISTIR-4340

Keywords: *Algorithms, Geometry, Riemannian manifolds, Linearity, Computer programs, *Voronoi diagrams, Computer calculations.

Let S be a set of n sites chosen independently from a uniform distribution in a cube in 3-dimensional Euclidean space. In the paper, an expected $O(n)$ algorithm for constructing the Voronoi diagram for S together with numerical results obtained from an implementation of the algorithm are presented.

001,290
PB90-235011 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Radiation Research.
Evaluation of the Integral $\int_0^\infty I_0(kr) \int_0^\infty I_0(k'r) r^2 dr$ squared dr.
 L. C. Maximon. Jun 90, 30p NISTIR-4355

Keywords: *Integral equations, *Bessel functions, Delta function, Step functions, Legendre functions, Wave equations.

The integral $\int_0^\infty I_0(kr) \int_0^\infty I_0(k'r) r^2 dr$ squared dr, in which the spherical Bessel functions $\int_0^\infty I_0(kr)$ are the radial eigenfunctions of the three-dimensional wave equation in spherical coordinates, is evaluated in terms of distributions, in particular step functions and delta functions. It is shown that the behavior of $\int_0^\infty I_0(kr)$ is very different in the cases $l-l'$ even (0, + or - 2, + or - 4, ...) and $l-l'$ odd (+ or - 1, + or - 3, ...). For $l-l'$ even it is expressed in terms of the delta function, step functions, and Legendre polynomials. For $l-l'$ odd it is expressed in terms of Legendre functions of the second kind and step functions; no delta functions appear.

001,291
PB90-257593 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Mathematical Treatment of the Spherical Stereology.
 C. Hagwood. Jul 90, 22p NISTIR-4370

Keywords: *Spheres, Density measurement, Probability theory, Estimating, *Stereology.

Stereology is the study of 3-dimensional particles based on their two dimensional cross-sections. In the paper the particles are assumed to be spheres with a random radii distribution. The mathematical aspects of this type of stereology are considered.

001,292
PB90-269499 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.

MATHEMATICAL SCIENCES

Algebra, Analysis, Geometry, & Mathematical Logic

Adaptive Integration Over a Triangulated Region.
E. de Doncker, D. K. Kahaner, and B. Starkenburg.
Aug 90, 15p NISTIR-4376

Keywords: *Numerical integration, Numerical quadrature, Approximation, Extrapolation, Triangles, Fortran, TRIEX algorithm, Two dimensional, Epsilon algorithm.

The authors present an adaptive algorithm which can be used for integration over a triangulated two-dimensional region D . The integrand function may depict some types of singularity on subdivision lines. The algorithm produces a sequence of approximations to the integral over D such that an extrapolation to its limit can be applied. The algorithm is a generalization of the TRIEX algorithm by de Doncker and Robinson.

001,293
PB91-107680

(Order as PB91-107656, PC A06)
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Applied and Computational Mathematics Div.

Tables of the Inverse Laplace Transform of the Function $e^{\beta \sup(-s)}$ (\sup sup beta)).

M. Dishon, J. T. Bendler, and G. H. Weiss. 1990, 34p
Prepared in cooperation with General Electric Co., Schenectady, NY. Research and Development Center, and National Institutes of Health, Bethesda, MD. Div. of Computer Research and Technology.
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 v4 p433-467 Jul-Aug 90.

Keywords: *Laplace transformation, Numerical analysis, Approximation, Tables(Data), *Inverse Laplace transforms.

The inverse transform, $g(t) = L \sup(-1)(e^{\beta \sup(-s)}$ (sup beta)), $0 < \beta < 1$, is a stable law that arises in a number of different applications in chemical physics, polymer physics, solid-state physics, and applied mathematics. Because of its important applications, a number of investigators have suggested approximations to $g(t)$. However, there have so far been no accurately calculated values available for checking or other purposes. The authors present tables, accurate to six figures, of $g(t)$ for a number of values of β between 0.25 and 0.999. In addition, since $g(t)$, regarded as a function of β , is unimodal with a peak occurring at $t = t_{\text{sub max}}$ with both tabulate and graph $t_{\text{sub max}}$ and $1/g(t_{\text{sub max}})$ as a function of β , as well as giving polynomial approximations to $1/g(t_{\text{sub max}})$.

001,294
PB91-112250

Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Mechanical Production Metrology Div.

Asymptotic Approximation of Integral Manifolds.

Final rept.

D. E. Gilsinn. 1987, 12p

Pub. in SIAM (Society for Industrial and Applied Mathematics) Jnl. on Applied Mathematics 47, n5 p929-940 Oct 87.

Keywords: *Nonlinear differential equations, Van der Pol differential equation, Fixed points(Mathematics), Approximation, Reprints, Mathematical manifolds, Transformations(Mathematics), Integral manifolds, Asymptotic methods.

Multi-degree of freedom nonlinear differential equations can often be transformed by means of the method of averaging into equivalent systems with only high order terms. They are called normal systems. Under appropriate small order of perturbation conditions, normal systems have unique surfaces of solutions called integral manifolds. They generalize the notions of periodic and almost periodic solutions for single degree of freedom systems. In parametric form, the integral manifolds satisfy a certain system of partial differential equations. Conversely, an N -th order asymptotic integral manifold is defined as a formal solution of that system of partial differential equations, up to order N in the perturbation parameter. In the main result a system of integral equations is written for the remainder terms. By a contraction argument the system of integral equations has a fixed point, which added to the N -th order asymptotic integral manifold forms an integral manifold for the normal system. By uniqueness this is the integral manifold sought. This implies that the unique integral manifold for the normal system can be written as a formal series plus high order error terms.

001,295
PB91-118042

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD.

Introduction to Quasicrystals.

Final rept.

J. W. Cahn, and J. E. Taylor. 1987, 22p

Sponsored by National Science Foundation, Washington, DC.

Pub. in Contemporary Mathematics 64, p265-286 1987.

Keywords: Aluminum manganese alloys, Electron diffraction, Fourier analysis, Reprints, *Quasicrystals, Icosahedral phase.

A written version of a talk about quasicrystals is presented at the 1985 annual meeting of the American Mathematical Society. It will be published in a centennial symposium volume in honor of the woman mathematician, S. Kovalevskaya. The paper is intended to be for a popular mathematics rather than physics audience, and it raises a number of mathematical issues.

Operations Research

001,296

PB90-155391

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Optimal 3-Dimensional Methods for Linear Programming.

P. D. Dornich, P. T. Boggs, J. R. Donaldson, and C. Witzgall. Dec 89, 25p NISTIR-89/4225

Keywords: *Linear programming, *Algorithms, Optimization, Ordinary differential equations, Iteration, Tests, Method of centers.

Interior point algorithms for solving linear programming problems are considered. An optimal 3-dimensional method is developed that, at each iteration, solves a subproblem based on minimizing the cost function on low-dimensional cross sections of the feasible region. The generators for the original 2-dimensional subproblems are derived from either a discrete or a continuous version of Huard's method of centers. The generators for the optimal 3-dimensional subproblem included the dual affine search direction, and two higher-order search directions. One of the higher order directions is a third order correction to the Newton recentering direction, and the other is a correction to the dual affine direction that is motivated by the use of rank-one updates of the second derivative information. Numerical results are presented for the optimal 3-dimensional method that indicate almost a 23% reduction in CPU time compared to the best dual affine implementation.

Statistical Analysis

001,297

PB90-150129

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.

Computational Examination of Orthogonal Distance Regression.

Final rept.

P. T. Boggs, C. H. Spiegelman, J. R. Donaldson, and R. B. Schnabel. 1988, 33p

Pub. in Jnl. of Econometrics 38, n1-2 p169-201 1988.

Keywords: *Data smoothing, *Statistical analysis, Errors, Monte Carlo method, Reprints, *Parameter identification, Ordinary least squares, Orthogonal distance regression.

Classical or ordinary least squares (OLS) is one of the most commonly used criteria for fitting data to models and for estimating parameters. This is true even when a key assumption for its use, namely that the independent variables are known exactly, is violated. Orthogonal distance regression (ODR) extends least squares data fitting to problems with independent variables that are not known exactly. The paper presents the results of an empirical study designed to examine whether ODR provides better results than OLS when there are errors in the independent variable. It examines a variety of functions, both linear and nonlinear, under a variety of experimental conditions. The results

indicate that, for the data and performance criteria considered, ODR never performs appreciably worse than OLS and sometimes performs considerably better. This leads to the conclusion that ODR is appropriate for a wide variety of practical problems.

001,298

PB90-151747

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.

Orthogonal Distance Regression.

P. T. Boggs, and J. R. Donaldson. Nov 89, 18p
NISTIR-89/4197

Keywords: *Error analysis, Mathematical models, Algorithms, Least squares method, Covariance, Confidence limits, Computerized simulation, *Maximum likelihood estimates, Computer calculations.

Orthogonal Distance Regression (ODR) is the name given to the computational problem associated with finding the maximum likelihood estimators of measurement error models in the case of normally distributed errors. The authors examine the stable and efficient algorithm of Boggs et al. for finding the solution of the problem when the underlying model is assumed to be nonlinear in both the independent variable and the parameters. They also describe the associated public domain software package, ODRPACK. They then review the results of a baseline simulation study that compares ODR with ordinary least squares (OLS). They also present the new results of an extension to the study. Finally they discuss the use of the asymptotic covariance matrix for computing confidence regions and intervals for the estimated parameters. The conclusions are that ODR is better than OLS for the criteria considered, and that ODRPACK can provide effective solutions and useful statistical information for nonlinear ODR problems.

001,299

PB90-155409

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Boulder, CO. Center for Computing and Applied Mathematics.

Algorithm and Computer Program for the Calculation of Envelope Curves.

M. McClain, A. Feldman, D. Kahaner, and X. T. Ying. Dec 89, 26p NISTIR-89/4210

Keywords: *Curve fitting, *Algorithms, Transmittance, Interpolation, Oscillations, Refractivity, Absorptivity, *Computer applications, Computer calculations.

A procedure has been developed to numerically calculate the envelope functions of an oscillatory curve. The method has been shown to be applicable to optical transmission data, but it is general enough to be used for many other data sets. The program is available on request.

001,300

PB90-169772

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD.

Some Thoughts on Variable-Selection in Multiple Regression.

Final rept.

J. Mandel. 1989, 5p

Pub. in Jnl. of Quality Technology 21, n1 p2-6 1989.

Keywords: *Linear regression, *Regression analysis, Mathematical prediction, Reprints, *Variable selection, Goodness of fit.

The practice of variable-selection in multiple linear regression is examined both logically and statistically in terms of the major objectives of regression analysis. It is argued that in addition to goodness-of-fit considerations, due attention should be given to determining the domain, in the space of regressors, in which the regression equation can be used as a prediction device. Such a domain has been called the 'effective prediction domain' (EDP). It is shown that failure to do so can result in serious misuse of the regression equation, especially when regressors have been omitted.

001,301

PB90-170127

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.

Survey Sampling Methods.

Final rept.
K. Eberhardt. 1990, 39p
Pub. in Handbook of Statistical Methods for Engineers and Scientists, Chapter 9, pp. 1-9.39 1990.

Keywords: *Sampling, *Statistical analysis, Methodology, Cluster sampling, Randomization, Stratification, Ratios, Mathematical prediction, Least squares method, Reprints.

The chapter gives a general overview of survey sampling methodology, that is, methods for sample selection and inferences about finite populations. The basic analytical methods covered include: estimation of a population mean, total or proportion, ratio estimation, determination of sample size, and evaluation of sampling uncertainty in an estimate. The following specific sampling techniques are described: simple random sampling, stratified sampling, post stratification, balanced sampling, single-stage cluster sampling, and two-stage cluster sampling. The theoretical background of the methodology is outlined in terms of both classical randomization-based sampling theory and model-based linear least-squares prediction theory.

001,302
PB90-187733 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Scientific Computing Div.
Guidelines for the Infrastructure of Statistical Software.
Final rept.
S. E. Howe, and R. N. Freemire. 1986, 6p
Pub. in Proc. ASA Statist. Computing Section, p206-211 1986.

Keywords: *Statistical analysis, *Standards, Subroutines, Reprints, *Computer software, FORTRAN programming language, Software tools.

The collection, documentation, dissemination, and use of statistical software, particularly Fortran subprograms, can be facilitated through writing in a standard language; well-designed user interfaces; exception handling conventions; conventions for machine constants; sufficient on-line documentation; and software for easy testing. Guidelines regarding each of these features are presented, and public-domain software tools to aid developers in conforming to several of the guidelines are describes.

001,303
PB90-221821 PC A03/MF A01
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.
Variances Based on Data with Dead Time between the Measurements.
Technical note.
J. A. Barnes, and D. W. Allan. Mar 90, 47p NIST/TN-1318
Also available from Supt. of Docs. See also PB89-174049. Prepared in cooperation with Austron, Inc., Boulder, CO.

Keywords: *Variance(Statistics), Frequency stability, Dead time, Bias, Data sampling, Measurement, Tables(Data), *Allan variance.

The accepted definition of frequency stability in the time domain is the two-sample variance (or Allan variance). It is based on the measurement of average frequencies over adjacent time intervals, with no 'dead time' between the intervals. In 1974 a table of bias functions which related variance estimates with various configurations of number of samples and dead time to the Allan variance was published. The tables were based on noises with pure power-law spectral densities. Often situations occur that unavoidably have dead time between measurements, but still the conventional variances are not convergent. Some of these applications are outside of the time-and-frequency field. Also, the dead times are often distributed throughout a given average, and this distributed dead time is not treated in the 1974 tables. The paper reviews the bias functions $B_1(N,r,\mu)$, and $B_2(r,\mu)$ and introduces a new bias function, $B_3(2,M,r,\mu)$, to handle the commonly occurring cases of the effect of distributed dead time on the computed variances. Some convenient and easy-to-interpret asymptotic limits are reported. A set of tables for the bias functions are included at the end of the paper.

001,304
PB90-242231 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.

Lower Bound of Confidence Coefficients for a Confidence Interval on Variance Components.

Final rept.
C. M. Wang. 1990, 6p
Pub. in Biometrics 46, p187-192 Mar 90.

Keywords: *Variance(Statistics), *Confidence limits, Reprints.

The variance component in the one-factor components-of-variance model is of interest in many fields of application. The paper shows that the lower bound of the confidence coefficients for a widely used confidence interval on the variance component is $1 - \alpha$ instead of the previously known result of $1 - 2\alpha$.

001,305
PB90-271388 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Exact Moments of the Symmetric Cubic Assignment Statistic.
Final rept.
H. K. Iyer, and D. F. Vecchia. 1989, 13p
Pub. in Commun. Statist.-Theory Meth. 18, n12 p4309-4320 1989.

Keywords: Allocation models, Permutations, Approximation, Reprints, *Assignment models, Pearson distributions.

Hubert (1987, Assignment Methods in Combinatorial Data Analysis) presented a class of permutation, or random assignment, techniques for assessing correspondence between general k-dimensional proximity measures on a set of 'objects.' A major problem in higher-order assignment models is the prohibitive level of computation that is required. The authors present the first three exact moments of a test statistic for the symmetric cubic assignment model. Efficient computational formulas for the first three moments have been derived, thereby permitting approximation of the permutation distribution using well-known methods.

001,306
PB91-101626 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Statistical Engineering Div.
Exact Distribution-Free Tests for Equality of Several Linear Models.
Final rept.
D. F. Vecchia, and H. K. Iyer. 1989, 22p
Pub. in Communications in Statistics, Theory and Methods 18, n7 p2467-2488 1989.

Keywords: *Statistical tests, *Mathematical models, Permutations, Nonparametric statistics, Linear regression, Stochastic processes, Reprints.

Exact tests for the equality of several linear models are developed using permutation techniques. Two cases of the linear model, characterized by either stochastic or nonstochastic predictors, are considered: the linear regression model (LRM) and the general linear model (GLM). A general class of test statistics using the volume of simplexes as the basic unit of analysis is proposed for this problem. The resulting class of statistics is shown to be a natural generalization of the multi-response permutation procedure (MRPP) test statistics which have been shown to comprise many of the statistics used in both parametric and nonparametric analysis of the standard g-sample problem. In the LRM case, exact moments of all orders are derived for the permutation distribution of any test statistic in the general class. Moment-based approximation of significance levels is shown to be computationally feasible in the simple LRM.

General

001,307
PB90-136441 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Applied Mathematics.
Samuel Stanley Wilks' Princeton Appointment, and Statistics at Princeton Before Wilks.
Final rept.
C. Eisenhart. 1989, 11p
Pub. in A Century of Mathematics in America, pt3 p577-587.

Keywords: *Statistical analysis, Probability theory, Mathematics, Reprints, *Wilks Samuel Stanley, *Princeton University, Higher education.

The paper discusses the appointment of Samuel Stanley Wilks (1906-1964) to a position in the Department of Mathematics, Princeton University, in 1933. Wilks taught his first statistics course in the Department of Mathematics in 1936-1937. The paper describes statistics at Princeton in prior years, and gives an explanation of the delay in Wilk's teaching statistics at Princeton.

001,308
PB90-216508 PC A99/MF A04
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Guide to Available Mathematical Software, March 1990.
R. F. Boisvert, S. E. Howe, D. K. Kahaner, and J. L. Springmann. Mar 90, 683p NISTIR-90/4237
See also PB89-170864 and PB84-171305.

Keywords: *Computer programs, *Applications of mathematics, Statistical analysis, Utility routines, Optimization, Mathematical models, Computerized simulation, Linear algebra, *Computer software, National Institute of Standards and Technology, Computer graphics, Online systems.

The catalog of mathematical and statistical software is made available to computer users at the National Institute of Standards and Technology by its Center for Computing and Applied Mathematics. The edition includes descriptions of 5069 software modules comprising 40 software packages implemented on six different computer systems. The catalog is divided into five parts: a classification scheme for mathematical and statistical problems, a list of software modules organized according to the problems they solve, a more detailed list of software modules in alphabetical order, a description of each software package and its implementations, and a keyword index to the problem classification scheme.

MEDICINE & BIOLOGY

Biochemistry

001,309
PB90-152455 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Engineering of Binding Affinity at Metal Ion Binding Sites for the Stabilization of Proteins: Subtilisin as a Test Case.
Final rept.
M. W. Pantoliano, M. Whitlow, J. F. Wood, M. L. Rollence, B. C. Finzel, G. L. Gilliland, T. L. Poulos, and P. N. Bryan. 1988, 7p
Pub. in Biochemistry 27, n22 p8311-8317 1988.

Keywords: *Metal containing organic compounds, Ions, Volumetric analysis, X ray diffraction, Mutation, Reprints, *Calcium-binding proteins, *Binding sites, *Subtilisins, Serine proteases, Osmolar concentration.

A weak $Ca(2+)$ binding site in the bacterial serine protease subtilisin BPN' (EC 3.4.21.14) was chosen as a model to explore the feasibility of stabilizing a protein by increasing the binding affinity at a metal ion binding site. The existence of this weak $Ca(2+)$ binding site was first discovered through a study of the rate of thermal inactivation of wild-type subtilisin BPN' at 65 C as a function of the free $Ca(2+)$. Increasing the $Ca(2+)$ in the range 0.10-100 mM caused a 100-fold decrease in the rate of thermal inactivation. The data were found to closely fit a theoretical titration curve for a single $Ca(2+)$ specific binding site with an apparent $\log K = 1.49$. A series of refined X-ray crystal structures ($R < 0.15, 1.7 A$) of subtilisin in the presence of 0.0, 25.0, and 40.0 mM $CaCl_2$ has allowed a detailed structural characterization of this $Ca(2+)$ binding site. Negatively charged side chains were introduced in the vicinity of the bound $Ca(2+)$ by changing Pro 172 and

Biochemistry

Gly 131 to Asp residues through site-directed and random mutagenesis techniques, respectively. These changes were found to increase the affinity of the Ca(2+) binding site by 3.4- and 2-fold, respectively, when compared with the wild-type protein (ionic strength = 0.10). X-ray studies of these new variants of subtilisin revealed the carboxylate side chains to be 6.8 and 13.2 Å, respectively, from the bound Ca(2+).

001,310
PB90-170309 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Organic Analytical Research Div.
Mass Spectral Identification of 2-Amino-4-(5-Nitro-2-Furyl)thiazole Metabolites.
Final rept.
M. B. Mattammal, V. M. Lakshmi, T. V. Zenser, B. B. Davis, and E. V. White. 1988, 5p
Pub. in Biomed. Environ. Mass Spectrom. 15, n9 p495-499 1988.

Keywords: *Mass spectroscopy, *Qualitative analysis, *Ribosomes, *Thiazoles, *Nitro compounds, *Furans, Electron beams, Carcinogens, Biochemistry, Reprints, *Metabolites, Synthesis(Chemistry).

The electron impact mass spectra of 2-amino-4-(5-nitro-2-furyl)thiazole metabolites obtained from microsomal incubations and chemical syntheses were studied. The identities of the metabolites were established by chemical ionization, high resolution, and metastable measurements. An intense array of peaks are seen resulting from multiple modes of cleavage, skeletal rearrangements, and hydrogen back transfer.

001,311
PB90-206723 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Structure of Insulin: Results of Joint Neutron and X-ray Refinement.
Final rept.
A. Wlodawer, H. Savage, and G. Dodson. 1989, 9p
Pub. in Acta Crystallographica B45, n1 p99-107 1989.

Keywords: *Insulin, *Molecular structure, *Neutron diffraction, *X ray diffraction, Least squares method, Temperature, Hydrogen, Swine, Crystals, Solvents, Reprints.

Neutron diffraction data for porcine 2Zn insulin were collected to 2.2Å resolution from a single crystal deuterated by slow exchange of mother liquor. A joint neutron/x-ray restrained least squares refinement was undertaken using the neutron data, as well as the 1.5Å resolution x-ray data collected previously. The final R-factors were 0.182 for the x-ray data and 0.191 for the neutron data. Resulting atomic coordinates were compared with the initial x-ray model, showing the totals rms shift at 0.36Å for the protein and 0.6Å for the solvent. Temperature factors for both crystallographically independent molecules were analyzed and their differences were correlated with the crystal packing. Protonation of certain individual amino acids were analyzed. Amide hydrogen exchange was investigated in a refinement of atomic occupancies. Regions of unexchanged amide groups were found in the center of the B helices. Solvent structure was compared in the two models, with some indication of differences due to deuteration.

001,312
PB90-241415 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Separation and Characterization of Fibronectin Domains by Two-Dimensional Electrophoresis.
Final rept.
J. J. Edwards, D. J. Reeder, and D. H. Atha. 1990, 6p
Pub. in Applied and Theoretical Electrophoresis 1, p207-212 1990.

Keywords: *Biochemistry, Molecular weight, Enzymes, Hydrolysis, Neuraminidase, Carbohydrates, Reprints, *Two-dimensional gel electrophoresis, *Computer-assisted image processing, *Fibronectin, Gel chromatography, Affinity chromatography, Isoelectric point, Isoelectric focusing, Hydroxyapatite, Carbohydrate conformation, Protein conformation.

Two-dimensional gel electrophoresis (2DGE) and image processing were used to quantify protein and carbohydrate heterogeneity in human plasma fibronectin (FN) and its enzymatically produced domains. After a 30 minute thermolysin digest of FN, the do-

maines were identified in 2DGE by their known isoelectric points and molecular weights, which were compared to domain standards purified by hydroxyapatite, gel exclusion and heparin-Sepharose chromatography. Three individual species were observed in the cell binding domain which may correspond to the heterogeneity known to result from alternative splicings of the fibronectin gene. In addition, the carbohydrate heterogeneity in the gelatin binding domain was analyzed by 2DGE and isoelectric focusing (IEF) before and after treatment with N-glycanase and neuraminidase to remove selected carbohydrate moieties.

001,313
PB91-101675 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Organic Analytical Research Div.
Liposome-Based Flow Injection Enzyme Immunoassay for Theophylline.
Final rept.
T. G. Wu, and R. A. Durst. 1990, 9p
Pub. in Mikrochimica Acta I, p187-195 1990.

Keywords: *Enzymes, Antibodies, Reprints, *Immunoassay, *Theophylline, *Liposomes, Flow injection analysis.

Preliminary results are presented on the development of a sensitive, quantitative immunoassay based on a regenerable, flow injection analysis system incorporating a double-amplification approach. The double amplification is achieved by means of liposome-encapsulated peroxidase enzyme molecules which are released subsequent to a competitive immunological reaction with analyte molecules for immobilized antibodies. The released peroxidase enzymatically cleaves, from an organofluorine substrate, fluoride ions which are then potentiometrically measured. The entire process is carried out in a flow injection analysis system. The competition between the analyte molecules (theophylline) and the theophylline-derivatized liposomes for immobilized antibody sites in flow-through immunoreactor column results in unbound liposomes being carried downstream where they are ruptured in the presence of hydrogen peroxide and p-fluorophenol. The peroxidase molecules released react enzymatically to produce fluoride ions which are measured with an ion-selective electrode.

001,314
PB91-133975 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Separation of Amino Acids Using Composite Ion Exchange Membranes.
Final rept.
B. K. Dutta, and S. K. Sikdar. 1990, 11p
Pub. in Annals of the New York Academy of Sciences 589, p203-213, 20 May 90.

Keywords: *Ion exchanging, *Membranes, *Amino acids, Thin films, Permeameters, Sulfonic acids, Mass transfer, Water, Composite materials, Polymers, Reprints, *Separation processes, Perfluorosulfonic acid.

A new composite ion exchange membrane for separating amino acids from aqueous solutions was made by casting a thin (10 microns) perfluorosulfonic acid (PFSA) film on a highly porous thin (20 microns) polytetrafluoroethylene support. A stirred permeation cell was used to measure transport rates of amino acids from single- and multi-component aqueous solutions. For comparison, permeation data were also collected using a commercial PFSA membrane about 170 microns thick. The amino acid fluxes for the composite membrane were greater by an order of magnitude, 10(sup-7) vs. 10(sup-8)mol/sq cm-s.

001,315
PB91-134429 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Models for Strong Interactions in Proteins and Enzymes. 1. Enhanced Acidities of Principal Biological Hydrogen Donors.
Final rept.
M. Mautner. 1988, 5p
See also Part 2, PB91-134437.
Pub. in Jnl. of American Chemical Society 110, n10 p3071-3075 1988.

Keywords: *Proteins, *Enzymes, *Peptides, *Hydrogen bonds, Chemical bonds, Hydrogen, Amides, Proton spectra, Dissociation energy, Acidity, Donor materials, Mass spectra, Reprints, Binding energy.

The hydrogen bond donor strength of the peptide link in solvent-free protein environments it related to the intrinsic NH acidity. In this relation, the acid dissociation energies of amides and of the model amino acid derivative CH3CONHCH(CH3)COOCH3, (ie. CH3CO-Ala-OCH3m denoted as AAlaNH), were measured in solvent-free gas phase conditions. The acid dissociation energies of the amides HCONH, HCONHCH3 and CH3CONHCH3 are all similar with acid dissociation energies = 362 - 364 kcal/mol.

001,316
PB91-134437 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Kinetics Div.
Models for Strong Interactions in Proteins and Enzymes. 2. Interactions of Ions with the Peptide Link and with Imidazole.
Final rept.
M. Mautner. 1988, 6p
See also Part 1, PB91-134429.
Pub. in Jnl. of American Chemical Society 110, n10 p3075-3080 1988.

Keywords: *Proteins, *Enzymes, *Dissociation energy, *Imidazoles, Hydrogen bonds, Acidity, Mass spectra, Donor materials, Proton spectra, Reprints.

The ionic interactions of the imidazole moiety in solvent-free protein interiors are critical to enzyme energetics. In this relation, bond dissociation energies of anionic and cationic complexes of imidazole were measured in the solvent-free gas-phase environment. The intrinsic acidities of azoles, ie. acid dissociation energies which are related to donor properties in hydrogen bonds, were also measured. In comparison to pyrrole, the acid dissociation energy = 360.1 kcal/mol, imidazole is a strong acid, ie. the acid dissociation energy is low, 351.8 kcal/mol.

Botany

001,317
N90-13945/2
(Order as N90-13939/5, PC A14/MF A02)
National Inst. of Standards and Technology, Boulder, CO. Chemical Engineering Science Div.
Physical Phenomena and the Microgravity Response.
P. Todd. Aug 89, 14p
In NASA, Ames Research Center, Cells in Space p103-116.

Keywords: *Cells (Biology), Cytology, *Diffusion, Acceleration (Physics), Inertia, Protein crystal growth, *Chemical reaction kinetics.

The living biological cell is not a sack of Newtonian fluid containing systems of chemical reactions at equilibrium. It is a kinetically driven system, not a thermodynamically driven system. While the cell as a whole might be considered isothermal, at the scale of individual macromolecular events there is heat generated, and presumably sharp thermal gradients exist at the submicron level. Basic physical phenomena to be considered when exploring the cell's response to inertial acceleration include particle sedimentation, solutal convection, motility electrokinetics, cytoskeletal work, and hydrostatic pressure. Protein crystal growth experiments, for example, illustrate the profound effects of convection currents on macromolecular assembly. Reaction kinetics in the cell vary all the way from diffusion-limited to life-time limited. Transport processes vary from free diffusion, to facilitated and active transmembrane transport, to contractile-protein-driven motility, to crystalline immobilization. At least four physical states of matter exist in the cell: aqueous, non-aqueous, immiscible-aqueous, and solid. Levels of order vary from crystalline to free solution. The relative volumes of these states profoundly influence the cell's response to inertial acceleration. Such subcellular phenomena as stretch-receptor activation, microtubule re-assembly, synaptic junction formation, chemotactic receptor activation, and statolith sedimentation were studied recently with respect to both their basic mechanisms and their responsiveness to inertial acceleration. From such studies a widespread role of cytoskeletal organization is becoming apparent.

Clinical Chemistry

001,318
PB90-150244 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Organic Analytical Research Div.
National Reference System for Cholesterol.
 Final rept.
 R. E. Vanderlinde, G. N. Bowers, R. Schaffer, and G.
 C. Edwards. 1989, 16p
 Pub. in Clinics in Laboratory Medicine 9, n1 p89-104
 Mar 89.

Keywords: *Cholesterol, *Blood chemical analysis,
 *Clinical medicine, Laboratories, Reprints, *Reference
 values.

The effective utilization of cholesterol risk guidelines
 by physicians requires reliable and accurate patient
 serum cholesterol values. Each clinical or office labo-
 ratory's serum cholesterol analyses should be trace-
 able to the National Reference System for Cholesterol
 (NRS/CHOL), an accuracy-based national system for
 cholesterol standardization. The NRS/CHOL is a reali-
 ty that is progressively becoming the way in which ac-
 curacy of cholesterol results can be ensured. Proof of
 traceability to NRS/CHOL within each segment of the
 clinical laboratory will soon be the norm that makes a
 sound conceptual reference system into an everyday
 reality, reaching into many thousands of working sites
 that measure cholesterol in patient serum samples. It
 is possible to reach the national analytical goal for cho-
 lesterol so that 'results from any clinical laboratory in
 the United States can be interchanged with those of
 any other clinical laboratory within defined limits of ac-
 curacy and precision required to meet the needs of
 medical practice'.

001,319
PB90-152844 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Inorganic Analytical Research Div.
Laboratory Robotics for Trace Analysis.
 Final rept.
 G. Hawk, and S. Kingston. 1988, 14p
 Pub. in Quantitative Trace Analysis of Biological Mate-
 rials, p285-298 1988.

Keywords: *Laboratory equipment, *Biological labora-
 tories, Utilization, Chemical analysis, Automation, Re-
 prints, *Robotics.

The equipment and biological applications in the rela-
 tively new field of laboratory robotics is described.
 Sources of equipment are given and specific biological
 applications are described. The use of robotics in the
 analytical laboratory is described as it presently exists
 and projected into the future. Specific applications of
 flexible laboratory automation are presented for inor-
 ganic analysis in biological systems.

001,320
PB90-205782 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Fire Measurement and Research
 Div.
**Analysis of Carboxyhemoglobin and Cyanide in
 Blood from Victims of the Dupont Plaza Hotel Fire
 in Puerto Rico.**
 Final rept.
 B. C. Levin, P. R. Rechani, J. L. Gurman, F. Landron,
 H. M. Clark, M. F. Yoklavich, J. R. Rodriguez, L.
 Droz, F. Mattos de Cabrera, and S. Kaye. 1990, 18p
 Pub. in Jnl. of Forensic Sciences 35, n1 p151-168 Jan
 90.

Keywords: *Blood chemical analysis, *Cyanides,
 *Fires, Toxicology, Puerto Rico, Carbon monoxide,
 Reprints, *Carboxyhemoglobins, *Fire victims.

Ninety-seven people died from a fire that occurred in
 the Dupont Plaza Hotel in Puerto Rico on 31 Dec 1986.
 All, except four who died later in the hospital, were
 found dead at the scene. All of the fatalities at the
 hotel (except for eight) were burned beyond recogni-
 tion. Blood from seventy-eight of the victims was
 screened for carboxyhemoglobin at the Institute for
 Forensic Sciences in Puerto Rico and was then sent to
 the National Institute of Standards and Technology,
 Gaithersburg, Maryland, for analysis of carboxyhe-
 moglobin and cyanide concentrations. The blood data
 indicated that carbon monoxide and hydrogen cya-
 nide, singly or combined, were probably not responsi-
 ble for the majority of the deaths that occurred in the
 badly burned victims. On the other hand, the signifi-

cantly higher carboxyhemoglobin in the nonburned vic-
 tims indicated that carbon monoxide alone or com-
 bined with hydrogen cyanide probably played a major
 role in the cause of their deaths.

Clinical Medicine

001,321
PB90-169822 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Ionizing Radiation Physics Div.
**X-ray Attenuation Properties of Radiographic Con-
 trast Media.**
 Final rept.
 P. Lumbruso, and C. E. Dick. 1987, 7p
 Pub. in Medical Physics 14, n5 p752-758 Sep/Oct 87.

Keywords: *Radiography, X ray spectra, Computerized
 simulation, Attenuation, Contrast, Predictions, Re-
 prints, *Biomedical radiography, *X-ray radiography,
 Imaging techniques.

A systematic study has been carried out to assess the
 x-ray attenuation effects of various elements when
 used as radiographic contrast enhancing media. The
 study examines the effects of solutions of molecules
 with effective atomic numbers from 40 to 92 on the
 signal contrast ratio of radiographic images formed
 with various input x-ray spectra on suitable phantoms.
 A variety of x-ray spectra were used including monoener-
 getic spectra, constant potential x-ray tube spectra,
 and CT spectra. In addition, a computer model was
 used to predict the effects studied. In general, the
 computer model is able to accurately predict the re-
 sulting signal contrast ratio for a given combination of
 contrast media, input x-ray spectra, and phantom com-
 position. From these data and calculations it may be
 possible to design new contrast media which are tai-
 lored to specific diagnostic imaging tasks.

001,322
PB90-261272 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Center for Radiation Research.
**AAPM (American Association of Physicists) Ac-
 credited Dosimetry Calibration Laboratories.**
 Final rept.
 R. Loevinger. 1985, 12p
 Pub. in Proceedings of Workshop on Radiation Survey
 Instruments and Calibrations, Gaithersburg, MD., July
 10-12, 1984, pD.11-D.21 1985.

Keywords: Ionizing radiation, Reprints, *Dosimetry
 calibration laboratories, Accreditation, Radiation ther-
 apy.

The development and operations of five dosimetry
 calibration laboratories accredited by the American
 Association of Physicists (AAPM) is the subject of the
 paper. These laboratories calibrate instruments that
 are used to calibrate beams used for radiation therapy.

001,323
PB90-271669 Not available NTIS
 National Inst. of Standards and Technology (IMSE),
 Gaithersburg, MD. Polymers Div.
**Use of Bone Mineral Ratio for Early Diagnosis of
 Osteoporosis.**
 Final rept.
 M. S. Tung, C. M. Shih, M. Tung, S. Gupta, and N. E.
 Herrera. 1990, 7p
 Sponsored by American Dental Association Health
 Foundation, Chicago, IL.
 Pub. in Jnl. Orth. Surg. ROC 7, p46-52 1990.

Keywords: *Bones, *Minerals, *Osteoporosis, Diagno-
 sis, Reprints, Risk factors.

The bone mineral ratio (BMR) of trabecular to compact
 bone is proposed as a parameter for identification of
 asymptomatic population at risk of osteoporosis. The
 calculation indicates that, both in male and female
 groups, BMR is not significantly different between
 young and older normal subjects and decreases sig-
 nificantly for osteoporotic patients. This is indicative of
 preferential bone loss in trabecular bone and suggests
 that BMR should be a sensitive parameter for early di-
 agnosis of osteoporosis.

Cytology, Genetics, & Molecular
 Biology

001,324
PB90-153446 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Chemical Thermodynamics Div.
**Arginine Substituted for Leucine at Position 195 Pro-
 duces a Cyclic Amp-Independent Form of the 'Es-
 cherichia Coli' Cyclic AMP Receptor Protein.**
 Final rept.
 J. G. Harman, A. Peterkofsky, and K. McKenney.
 1988, 6p
 Pub. in Jnl. of Biological Chemistry 263, n17 p8072-
 8077 1988.

Keywords: *Escherichia coli, *Leucine, *Arginine,
 *Mutation, Amino acids, Substitution reactions, In vitro
 analysis, In vivo analysis, Deoxyribonucleic acids, Re-
 prints, *Protein kinases, *Cyclic AMP receptors, Bac-
 terial gene expression, Allosteric pathways.

Mutant forms of the Escherichia coli cAMP receptor
 protein (CRP) that activate CRP-dependent promoters
 in the absence of the normal allosteric effector (cAMP)
 have been described. A previous report detailed the
 properties of three CRP mutants. One protein, 220
 CRP, has amino acid substitutions at positions 127 and
 170 and has low CRP activity in vivo. A second protein,
 CRP 222, has the amino acid substitutions present in
 220 CRP and a third substitution (arginine for leucine)
 at position 195. CRP 222 has high CRP activity in vivo
 and high apparent affinity for lacP DNA relative to the
 220 CRP in vitro. To evaluate the effect of amino acid
 substitution at position 195 on CRP activity two mutant
 crp alleles, crpR195 and crpP195, have been con-
 structed. These studies show that the effects of multi-
 ple mutations in CRP can be both cumulative and inter-
 active and that the properties of CRP mutants with
 multiple mutations cannot be predicted from those of
 proteins having isolated mutations.

001,325
PB90-169939 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Chemical Thermodynamics Div.
**Deletion Analysis of the DNA Sequence Required
 for the In Vitro Initiation of Replication of Bacterio-
 phage.**
 Final rept.
 S. Wickner, and K. McKenney. 1987, 5p
 Pub. in Jnl. of Biological Chemistry 262, n27 p3163-
 3167 1987.

Keywords: In vitro analysis, Reprints, *Phage lambda,
 *Gene deletion, *Virus replication, *Base sequence,
 *Viral DNA, Base pairs, Templates.

Supercoiled DNA containing the replication origin of
 bacteriophage lambda can be replicated in vitro. This
 reaction requires purified lambda O and P replication
 proteins and a partially purified mixture of Escherichia
 coli proteins. The lambda origin region has four re-
 peats of a 19 base-pair sequence to which O protein
 binds. In vitro replication of RF I DNAs prepared from
 cells infected with these two M13 ori lambda phage
 was dependent on lambda O and P proteins and a
 crude protein fraction from uninfected E. coli; with
 these conditions there was no replication of M13mp8
 RF I DNA. Deletions were made from the left and the
 right ends of the lambda origin DNA and determined
 the deletion endpoints by DNA sequencing. RF I DNAs
 prepared from cells infected with phage carrying ori
 lambda deletions have been tested for their ability to
 function as templates for O and P dependent replica-
 tion in vitro. The results show that lambda DNA be-
 tween nucleotide positions 39072 and 39160 is re-
 quired for efficient O and P dependent replications.
 This 89 base-pair piece of DNA includes only two of
 the four 19 base pair O protein binding sites (the two
 right most) and the adjoining adenine and thymine rich
 region to the right of the O binding sites.

001,326
PB90-193517 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Chemical Thermodynamics Div.
**Vector Averaging Method for Locating Small Dif-
 ferences between Nearly Identical Protein Struc-
 tures.**
 Final rept.
 I. T. Weber. 1987, 6p
 Pub. in Jnl. of Applied Crystallography 20, p388-393
 Oct 87.

Keywords: Comparison, Vectors, Reprints, *Protein conformation.

When two similar protein structures are compared it is often difficult to analyze or even identify smaller differences, especially if the proteins are large. A method is described in which the refined coordinates of two nearly identical protein structures are compared by a vector averaging of the differences in atomic coordinates over several consecutive residues. The technique detects regions of the protein where all the atoms move in the same direction. The magnitude and direction of the resultant average vector give the local conformational difference between the two structures. Regions with such correlated movements have been identified in several different protein structures.

001,327
PB90-193525 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Structure of a Complex of Catabolite Gene Activator Protein and Cyclic AMP Refined at 2.5 Å Resolution.

Final rept.
I. T. Weber, and T. A. Steitz. 1987, 16p
Pub. in Jnl. of Molecular Biology 198, n2 p311-326 1987.

Keywords: *Genes, Crystallography, Reprints, *Catabolism, *Protein conformation, *Adenosine cyclic monophosphate.

The structure of a dimer of the E. coli catabolite gene activator protein has been refined at 2.5 Å resolution to a crystallographic R-factor of 20.7%. The two subunits are in different conformations and each contains one bound molecule of the allosteric activator, cAMP. An amino terminal domain is linked to the smaller carboxy terminal domain by a 9 residue hinge region that exists in different conformations in the two subunits, giving rise to approximately a 30 deg rotation between the positions of the small domains relative to the large domains. The amino terminal domain contains an anti-parallel beta roll structure in which the interstrand hydrogen bonding is well determined. The beta roll can be described as a long antiparallel beta ribbon that folds into a right handed supercoil and forms part of the cAMP binding site. Each cAMP molecule is in an anti conformation and has ionic and hydrogen bond interactions with both subunits.

001,328
PB90-206012 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

NBS Biological Macromolecule Crystallization Database.

Final rept.
G. L. Gilliland. 1987, 2p
Pub. in Crystallographic Databases, p156-157 1987.

Keywords: *Crystallization, *Deoxyribonucleic acids, *Ribonucleic acids, Computer systems programs, Reprints, *Databases, Microcomputers.

The National Bureau of Standards is supporting the development and distribution of a Biological Macromolecule Crystallization Database. The database contains published data only. The database management system is being developed for personal computers. Data and software will be available in early 1988.

001,329
PB90-206046 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Small Angle Neutron Scattering Method for In Situ Studies of the Dense Cores of Biological Cells and Vesicles: Application to Isolated Neurosecretory Vesicles.

Final rept.
S. Krueger, J. W. Lynn, J. T. Russell, and R. Nossal. 1989, 10p
Pub. in Jnl. Appl. Cryst. 22, p546-555 1989.

Keywords: *Neutron scattering, *Cells(Biology), Crystallization, Reprints, *Neurosecretory systems, Cell membrane.

Small-angle neutron scattering was used to study the structure of the dense cores of intact neurosecretory vesicles (NSV). Contrast-variation techniques were used to minimize the scattering due to vesicle membranes and emphasize that due to the cores. By examination of a suspension of NSV membranes along with

the intact NSV, residual membrane scattering was suppressed. The resultant scattering is inconsistent with model calculations which assume that the dense state of the vesicle cores is achieved by random dense packing or crystallization of small globular particles. Rather, the data suggest that the core constituents exist in a disordered state, forming aggregates with radii of gyration significantly larger than 100 Å.

001,330
PB90-206053 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Neutron and Light-Scattering Studies of DNA Gyrase and Its Complex with DNA.

Final rept.
S. Krueger, G. Zaccari, A. Wlodawer, J. Langowski, M. O'Dea, A. Maxwell, and M. Gellert. 1990, 10p
Pub. in Jnl. of Molecular Biology 211, p211-220 1990.

Keywords: *Neutron scattering, *Light scattering, *Molecular structure, Escherichia coli, Reprints, *DNA gyrase, *Superhelical DNA, DNA binding proteins.

The solution structure of Escherichia coli DNA gyrase, an enzyme that catalyzes the ATP-dependent supercoiling of DNA, has been characterized by small-angle neutron scattering (SANS) and dynamic light-scattering (DLS). The enzyme and its complex with a 172 base-pair fragment of duplex DNA, in H₂O or (2)H₂O solvent, were studied by contrast variation and the measurement of hydrodynamic parameters as a function of scattering angle. The complex was also measured in the presence of 5'-adenylyl-beta gamma-imidodiphosphate (ADPNP), a non-hydrolyzable ATP analog that is known to support limited supercoiling. The values of the radius of gyration, R_g = 67 Å, from SANS and the hydrodynamic radius, R_h = 64 Å from DLS predict a larger than expected volume for the enzyme, supporting the notion of channels or cavities within the molecule. In addition, several classes of models were rejected based on SANS data obtained in (2)H₂O at larger scattering angles. The best fit to both the SANS and DLS data is obtained for oblate, inhomogeneous particles approximately 175 Å wide and 52 Å thick. Such particles provide a large surface area for DNA interaction.

001,331
PB90-206103 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Autoregulation of the Yeast Copper Metallothionein Gene Depends on Metal Binding.

Final rept.
C. F. Wright, D. H. Hamer, and K. McKenney. 1988, 5p
Pub. in Jnl. of Biological Chemistry 263, n3 p1570-1574 1988.

Keywords: *Genes, *Yeasts, *Copper, *Proteins, Amino acids, Mutation, Reprints, *Metallothionein, *Gene expression regulation, Genetic transcription, Fungal proteins.

The yeast CUP1 gene product, copper metallothionein, acts to repress the basal transcription of its own structural gene. By creating a series of truncation and amino acid substitutions in CUP1, we show that the ability of the protein to autoregulate is directly correlated to its ability to bind and detoxify copper. These results support a model in which metallothionein controls the level of free intracellular copper available to interact with positive transcription factors. In addition, mutations in chemically equivalent cysteine residues were functionally dissimilar, suggesting that partial sites in the molecule are critical for the formation of the sulfur-metal cluster.

001,332
PB90-206715 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Structure of Phosphate-Free Ribonuclease A Refined at 1.26 Å.

Final rept.
A. Wlodawer, L. A. Svensson, L. Sjolin, and G. L. Gilliland. 1988, 13p
Pub. in Biochemistry 27, n8 p2705-2717 1988.

Keywords: *Molecular structure, *Phosphates, X ray diffraction, Least squares method, Cattle, Reprints, *Ribonuclease A.

The structure of phosphate-free bovine ribonuclease A has been refined at 1.26 Å resolution by a restrained

least-squares procedure to a final R factor of 0.15. X-ray diffraction data were collected with an electronic position-sensitive detector. The final model consists of all atoms in the polypeptide chain including hydrogens, 188 water sites with full or partial occupancy, and a single molecule of t-butanol. Thirteen side chains were modeled with two alternate conformations. Major changes to the active site include addition of two waters in the phosphate-binding pocket, disordering of Gln11 and tilting of the imidazole ring of His19. The structure of the protein and of the associated solvent was extensively compared with three other high resolution, refined structures of this enzyme.

001,333
PB90-206731 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Structure of Form III Crystals of Bovine Pancreatic Trypsin Inhibitor.

Final rept.
A. Wlodawer, W. Gallagher, G. L. Gilliland, J. Nachman, and C. Woodward. 1987, 12p
Pub. in Jnl. of Molecular Biology 198, n3 p469-480 1987.

Keywords: *Molecular structure, *Pancreas, X ray diffraction, Cattle, Crystals, Least squares method, Phosphates, Hydrogen bonds, Reprints, *Trypsin inhibitors.

The structure of bovine pancreatic trypsin inhibitor (BPTI) has been solved in a new crystal form III: The crystals belong to space group P21212 with a = 55.2 Å, b = 38.2 Å, c = 24.05 Å. The structure was solved on the basis of coordinates of forms I and II of BPTI by molecular replacement, and the X-ray data extending to 1.7 Å were used in a restrained least squares refinement. The final R factor was 0.16 and the deviation of bonded distances from ideality 0.020 Å. Root mean square discrepancy between Ca coordinates of forms III and I are 0.47 Å, while between forms II and III the discrepancy is 0.39 Å. These deviations are about a factor of three larger than the expected experimental errors, showing that true differences exist between the three crystal forms. Two residues (Arg 39 and Asp 50) were modeled with two positions for their side chains. The final model includes 73 water molecules and one phosphate bound to the protein. Sixteen waters occupy approximately the same positions in all three crystal forms studied to date, indicating their close association with the protein molecule. Temperature factors also show high correlation between the three crystal forms.

001,334
PB90-218322 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Effect of a Camp-Independent Mutation on Crystal Structure of Catabolite Gene Activator Protein.

Final rept.
I. T. Weber, M. C. Vaney, G. L. Gilliland, J. G. Harman, and A. Peterkofsky. 1987, 10p
Pub. in UCLA Symposia on Molecular and Cellular Biology, New Series, v69 p65-74 1987.

Keywords: *Mutations, *Crystals, Escherichia coli, X ray diffraction, Fourier analysis, Amino acids, Reprints, *Cyclic AMP, *Gene expression, Phenotype.

E. coli NCR91 synthesizes a mutant form of the catabolite gene activator protein in which Ala 144 is replaced by Thr. This mutant has a CAP phenotype; in the absence of cAMP it is able to express genes that normally require cAMP. CAP91 has been purified and crystallized with cAMP under the same conditions as crystals of the wild type CAP-cAMP complex. X-ray diffraction data were measured to 2.4 Å resolution and the wild type CAP phases were used to determine the CAP91 structure. A difference Fourier showed two Ala to Thr substitutions in the dimer and a motion of one Cys 178. The CAP91 coordinates were refined to an R factor of 0.186 and the changes compared with the wild type included concerted motions distal to the mutation site. The effect of adenosine on the CAP91 structure has been tested.

001,335
PB90-218447 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Binding of Substituted cis-Pt(II)-Diammines to Duplex DNA.

Final rept.
S. L. McCarthy, R. J. Hinde, K. J. Miller, J. S. Anderson, and H. Basch. 1990, 7p
Pub. in Biopolymers 29, p785-790 1990.

Keywords: *Metabolism, *Deoxyribonucleic acids, Computerized simulation, Reprints, *Cisplatin, Nucleic acid conformation, Cell survival, Nucleic acid heteroduplexes.

The results of a study of the binding to DNA of substituted cis-Pt(II) diammines, (cis-DP) are presented. Computer modeling of a series of cis-Pt(NH₂R)₂(+2)-where R=H, CH₃, cyclopropyl, cyclobutyl, and cyclopentyl-to N7(G) atoms of two adjacent intrastrand guanine bases in a square planar complex in a pentamer duplex of DNA were performed. The stability of the complexes is studied by calculating the relative conformational energy of the cis-DP-DNA complexes with molecular mechanics (MM) and the intrinsic binding energy, which is the relative binding energy for ligand replacement in the presence of the substituents R with quantum mechanics. In the model, the receptor site geometry and the conformation of the DNA is changed little in the accommodation of the series of monosubstituted diammines. These diammines bind to one family of DNA conformations, denoted as IC in a previous study, and this suggests that a common conformational feature in the DNA may exist to explain the smooth trend in activity. The slight increase in van der Waals energy resulting from an increasing number of atoms in the substituents is countered by a larger decrease in the ligand replacement energy as the substituent increases in size.

001,336
PB90-271354 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Crystal Structures of Bacterial Glutaminase-Asparaginases.

Final rept.
R. W. Harrison, I. T. Weber, H. L. Ammon, K. C. Murphy, A. Wlodawer, G. L. Gilliland, and J. Roberts. 1987, 11p
Pub. in Protein Structure, Folding, and Design 2, p83-92 1987.

Keywords: *Glutaminase, *Bacteria, *Crystals, Pseudomonas, Escherichia coli, Peptides, Electrons, Reprints, *Protein conformation, *Asparaginase, Acinetobacter glutaminasificans, Vibrio succinogenes, Amino acid sequence.

The crystal structures of amidohydrolases from Acinetobacter glutaminasificans (AgGA), Pseudomonas 7A (PGA), Vibrio succinogenes (VsA) and E. coli (EcA) are under investigation. AgGA crystallizes in space group I222 with one subunit in the asymmetric unit. The structure was determined by multiple isomorphous replacement techniques at 4-5 Å resolution coupled with phase improvement and extension by density modification techniques. The peptide backbone has been traced in 3.2 Å electron density maps. Peptide sequences are now available for AgGA and refinement based on predicted sequences is in progress; the connectivity is not yet fully established. The AgGA subunit consists of two domains: the amino-terminal domain folds into a 5-stranded beta-sheet surrounded by 5 alpha-helices; the carboxy-terminal domain contains 3 alpha-helices and less regular structure.

001,337
PB91-118257 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Structure of Hydroxyl Radical-Induced DNA-Protein Crosslinks in Calf Thymus Nucleohistone In vitro.
Final rept.
E. Gajewski, A. F. Fuciarelli, and M. Dizdaroglu. 1988, 15p
Pub. in International Jnl. of Radiation Biology 54, n3 p445-459 1988.

Keywords: *Deoxyribonucleic acids, *Histones, Molecular structure, In vitro analysis, Cattle, Thymus gland, Ionizing radiation, Reprints, *DNA-binding proteins, *Cross-linking reagents, *Hydroxyl radical, Chromatin, Mass fragmentography, Radiation dose-response relationships.

Hydroxyl radicals are known to produce DNA-protein crosslinks in chromatin in vivo and in vitro. Here, DNA-

protein crosslinks formed between aliphatic amino acids and thymine in calf thymus nucleohistone exposed to hydroxyl radicals in N₂O-saturated aqueous solution were investigated. Hydroxyl radicals were generated by ionizing radiation. Aliphatic amino acids are the predominant types of amino acids in the core histones of calf thymus, and thus are likely to form crosslinks with DNA. For identification, hydroxyl radical-induced crosslinking of thymine to aliphatic amino acids in model systems, i.e., an aqueous mixture of thymine and a single amino acid were first investigated. Samples were analyzed for possible thymine-amino acid crosslinks by gas chromatography-mass spectrometry. Using this approach, structure of such crosslinks was elucidated and information on their gas chromatographic and mass spectral properties was obtained. Gas chromatography-mass spectrometry with selected-ion monitoring was then used to identify DNA-protein crosslinks in acidic hydrolysates of calf thymus nucleohistone exposed to hydroxyl radicals in buffered aqueous solution. DNA-protein crosslinks involving thymine and the amino acids Gly, Ala, Val, Leu, Ile and Thr were identified.

001,338
PB91-134775 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Chemical Engineering Science Div.
Overview of Techniques of Analysis of Cell Damage.
Final rept.
P. Todd, S. S. Hymer, S. G. Delcourt, and M. E. Kunze. 1989, 9p
Sponsored by Department of Energy, Washington, DC., and Battelle Pacific Northwest Labs., Richland, WA.
Pub. in Multilevel Health Effects Research: From Molecules to Man, p109-117 1989.

Keywords: *Mutations, *Cells(Biology), Humans, In vitro analysis, Mutagens, In vivo analysis, Reprints, *DNA damage, DNA probes, Biotechnology, Recombinant DNA, Chromosome aberrations, Flow cytometry, Affinity labels, Chromosome deletion, Translocation(Genetics).

Most physical and chemical methods for analyzing cell damage have been developed for cells damaged in vitro. In many cases, these methods can be transferred, with minor modifications, to the analysis of cell damage in vivo. Molecular end points for cell damage include: chemical modifications of DNA, chromosome aberrations, point mutations, gene deletions/translocations, malignant transformation, and reproductive death. For each of these end points, in vivo methods of analysis have been developed, including centrifugation and electrophoresis of unlabeled DNA, use of probes to detect DNA damage, characterization of severe chromosome damage by flow cytometry, somatic mutant cell identification by image analysis and flow cytometry, electrophoresis of cellular proteins, and flow cytometry, image analysis, and electrophoresis for detecting cell population shifts. In most cases, problems of sensitivity, specificity, and analysis of large cell populations had to be solved to apply these methods in vivo.

Dentistry

001,339
PB90-217753 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Tooth-Bound Fluoride and Dental Caries.
Final rept.
L. C. Chow. 1990, 6p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 69, p595-600 Feb 90.

Keywords: *Dentistry, *Dental caries, *Fluorides, Reprints, *Dental enamel, Hydroxyapatites.

The cariostatic effects of tooth-bound fluoride reported in the recent literature are reviewed. Several treatment procedures which can increase the tooth-bound fluoride content are described. Based on the information, it is suggested that effectiveness of currently used topical fluoride treatments may be significantly increased by (1) including in the regimen a dicalcium-phosphate-dihydrate-forming treatment so that a portion of the

lable fluoride is re-incorporated as tooth-bound fluoride, and (2) employing application methods which ensure the effective delivery of treatment agents to the fissures, and to approximal and cervical surfaces where most caries occurs.

001,340
PB90-242223 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Fluoride Analysis in Nanoliter- and Microliter-size Fluid Samples.
Final rept.
G. L. Vogel, C. M. Carey, L. C. Chow, and J. Ekstrand. 1990, 7p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 69, p522-528 Feb 90.

Keywords: *Quantitative analysis, *Fluorides, Microanalysis, Volumetric analysis, Accuracy, Electrodes, Teeth, Enamels, Measurement, Etching, Reprints, Caries, Plaque formation.

A variety of techniques is described for measuring fluoride in volumes of from 0.005 to 5 microliters including: (1) micropipette procedures for transference and dilution of samples, (2) construction of miniature and micro fluoride-selective electrodes, and (3) methods for adapting standard electrodes for micro- and semi-micro volumes. The described techniques have a number of advantages, including speed of analysis, high accuracy, and adaptability to many types of fluid samples. Recent studies involving use of the procedures include the analysis of fluoride in: (1) plaque fluid samples from single sites before and after topical fluoride administration, (2) tooth mineral samples recovered by acid-etch or microdrill biopsy of enamel, and (3) fluid recovered from the interior of the tooth during simulation of the caries process.

001,341
PB90-254954 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Micro-Analysis of Plaque Fluid from Single-Site Fasted Plaque.
Final rept.
G. L. Vogel, C. M. Carey, L. C. Chow, and A. Tatevossian. 1990, 8p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Jnl. of Dental Research 69, n6 p1316-1323 Jun 90.

Keywords: *Dental caries, *Chemical analysis, Calcium phosphates, Fluids, Teeth, Ions, Minerals, Sites, Reprints, *Dental plaque, *Clinical chemistry, Dental enamel.

Despite the site-specific nature of caries, nearly all data on the concentration of ions relevant to the level of saturation of plaque fluid with respect to calcium phosphate minerals or enamel are from studies that used pooled samples. A procedure is described for the collection and analysis of inorganic ions relevant to these saturation levels in plaque fluid samples collected from a single surface on a single tooth. Various methods for examining data obtained by this procedure are described, and a mathematical procedure employing potential plots is recommended.

Microbiology

001,342
PB90-169848 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Small Angle Neutron and X-Ray Scattering from Magnetite Crystals in Magnetotactic Bacteria.
Final rept.
S. Krueger, G. J. Olson, J. J. Rhyne, R. P. Blakemore, Y. A. Gorby, and N. Blakemore. 1989, 12p
Pub. in Jnl. of Magnetism and Magnetic Materials 82, p17-28 1989.

Keywords: *Bacteria, *Magnetite, Neutron scattering, Reprints, *Magnetotactic bacteria, *Aquaspirillum

Microbiology

magnetotacticum, *Magnetosomes, X ray scattering, Small angle scattering.

Small angle neutron and X-ray scattering were used to study the magnetic and structural properties, respectively, of intracellular magnetite crystals (magnetosomes) in the bacterium, *Aquaspirillum magnetotacticum*, grown in pure culture. An average of twenty magnetite particles of diameter 400-500 Å are arranged in a chain that longitudinally traverses each cell. Behaving like magnetic dipoles, the bacteria orient in the geomagnetic field. Small angle X-ray scattering measurements revealed that bacteria grown in the presence of large amounts of iron contained magnetosomes with diameters averaging approximately 400 Å. Those grown under iron-starved conditions contained particles with slightly smaller diameters.

001,343
PB90-170069 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Inactivation of Human Immunodeficiency Virus (HIV) by Ionizing Radiation in Body Fluids and Serological Evidence.
 Final rept.
 P. D. Bigbee, P. S. Sarin, J. C. Humphreys, W. G. Eubanks, D. Sun, D. G. Hocken, A. Thornton, D. E. Adams, and M. G. Simic. 1989, 8p
 Pub. in *Jnl. of Forensic Sciences*, p1303-1310 Nov 89.

Keywords: *Ionizing radiation, *Body fluids, *Blood, Deoxyribonucleic acids, Enzymes, Viral proteins, Reprints, *Human Immunodeficiency Virus(HIV), Forensic medicine.

A method to use ionizing radiation to inactivate HIV (Human Immunodeficiency Virus) in human body fluids was studied in an effort to reduce the risk of accidental infection to forensic science laboratory workers. Experiments conducted indicate that an X-ray absorbed dose of 25 krad was required to completely inactivate HIV. This does not alter forensically important constituents such as enzymes and proteins in body fluids. The method of inactivation of HIV cannot be used on body fluids which will be subjected to deoxyribonucleic acid (DNA) typing.

001,344
PB90-192477 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Chemical Thermodynamics Div.
Mechanistic and Physiological Consequences of HPr(ser) Phosphorylation on the Activities of the Phosphoenolpyruvate: Sugar Phosphotransferase System in Gram-Positive Bacteria. Studies with Site-Specific Mutants of HPr.
 Final rept.
 J. Reizer, S. L. Sutrina, M. H. Saier, G. C. Stewart, A. Peterkofsky, and P. Reddy. 1989, 10p
 Pub. in *European Molecular Biology Organization Jnl.* 8, n7 p2111-2120 1989.

Keywords: *Mutations, *Phosphorylation, *Phosphotransferase, Catalysis, Amino acids, Reprints, *Gram-positive bacteria, *Phosphoenolpyruvate.

The bacterial phosphotransferase system (PTS) catalyzes the transport and phosphorylation of its sugar substrates. The protein-kinase-catalyzed phosphorylation of serine 46 in the phosphocarrier protein, HPr, inhibits PTS activity, but neither the mechanism of this inhibition nor its physiological significance is known. Site-specific HPr mutants were constructed in which serine 46 was replaced by alanine (S46A), threonine (S46T), tyrosine (S46Y) or aspartate (S46D). The purified S46D protein exhibited markedly lower V_{max} and higher K_m values than the wild-type. S46T or S46A protein for the phosphoryl transfer reactions involving HPr(His-P). Interactions of HPr with the enzymes catalyzing phosphoryl transfer to and from HPr regulated the kinase-catalyzed reaction. These results establish the inhibitory effect of a negative charge at position 46 on PTS-mediated phosphoryl transfer and suggest that HPr is phosphorylated on both histidyl and seryl residues by enzymes that recognize its tertiary rather than its primary structure. In vivo studies showed that a negative charge on residue 46 HPr strongly inhibits PTS-mediated sugar uptake, but that competition of two PTS permeases for HPr(His-P) is quantitatively more important to the regulation of PTS function than serine 46 phosphorylation.

001,345
PB90-241571 Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Small-Angle Neutron Scattering from Bacterial Magnetite.
 Final rept.
 S. Krueger, G. J. Olson, J. J. Rhyne, R. P. Blakemore, Y. A. Gorby, and N. Blakemore. 1990, 3p
 Pub. in *Jnl. of Applied Physics* 67, n9 p4475-4477, 1 May 90.

Keywords: *Magnetite, Neutron scattering, Paramagnetism, Reprints, *Magnetotactic bacteria, *Magnetosomes, Small angle scattering.

Small-angle neutron scattering was used to study the magnetic properties of intracellular magnetite crystals (magnetosomes) in the bacterium, *Aquaspirillum magnetotacticum*, grown in pure culture. An average of 20 single-domain magnetite (Fe₃O₄) particles of diameter 400-500 Å are arranged in a chain that longitudinally traverses each cell. The net magnetic dipole moment carried by each chain is sufficient to orient the bacterium in the geomagnetic field. A contrast variation series, performed on a nonmagnetic variant, established that a 30% D₂O/H₂O ratio in the suspension buffer resulted in the minimization of the scattering from the bacterium itself, thereby enhancing that from the magnetosomes.

001,346
PB91-135046 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Significance of Cell Fluorescence Color of Acridine Orange-Stained 'Thiobacillus ferrooxidans' Under Epifluorescence Microscopy.
 Final rept.
 T. Y. Yeh, R. M. Kelly, J. C. Cox, and G. J. Olson. 1988, 10p
 Pub. in *Proceedings of International Symposium Biohydrometallurgy*, p145-150 1988.

Keywords: *Soil microbiology, *Bacteriology, *Fluorescence, *Metals, *Microscopy, Labeled substances, Oxidation, Iron, Isotopic labeling, Proton spectra, Hydrometallurgy, Leaching, Acridines, Biological stains, Cell wall, Reprints, *Thiobacillus oxidans.

Epifluorescence microscopy with acridine orange stain and proton motive force measurements with radioactively labeled permeant ions used in the study of *Thiobacillus ferrooxidans* have shown that there is a relationship between cell fluorescence color and cellular metabolic activity. A hypothesis that relates changes in intracellular pH and membrane potential with the color of dye fluorescence has been considered in light of recent experimental results. A predominance of green fluorescence has been associated with relatively large proton motive forces while a shift towards yellow fluorescence indicates smaller proton motive forces.

Pharmacology & Pharmacological Chemistry

001,347
PB90-171000 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Enhanced Root Fluoride Uptake by Monocalcium Phosphate Monohydrate Gels.
 Final rept.
 S. Takagi, L. C. Chow, and C. T. Schreiber. 1990, 5p
 Sponsored by American Dental Association Health Foundation, Chicago, IL.
 Pub. in *Caries Research* 24, p18-22 1990.

Keywords: *Fluoride, Calcium fluorides, Reprints, *Tooth root, *Monocalcium phosphate monohydrate, *Pharmacokinetics, Dental enamel.

Application of monocalcium phosphate monohydrate (MCPM) gel, which produces small amounts of dicalcium phosphate dihydrate in enamel, was previously shown to increase the enamel reactivity with fluoride (F). The study was conducted to determine whether the MCPM gel treatment is also effective in enhancing F uptake by root surfaces of human teeth. The results show that samples receiving daily treatments with MCPM gel for 10 min followed by immersion in a 1 ppm F solution for 5 days acquired a significantly greater amount of F compared to the controls which had the same exposure to the F solution. Because the F solu-

tion was undersaturated with respect to calcium fluoride (CaF₂), the F incorporated into the root is apparently apatitic and not CaF₂. The experimental treatment should be feasible in the clinical situation since only a short treatment time was required and delivery of the MCPM gel to specific sites was relative easy.

001,348
PB90-254798 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Molecular Physics Div.
Theoretical Studies of cis-Pt(II)-Diammine Binding to Duplex DNA.
 Final rept.
 S. L. McCarthy, R. J. Hinde, K. J. Miller, J. S. Anderson, H. Basch, and M. Krauss. 1990, 14p
 Sponsored by National Foundation for Cancer Research, Bethesda, MD., and Rensselaer Polytechnic Inst., Troy, NY.
 Pub. in *Biopolymers* 29, p823-836 1990.

Keywords: *Deoxyribonucleic acids, *Antineoplastic agents, Ligands, Hydrogen bonds, Water, Quantum theory, Reprints, *Nucleic acid heteroduplexes, *Cis-platin, Nucleic acid conformation, Binding sites, Cell survival.

The binding of cis-Pt(II) diammine (cis-DP) to double-stranded DNA was studied with several kinked conformations that can accommodate the formation of a square planar complex. Molecular mechanics (MM) calculations were performed to optimize the molecular fit. These results were combined with quantum mechanical (QM) calculations to ascertain the relative energetics of ligand binding through water vs direct binding of the phosphate to the ammine and platinum, and to guide the selection of DNA conformations to model complex formation. Based on QM and MM calculations, models are proposed that may be characterized by several general features. A structure involving hydrogen bonding between each ammine and distinct adjacent phosphate groups, referred to as closed conformation (CC), has already been reported. This is also found in the crystal structure of small dimers. Alternative conformations that may be important in platination of duplex DNA are reported. They are characterized by an intermediate conformation (IC), involving hydrogen bonding between one ammine and phosphate group, and an open conformation (OC), without ammine phosphate hydrogen bonding.

001,349
PB90-254905 Not available NTIS
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Assessment of Loosely-Bound and Firmly-Bound Fluoride Uptake by Tooth Enamel from Topically Applied Fluoride Treatments.
 Final rept.
 B. Sieck, S. Takagi, and L. C. Chow. 1990, 5p
 Sponsored by American Dental Association Health Foundation, Chicago, IL.
 Pub. in *Jnl. of Dental Research* 69, n6 p1261-1265 Jun 90.

Keywords: *Calcium fluorides, Compositions, Biopsy, Reprints, *Dental enamel, *Pharmacokinetics, Hydroxapatites.

The amounts of loosely-bound fluoride (F) deposited on human enamel by two topical F treatments were measured with use of a constant-composition F washing method. Enamel biopsies conducted before treatment and after the washing were used for determination of the firmly-bound F uptake. The results showed that (1) the washing system did not remove F from untreated enamel surface, (2) a four-minute application of an acidulated phosphate fluoride (APF) gel deposited 27.2 (2.4) (mean, S.E.) micro g of loosely-bound F per sq cm of enamel surface and 186 (111) ppm of firmly-bound F in the outer 10 micro m of enamel, and (3) a four-minute application of a pH-2.1 dicalcium phosphate dihydrate (DCPD)-forming solution followed by APF produced 44.9 (3.1) micro g/sq cm of loosely-bound F and 1280 (354) ppm of firmly-bound F in the outer 10 micro m of enamel.

Physiology

001,350
PB90-254350 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Robot Systems Div.
Motion, Depth, and Image Flow.
 Final rept.
 J. S. Albus, and T. H. Hong. 1990, 10p
 Pub. in Proceedings of IEEE (Institute of Electrical and
 Electronics Engineers) International Conference on
 Robotics and Automation, Cincinnati, OH., May 13-18,
 1990, p1161-1170.

Keywords: *Visual perception, *Motion, *Space percep-
 tion, *Images, Reprints, *Eye movements.

Motion relative to a surface is perhaps the most funda-
 mental of visual perceptions. Image flow can be
 caused either by motion of objects in the world, or by
 motion of the eye through the world. If knowledge
 exists of eye motion, dense range maps can be com-
 puted locally for all stationary object pixels. Range
 from image flow can be computed either by gradient
 methods or by correlation methods. The former are
 simple but subject to quantization noise. The latter are
 complex but much more accurate. If eye rotation is
 known, image flow due to eye translation can be sepa-
 rated from flow due to rotation, and moving objects
 can be segmented from a stationary background.

Radiobiology

001,351
AD-A214 233/9 PC A03/MF A01
 Armed Forces Radiobiology Research Inst., Bethesda,
 MD.
**Quantitative Measurement of Radiation-Induced
 Base Products in DNA Using Gas Chromatogra-
 phy-Mass Spectrometry.**
 A. F. Fuciarelli, B. J. Wegher, E. Gajewski, M.
 Dizdaroglu, and W. F. Blakely. 1989, 14p Rept no.
 AFRR1-SR89-30
 Pub. in Radiation Research, v119 n219-231 1989.

Keywords: Accuracy, Calibration, *Deoxyribonucleic
 acids, Exposure(Physiology), Intensity, Internal, Ioniz-
 ing radiation, Ions, Measurement, Modification, Pur-
 ines, Pyrimidines, Quantitative analysis, *Radiation ef-
 fects, Reprints, Standards, Chemical bonds, Methyl
 radicals, Silicon, Amines, Hydroxyl radicals, Hydroxyur-
 acil, Thymine, Glycol, Dihydrothymines, Azathymines,
 Diaminofornamidopyrimidines, Hydroxyguanines,
 Azaacenes, *Gas chromatography, Mass spectrom-
 etry, *DNA damage.

Gas chromatography-mass spectrometry with select-
 ed-ion monitoring was used to study radiation-induced
 damage to DNA. Quantitative analysis of modified
 purine and pyrimidine bases resulting from exposure to
 ionizing radiation using this technique is dependent
 upon the selection of appropriate internal standards
 and calibration of the mass spectrometer for its re-
 sponse to known quantities of the internal standards
 and the products of interest. The compounds 6-azath-
 ymine and 8-azaadenine were found to be suitable in-
 ternal standards for quantitative measurements of
 base damage in DNA. For the purpose of calibration of
 the mass spectrometer, relative molar response fac-
 tors for intense characteristics ions were determined
 for the trimethylsilyl derivatives of 5-hydroxyuracil,
 thymine glycol, and 5,6 dihydrothymine using 6-azath-
 ymine, and for the trimethylsilyl derivatives of 4,6-dia-
 mino-5-formamidopyrimidine, 8-hydroxyguanine using
 8-azaadenine. Accurate measurements of the yield of
 radiation-induced modifications to the DNA bases is
 also dependent upon two chemical steps in which the
 purines and pyrimidines are released from the sugar-
 phosphate backbone and the derivatized to make
 them volatile for gas chromatography. The complete-
 ness of these reactions, in addition to assessing the
 stability of the modified DNA bases in acid and their
 trimethylsilylated derivatives over the time necessary
 to complete the experimental analysis, was also exam-
 ined.

001,352
PB90-149097 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Ionizing Radiation Physics Div.

Soft-Tissue-Substitute Liquid.

Final rept.
 L. J. Goodman. 1988, 2p
 Pub. in Health Physics 54, n3 p349-350 1988.

Keywords: *Radiation measuring instruments, *Liq-
 uids, *Substitutes, Nuclear radiation, Radiation protec-
 tion, Reprints, *Tissue-equivalent detectors.

A four-element, soft-tissue-substitute liquid for use in
 making radiation protection measurements is de-
 scribed. The three-component mixture simulates the
 soft-tissue material specified by the International Com-
 mission on Radiation Units and Measurements for the
 ICRU sphere used to determine dose equivalents. The
 mixture is nontoxic, chemically inert, and uses com-
 monly available chemicals.

001,353
PB90-149303 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Ionizing Radiation Physics Div.
Radiochromic Solutions for Reference Dosimetry.
 Final rept.
 M. Farahani, J. H. Liang, and W. L. McLaughlin.
 1990, 7p
 Pub. in Applied Radiation and Isotopes 41, n1 p5-11
 1990.

Keywords: *Dosimetry, *Radiobiology, *Radioche-
 mistry, *Methyl sulfoxide, Irradiation, Dose rate, Re-
 prints, *Hexa(hydroxyethyl)pararosaniline nitrile, *Tri-
 ethyl phosphate, Dose-response relationships, Radi-
 ation absorption analysis.

A chemical radiochromic dosimeter using hexa(hydroxyethyl)pararosaniline nitrile(HHEV-CN)
 dissolved in an aerated mixture of triethyl phosphate
 and dimethyl sulfoxide can be used over a wide ab-
 sorbed dose range as a stable reference dosimeter,
 with useful characteristics, both for steady-state and
 pulsed radiation fields. Solutions of the leuco dye at 2-
 mM concentration, containing small amounts of acetic
 acid, p-nitrobenzoic acid and polyvinylbutyral, show
 high precision and a linear response for absorbed
 doses up to 4 kGy. When the leuco dye concentration
 is increased to 100 mM, the response is also linear,
 and absorbed doses as low as 0.5 Gy can be read with
 a precision of 1.3% (95% confidence limits). The radi-
 ation chemical yield is constant with changes in ab-
 sorbed dose rate, but it increases with concentration of
 the leuco dye up to 10(sup-1) molarity. The radiation
 chemical yields for dye formation are: for 2-mM solu-
 tion, G(dye) = 0.015 micro mol/J; for 100-mM solu-
 tion, G(dye) = 0.28 micro mol/J. The uncertainties for
 these measured values are plus or minus 2.6% (95%
 confidence limits). The molar linear absorption coef-
 ficient at 605-608 nm wavelength is 1.0 x 10(sup-5)L/
 mol/cm, the uncertainty (95% confidence limits) being
 plus or minus 2.2%. This dosimeter solution may be
 used in small sealed glass ampoules or plastic vials
 and is useful for measuring x- and y-ray doses of inter-
 est in food irradiation and in clinical radiology.

001,354
PB90-149493 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Ionizing Radiation Physics Div.
**Post-Irradiation Dosimetry of Meat by Electron
 Spin Resonance Spectroscopy of Bones.**
 Final rept.
 M. F. Desrosiers, and M. G. Simic. 1988, 3p
 Pub. in Jnl. of Agricultural and Food Chemistry 36, n3
 p601-603 1988.

Keywords: *Gamma irradiation, *Dosimetry, *Bones,
 Exposure, Chickens, Meat, Reprints, Electron spin res-
 onance, Dose-response relationships.

Electron Spin Resonance (ESR) spectroscopy was
 used to measure the production of free radicals in
 chicken bones induced by (60)Co gamma-rays. It was
 found that the radiation-induced ESR signal in bone
 could easily be distinguished from the endogenous
 ESR signal. Long term (4 months) stability studies at
 20 C showed no decay of the radiation-induced ESR
 signal. A linear relationship was observed between the
 radiation-induced ESR signal intensity and the ab-
 sorbed dose (1-5 kGy). It was concluded that ESR
 measurements of bones can be used to determine
 whether the bone-containing meat has been irradiated
 and also at what dose. The measurements clearly indi-
 cate feasibility of post-irradiation dosimetry of meats.

001,355
PB90-190703 Not available NTIS

National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Ionizing Radiation Div.
**Effects of Track Structure on Neutron Microdosi-
 metry and Nanodosimetry.**
 Final rept.
 R. S. Caswell, and J. J. Coyne. 1989, 9p
 Sponsored by Department of Energy, Washington, DC.
 Office of Health and Environmental Research.
 Pub. in Nucl. Tracks Radiat. Meas. 16, n2-3 p187-195
 1989.

Keywords: Tissues(Biology), Energy transfer, Particle
 tracks, Reprints, *Neutron dosimetry.

The process by which neutrons transfer their energy to
 tissue is described, including the deposition of energy
 by secondary charged particle tracks in small sites;
 that is, microdosimetry and nanodosimetry. Three ap-
 proximations are considered in order of increasing
 amounts of information on track structure: the contin-
 uous slowing-down approximation, the straggling ap-
 proximation, and the delta-ray approximation. Al-
 though simple approximations sometimes work quite
 well, much work remains to be done for very small
 sites, and for the inclusion of the effects of 'passers'
 in the calculations.

001,356
PB90-190737 Not available NTIS
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Ionizing Radiation Div.
Onion Skin as a Radiation Monitor.
 Final rept.
 M. F. Desrosiers, and W. L. McLaughlin. 1990, 3p
 Pub. in Radiation Physics and Chemistry 35, n1-3
 p321-323 1990.

Keywords: *Onions, *Dosimeters, *Allium, Electron
 paramagnetic resonance, Reprints.

The ESR spectra of the dry, outer skin of onion, red
 onion, garlic, and shallot were measured before and
 after irradiation. In all spectra only a single resonance
 (g = 2.00) was observed. The ESR signal intensity in-
 creased with absorbed dose, however, the radiation-
 induced signal decayed slowly with time. It was con-
 cluded that the outer skin of these foods are not suit-
 able as a long-term postirradiation monitor.

001,357
PB90-192691 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg,
 MD. Ionizing Radiation Div.
**Difficulties Encountered with Some Intermediate-
 Atomic Number Radiation Protection Dosimeters
 Irradiated on-Phantom in Low-Energy Photon
 Beams.**
 Final rept.
 C. G. Soares, E. L. Bright, and M. Ehrlich. 1988, 14p
 Pub. in Health Physics 54, n4 p431-444 Apr 88.

Keywords: *Photons, Lead(Metal), Cesium 137, Phan-
 tom, Reprints, *Personnel dosimetry, *Thermolu-
 minescent dosimetry.

During a measurement-assurance study done with a
 particular type of personnel dosimeter, unexpectedly
 poor results were obtained for a reliable participant
 who irradiated several of the dosimeters simultane-
 ously on-phantom in a low-energy bremsstrahlung beam.
 The dosimeters incorporated low- and higher-Z ele-
 ments, with the higher-Z elements under lead filters.
 Five different types of dosimeters were studied in
 greater detail by irradiating them on- and off-phantom,
 with their geometric centers displaced up to 10 cm
 along the vertical and horizontal axes through the
 center of the beam cross section. Two low-energy
 bremsstrahlung beams and a cesium-137 gamma-ray
 beam were used. Variation of response to low-energy
 photons with on-phantom location was observed to
 some degree in all higher-Z dosimeter elements cov-
 ered high-Z filters, and possibly in low-Z elements in
 a holder containing a high-Z filter. The reason for the ob-
 served dependence of response upon on-phantom lo-
 cation seems to be insufficient side shielding against
 phantom and filter albedo, as proved for one of the
 dosimeters. Lack of side shielding also makes these
 dosimeters unsuited for meaningful measurements of
 the effective dose equivalent.

001,358
PB90-203126 PC A03/MF A01
 National Inst. of Standards and Technology (NML),
 Gaithersburg, MD. Ionizing Radiation Div.

Radiobiology

Radiation Energy-Angle Algorithm for Use in Personnel Dosimetry.

Final rept.
M. Ehrlich. Apr 90, 15p NISTIR-90/4273

Keywords: *Algorithms, Dosimeters, Photons, *Personnel dosimetry, *Radiation energy, Calibration.

In an earlier publication, the author described an algorithm for arriving at the value of the individual dose equivalent from the readings of dosimeters having two areas of different energy-and angle-response functions. The algorithm is briefly reviewed here, and suggestions are made for obtaining, by numerical means, a plausible average of all solutions possible for a given type of dosimeter and number of calibration data.

001,359
PB90-205980 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Measurement of Absorbed Doses Near Metal and Dental Material Interfaces Irradiated by X- and Gamma-Ray Therapy Beams.

Final rept.
M. Farahani, F. C. Eichmiller, and W. L. McLaughlin. 1990, 17p
Sponsored by American Dental Association Health Foundation, Chicago, IL.
Pub. in Phys. Med. Biol. 35, n3 p369-385 1990.

Keywords: *Dental materials, *Radiation dosage, Alloys, Electrons, Polymers, Reprints, *Radiation scattering, Connective tissue.

Soft-tissue damage adjacent to dental restorations is a deleterious side effect of radiation therapy which is associated with low-energy electron scatter from dental materials of high electron density. The study was designed to investigate the enhancement of dose to soft tissue (or water) close to high electron-density materials and to measure the detailed lateral and depth-dose profiles in soft-tissue-simulating polymer adjacent to planar interfaces of several higher atomic-number materials. Interleaved stacks of calibrated thin radiochromic dosimeter films and tissue-simulating polymer were used for these measurements. Assemblies of these polymer-dosimeter stacks on both sides of the dental materials were irradiated in one fixed direction by collimated (60)Co gamma-ray or 10 MV x-ray beams directed perpendicularly to the material interfaces. In another test, designed to simulate more closely therapeutic treatment conditions, a phantom constructed on both sides of a row of restored and non-restored whole teeth was irradiated in one fixed direction by the collimated photon beams. Results indicate that the dose-enhancement in 'tissue' is as great as a factor of 2 on the backscatter side adjacent to gold and a factor of 1.2 adjacent to tooth tissue, but is insignificant on the forward-scatter side because of the predominant effect of attenuation by the high-density, high atomic-number absorbing material.

001,360
PB90-207762 PC A03/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Radiation Research.
Evaluation of NVLAP (National Voluntary Laboratory Accreditation Program) Personnel Dosimetry Testing Laboratory: X-rays.
H. T. Heaton. Apr 90, 16p NISTIR-90/4299

Keywords: *X rays, Tables(Data), Charts(Graphs), *Personnel dosimetry, *Reference laboratories, Dose equivalents.

The Pacific Northwest Laboratory (PNL) is the testing laboratory for the National Voluntary Laboratory Accreditation Program (NVLAP) for personnel radiation dosimeters. The Center for Radiation Research (CRR) has an agreement with NVLAP to monitor the laboratory to ensure that their reference radiation fields are known with sufficient accuracy. The report describes the measurements made by CRR personnel at PNL to ensure that their M30 and M150 x-ray beams are known within the specified accuracy.

001,361
PB90-241423 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Concept of Secondary Laboratories.
Final rept.
E. H. Eisenhower. 1985, 13p
Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibrations, Gaithersburg, MD., July 10-12, 1984, p4-16 1985.

Keywords: *Dosimetry, *Radiological laboratories, *Radiation measuring instruments, Quality assurance, Accuracy, Reprints, *SSDL, Calibration.

General characteristics, operational concepts, and functions of secondary standards dosimetry laboratories are described.

001,362
PB90-241431 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Interagency Committee on Occupational Radiation Protection Measurements.
Final rept.
E. H. Eisenhower. 1985, 4p
Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibrations, Gaithersburg, MD., July 10-12, 1984, pC.2-C.5 1985.

Keywords: *Dosimetry, Radiation counters, Measurement, Ionizing radiation, Bioassay, Accuracy, Radiation shielding, Reprints, *Radiation protection, Occupational exposure, ICRP, SSDL.

The Interagency Committee on Occupational Radiation Protection Measurements is a group of government agency representatives who have a common concern about the quality of measurements of ionizing radiation. Operational problems such as those discussed in the previous two sessions of the Workshop are of interest to the Committee because they may result in measurements with inadequate quality. The Committee is interested in finding solutions for such operational problems and in the development of national programs that will assure adequate measurement quality. It was the existence of problems in a particular area of measurement, and the need for acceptable solutions that resulted in creation of the Committee.

001,363
PB90-241449 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Secondary Standards Laboratories: An Overview.
Final rept.
E. H. Eisenhower. 1985, 10p
Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibrations, Gaithersburg, MD., July 10-12, 1984, pD.1-D.10 1985.

Keywords: *Radiological laboratories, *Dosimetry, Radiation measuring instruments, Quality assurance, Ionizing radiation, Reprints, *SSDL, Calibration, Accreditation.

The paper is an overview of secondary standards dosimetry laboratories (SSDL) for measurement of ionizing radiation. It outlines the requirements for achievement of status as a secondary laboratory, and the possible function of such laboratories. The particular function of providing calibrations of radiation-measuring instruments is considered in detail, including the description of a measurement quality assurance program. The accreditation of secondary laboratories, and the role of a representative accrediting organization, is discussed. Two examples of accreditation programs are given. The present status of secondary laboratories is described for the state, federal, and private sectors.

001,364
PB90-242298 PC A04/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD. National Voluntary Lab. Accreditation Program.
NVLAP (National Voluntary Laboratory Accreditation Program) Handbook: Personnel Radiation Dosimetry. Requirements for Accreditation.
R. L. Gladhill. Jul 89, 71p NISTIR-89/4125

Keywords: *Dosimetry, Laboratories, Handbooks, Assessments, Standards, Radiation measuring instruments, National Institute of Standards and Technology, Accreditation.

The document explains the operation and technical requirements of the Laboratory Accreditation Program for Personnel Radiation Dosimetry. All of the steps leading to accreditation are discussed. Technical requirements are explained indicating how the NVLAP criteria are applied. It is intended for use by staff of accredited laboratories, those seeking accreditation, other laboratory accreditation systems, and others needing information on the requirements for NVLAP accreditation.

001,365
PB90-254806 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Reference Dosimetry and Measurement Quality Assurance.
Final rept.
W. L. McLaughlin. 1989, 7p
Pub. in Applied Radiation and Isotopes 40, n10-12 p945-951 1989.

Keywords: *Dosimetry, *Radiation measuring instruments, Quality assurance, Primary standards, Alanines, Electron beams, Gamma ray spectroscopy, Iron sulfate, Chromates, Spectrophotometry, Reprints, Calibration standards.

Measurements of absorbed dose made by a reference dosimetry system, such as alanine, have been suggested for achieving quality assurance through traceability to primary standards. Such traceability can assist users of radiation worldwide in enhancing quality control in medicine, agriculture, and industry. International and national standards of absorbed dose are still needed for applications of gamma-ray and electron dosimetry at high doses (e.g. radiation therapy, food irradiation and industrial radiation processing). Reference systems, such as ferrous sulfate dosimeters measured by spectrophotometry and alanine measured by electron spin resonance spectrometry, are already well established. Another useful reference system for high doses is supplied as dichromate solutions measured by spectrophotometry. Reference dosimetry, particularly for electron beams, can be accomplished with thin alanine or radiochromic dye film dosimeters.

001,366
PB91-101162 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Assessing Radiation Dose to Food.
Final rept.
M. F. Desrosiers. 1990, 1p
Pub. in Nature 345, n6725 p485, 7 Jun 90.

Keywords: *Radiation dosage, *Food processing, *Ionizing radiation, Electron paramagnetic resonance, Bones, Reprints.

The Electron Spin Resonance (ESR) dose response of bone to ionizing radiation is described. The use of this relationship to obtain dose estimates for radiation processed foods is discussed.

001,367
PB91-118414 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.
Optimal Experimental Design for In vitro Studies with ELF Magnetic Fields.
Final rept.
M. Misakian, and W. T. Kaune. 1990, 5p
Pub. in Bioelectromagnetics 11, p251-255 1990.

Keywords: *Magnetic fields, *Extremely low radio frequencies, *Dosimetry, In vitro analysis, Electric fields, Reprints.

An experimental arrangement is described that maximizes the dosimetric information that can be obtained during in vitro studies with ELF magnetic fields. The arrangement enables researchers to distinguish between a purely magnetic-field effect and one that also involves the electric fields and currents induced by the magnetic field.

Toxicology

001,368
PB90-187832 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Effect of Copper Additives on Atmospheric Hydrogen Cyanide and Acute Inhalation Toxicity from the Combustion Products of Flexible Polyurethane.

Final rept.
B. C. Levin, M. Paabo, R. H. Harris, H. M. Clark, M. F. Yoklavich, N. Eller, and L. Highbarger. 1989, 6p
Pub. in Proceedings of Fire Retardant Chemicals Association Meeting, Scottsdale, AZ., October 15-18, 1989, p107-112.

Keywords: *Toxicity, *Copper, *Additives, *Combustion products, *Polyurethane, *Hydrogen cyanide, Respiration, Rats, Reprints.

A flexible polyurethane foam (FPU) was treated in the laboratory with water (control-FPU), water-dispersions of copper dust or cupric oxide, or a solution of copper sulfate to determine if the addition of copper or copper compounds following the formulation of the foam would reduce both the atmospheric concentrations of HCN which evolves during combustion of FPU and the acute inhalation toxicity produced from exposure to this smoke. When thermally decomposed in the NBS Toxicity Test Method apparatus via a two phase procedure previously shown to produce high concentrations of HCN, control-FPU produced maximum HCN concentrations seven to nine times higher than foams post-treated with copper or copper compounds. The control-FPU LC50 for acute 30 min exposures of Fischer 344 male rats was approximately half that of the cupric oxide-treated foam (the most efficient of the post-treatment additives tested).

001,369
PB90-217746 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Toxicological Effects of Different Time Exposures to the Fire Gases: Carbon Monoxide or Hydrogen Cyanide or to Carbon Monoxide Combined with Hydrogen Cyanide or Carbon Dioxide.

Final rept.
B. C. Levin, J. L. Gurman, M. Paabo, L. Baier, and T. Holt. 1987, 18p
Sponsored by Society of the Plastics Industry, Inc., New York, and International Isocyanate Inst.
Pub. in Proceedings of Joint Panel Meeting of the UJNR Panel on Fire Research and Safety (9th), Norwood, MA., May 4-8, 1987, p368-385.

Keywords: *Toxicology, *Carbon monoxide, *Hydrogen cyanide, *Combustion products, *Fires, Rats, Exposure, Reprints, Time factors.

The toxicity of single and multiple fire gases is being studied to determine whether the toxic effects of a material's combustion products can be explained by the toxicological interactions (as indicated by lethality) of the primary fire gases or if minor, more obscure gases need to be considered. LC50 values for Fischer 344 rats have been calculated for carbon monoxide (CO) and hydrogen cyanide (HCN) (as individual gases in air) for 1, 2, 5, 10, 20, 30, and 60 minute exposures plus relevant post-exposure periods using the NBS Toxicity Test Method apparatus. The concentration-time products for the various HCN exposures plus 24 hour post-exposure times are constant, but the concentration-time products for CO decreased for the 1, 2, and 5 minute exposures and then increased for the longer times. In exposures ranging from 5 to 60 minutes, the toxic effects of CO plus HCN were additive and, except for the 5 minute exposures, the presence of 5% carbon dioxide (CO2) decreased the LC50 values of CO. These results will be used in the computer model currently under development in the Center for Fire Research to predict the hazard that people will experience under various fire scenarios.

001,370
PB91-107433 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Fire Measurement and Research Div.

Toxicological Interactions between Carbon Monoxide and Carbon Dioxide.

Final rept.
B. C. Levin, M. Paabo, J. L. Gurman, S. E. Harris, and E. Braun. 1987, 30p
See also PB88-138888.
Pub. in Toxicology 47, p135-164 1987.

Keywords: *Toxicology, *Carbon dioxide, *Carbon monoxide, Rats, Combustion, Reprints, *Fire gases, Carboxyhemoglobin, Drug interactions, Dose-response relationships.

Fischer 344 male rats were subjected to 30-min individual or combined exposures of carbon monoxide

(CO) and carbon dioxide (CO2). All deaths from CO occurred during the exposures, and the LC50 values were 4600 and 5000 ppm, depending on experimental conditions. Animals exposed to CO2 concentrations ranging from 1.3 to 14.7% for 30 min were neither incapacitated nor fatally injured. The addition of non-lethal concentrations of CO2 (1.7 to 17.3%) to sublethal concentrations of CO (2500 to 4000 ppm) caused deaths of the exposed rats both during and following (up to 24 h) the 30-min exposures. The most toxic combination of these two gases (2500 ppm CO plus 5% CO2) increased the rate of carboxyhemoglobin (COHb) formation 1.5 times that found in rats exposed to 2500 ppm of CO alone. The COHb equilibrium levels were the same. Exposure to both CO and CO2 produced a greater degree of acidosis and a longer recovery time than that observed with either single gas. The results fit a mathematical model indicating a synergistic interaction. Combustion of 11 materials at their LC50 values indicated that CO was probably the primary toxicant in one case and that the combined CO plus CO2 was the cause of the deaths in three other cases.

001,371
PB91-112300 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Office of Fire Research Resources.

Reporting Combustion Product Toxicity Test Results.

Final rept.
C. Huggett. 1985, 4p
Pub. in Jnl. of Fire Science 3, n1 p79-82 Jan/Feb 85.

Keywords: *Combustion products, *Polyvinyl chloride, *Lethal dosage, Toxicity, Laboratory animals, Reprints, Laboratory tests, Inhalation.

The experimental results from a wide variety of tests for the inhalation toxicity of combustion products can be put on a common basis for comparison by estimating the effective exposure dose. Published data on the toxicity of the combustion products from polyvinyl chloride are analyzed by way of illustration.

001,372
PB91-118190 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Polymers Div.

Correlation of Molecular Total Surface Area with Organotin Toxicity for Biological and Physicochemical Applications.

Final rept.
G. Eng, E. J. Tierney, J. M. Bellama, and F. E. Brinckman. 1988, 5p
Pub. in Appl. Organomet. Chem. 2, n2 p171-175 1988.

Keywords: *Toxicity, Fibroblasts, Reprints, *Organotin compounds, Ankirodesmus falcatus, Cultured cells, Neuroblastoma, Daphnia magna, Rhithropanopeus harrisi.

There exists a high correlation between total surface area values and diorganotin toxicity towards several distinct types of organisms. This correlation was found for N2a neuroblastoma cells, 3T3 fibroblasts, Daphnia magna, Rhithropanopeus harrisi, and Ankirodesmus falcatus. In the case of Rhithropanopeus harrisi, a high correlation was also found between TSA and toxicity for triorganotins as well. The study suggests that the relationship between TSA toxicity is a function of the hydrophobicity of the organotin compounds rather electronic or steric effects.

001,373
PB91-134171 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Inorganic Analytical Research Div.

Dietary Intake Studies of Nutrients and Selected Toxic Elements in Human Subjects: Analytical Approaches.

Final rept.
G. V. Iyengar. 1987, 13p
Sponsored by Department of Agriculture, Beltsville, MD.
Pub. in Clinical Nutrition 6, n3 p105-117 May/June 87.

Keywords: *Diets, *Trace elements, *Nutrients, *Food analysis, Humans, Chemical analysis, Public health, Food contamination, Reprints, *Toxic substances, Heavy metals.

Biological trace element research is a multidisciplinary science that requires a combination of biological insight and analytical awareness in planning the studies. Several elements such as cadmium (Cd), chromium

(Cr), mercury (Hg), and lead (Pb) occur in biological and food samples at low concentrations, and, therefore, stringent precautions are necessary to overcome problems of contamination and inaccurate determinations. Every laboratory that attempts to engage in trace level elemental analysis of biomaterials must, as a rule, validate the analytical procedures by analyzing the available biological and dietary reference materials before generating new data. Unless these guidelines are incorporated into the investigations on a routine basis, very little progress can be expected in taking the benefits of biological trace element research studies to solve public health problems.

MILITARY SCIENCES

Antimissile Defense Systems

001,374
PB91-107607 PC A05/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Metrology for Space Power: Metrology Development and Survey of Space-Based Measurements.

Interim rept.
G. J. FitzPatrick, J. K. Olthoff, E. D. Simmon, and C. P. Fenimore. Sep 90, 76p NISTIR-442
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Antimissile defense, *Metrology, Aerospace engineering, Fiber optics, Electrooptics, Magneto-optics, Electric current meters, Reliability, Measurement, *Ballistic missile defense, Space based, Sensors.

The report documents the technical progress in the three investigations which make up the project 'SDI Measurement Techniques' funded by the Strategic Defense Initiative Office. The first investigation develops part of the mathematical background needed for assessing the reliability and efficiency of the diagnostics used in the development of pulsed power components and systems. The signature of measurement failure is demonstrated in an electro-optic system. The detection of such failures is the first stage in remotely restoring the integrity of a measurement system. The second investigation assesses the applicability of magneto-optic sensors for measuring microsecond and submicrosecond current pulses. The results of comparative measurements of fiber optic current sensors with conventional detectors is reported here. The third investigation involves the accumulation of existing information necessary to support an effective measurement development program. The results of an in-depth study of existing space-based measurement techniques are reported.

Logistics, Military Facilities, & Supplies

001,375
AD-A213 937/6 PC A10/MF A02
National Bureau of Standards (ICST), Gaithersburg, MD. Computer Aided Logistics System Support Office.

Presentations at CALS Conference (Computer-Aided Acquisition and Logistic Support).

Phase 1.2. Conferences. A DoD/Industry/NIST (National Institute of Standards Technology) Conference. Held in Philadelphia, Pennsylvania on Apr 20, 1989, Anaheim, California on Apr 27, 1989 and Gaithersburg, Maryland on May 2, 1989.
2 May 89, 224p
See also AD-A198 630.

Keywords: Acquisition, Automation, Computer applications, Data management, Digital systems, Engineering drawings, Feedback, Industries, Information exchange, Instructional materials, *Technology forecasting, *Management information systems, *Logistics support, Planning, Preparation, Standards, Symposia,

MILITARY SCIENCES

Logistics, Military Facilities, & Supplies

*Weapon systems, CALS(Computer Aided Acquisition and Logistics Support).

The CALS Phase I.2 Conference was held in conjunction with the National Computer Graphics Association's NCGA Integrate '89 in Philadelphia, Pennsylvania, on 20 April 1989; at the Federal Computer Conference and Defense & Government Computer Graphics Conference FCC/DGC West in Anaheim, California, on 27 April 1989; and at the National Institute of Standards and Technology (NIST) on 2 May 1989. Computer-aided Acquisition and Logistic Support (CALS) is a DOD and Industry initiative. CALS addresses the integration and use of automated digital technical information for weapon system design, manufacture, and support. CALS focusses on the generation, access, maintenance, and distribution of the technical data associated with weapon systems. This includes engineering drawings, product definition and logistic support analysis data, technical manuals, training materials, technical plans and reports, and operational feedback data. The CALS program will facilitate data exchange and access, and reduce the duplication of the data preparation effort. CALS provides both the initiative and the framework to integrate the existing islands of automation within DoD and Industry. (KR)

001,376
PB90-155862 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.
Facilities for Improving Evaluations of Electromagnetic Susceptibilities of Weapon Systems and Electronic Equipment.
M. T. Ma, and M. L. Crawford. Nov 89, 21p NISTIR-89/3928
Sponsored by Naval Sea Systems Command, Washington, DC.

Keywords: *Electromagnetic compatibility, *Magnetic permeability, *Weapon systems, *Electric equipment, *Test facilities, Frequency allocations, Spectrum signatures, Spurious radiation, Magnetic induction, Laboratories, Performance evaluation, Anechoic chambers.

A preliminary design of an improved testing facility for evaluating the electromagnetic susceptibility of weapon systems and electronic equipment is presented. The facility features a combination of the transverse electromagnetic (TEM) cell for low-frequency testing and the reverberating chamber for high-frequency operation. As a system, a coverage of the wide spectrum from 10 kHz to 18 GHz or even to 40 GHz is possible. The TEM/reverberating combination is designed for an input impedance of 50, 75, or 100 ohms to generate a cw electric field up to 200 V/m, or a pulsed electric field up to 50 kV/m with an approximate rise time of 10 ns. The average field for the reverberating mode of operation is described in a statistical sense. Theoretical characteristics for a case study, to meet a given set of requirements, are given.

001,377
PB90-187550 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Characterization of Eddy Current Probes: Results of an Interlaboratory Intercomparison.
Final rept.
T. E. Capobianco, and L. L. Dulcie. 1988, 6p
Sponsored by Army Materials Technology Lab., Watertown, MA.
Pub. in Proceedings of Defense Conference on Non-destructive Testing (37th), Jacksonville, FL., November 1-3, 1988, p211-216.

Keywords: *Nondestructive tests, *Electric measuring instruments, *Eddy current tests, *Standards, Electrical measurement, Electromagnetic testing, *Department of Defense.

NIST recently conducted a round robin involving potential users of a proposed new military standard. The draft standard attempts to establish a test method for characterizing eddy current probe performance. The three objectives of the study were: to assess the ability of potential standard users to implement the specified test; to introduce potential users to the technique; and to expose any shortcomings in the test method documentation. The round robin involved eleven participants representing a spectrum covering military labs to repair depots. Preliminary results from the study were incorporated in the second draft of the standard as a result of meeting the second and third objectives. The paper will concentrate on the fact that the round robin

results show that a significant problem exists with the test method implementation.

001,378
PB90-218173 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.
HVAC Emulation and On-Line Testing of EMC Systems.
Final rept.
W. B. May. 1985, 14p
Sponsored by Civil Engineering Lab. (Navy), Port Hueneme, CA.
Pub. in Proceedings of International Symposium on Recent Advances in Control and Operation of Building HVAC Systems, Trondheim, Norway, May 22-23, 1985, p39-52.

Keywords: *Military facilities, *Algorithms, *Buildings, Air conditioning, Heating, Control equipment, Computerized simulation, Simulation, Reprints, *Energy management systems, *HVAC systems, Energy consumption.

Repeatable testing of EMCS algorithms is possible using a building emulator. An emulator is a computer with analog and digital input/output capabilities which connects to the EMCS sensors and command points and produces the same signals on the EMCS inputs that an actual building and its equipment would produce in response to commands. A building emulator for EMCS algorithm testing using a building simulation computer program is being built by the United States Navy based on experience with prototypes. A test procedure to use the building emulator is also being developed.

001,379
PB90-228016 PC A15/MF A02
National Inst. of Standards and Technology (NCSL), Gaithersburg, MD.
Graphics Standards in the Computer-Aided Acquisition and Logistic Support (CALS) Program, Fiscal Year 1989. Volume 2. MIL-D-28003 Revisions, CGM Registration.
Progress rept. Oct 88-Sep 89.
D. R. Benigni. May 90, 333p NISTIR-4330
Sponsored by Office of the Secretary of Defense, Washington, DC.

Keywords: *Logistic support, *Computer graphics, *Standards, Acquisition, Requirements, Computer applications, Federal information processing standards.

The overall objective of the Department of Defense Computer-aided Acquisition and Logistic Support (CALS) Program is to integrate the design, manufacturing, and logistic functions through the efficient application of computer technology. NIST has been funded since Spring 1986 to recommend a suite of industry standards for system integration and digital data transfer, and to accelerate their implementation. The collection of reports represents the continuing efforts of the Graphics Software Group of NIST/NCSL in FY89 in support of computer graphics standards for CALS, and in particular Computer Graphics Metafile (CGM). It provides a progress report on continuing graphics standards efforts related to the CGM standard, including the Extended CGM (CGEM), Graphics Registration, and the CGM Application Profile for CALS (or MIL-D-28003). In addition, the creation of a Test Requirements Document for MIL-D-28003 is detailed. The Test Requirements Document will provide the basis for developing conformance tests to determine compliance with MIL-D-28003.

001,380
PB90-269465 PC A06/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Factory Automation Systems Div.
System Requirements Analysis for the U.S. Army Rock Island Arsenal Tool Management System.
Final rept.
S. P. Frechette, and C. R. McLean. Aug 90, 125p
NISTIR-4369
Sponsored by Rock Island Arsenal, IL.

Keywords: *Tools, *Tooling, *Maintenance management, *Military facilities, Service life, Industrial management, Production management, Industrial plants, Automatic control, Machining, *Computer-aided manufacturing, *Tool management, *Rock Island Arsenal, Data bases.

The U.S. Army is conducting an extensive manufacturing modernization program at the Rock Island Arsenal

(RIA) in Illinois. Tool management, as it applies to these automated systems, is one area that RIA has identified for additional modernization activities. Engineers at the Rock Island Arsenal and the National Institute of Standards and Technology (NIST) recognize that a consistent and integrated implementation of tool management is critical to the Army's manufacturing program. The purpose of the document is to outline requirements for implementing an automated tool management system at Rock Island. Tool management is not a single, simple activity--it is comprised of a complex and pervasive set of functions. No commercial systems are known to exist which perform all of the functions outlined in the document. The study documents joint efforts by NIST and RIA staff to develop an open architecture for tool management at the Rock Island manufacturing facility.

Nuclear Warfare

001,381
PB90-241241 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Fire Science and Engineering Div.
Fire Induced Flow Field - Theory and Experiment.
Final rept.
H. R. Baum, and B. J. McCaffrey. 1989, 20p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Proceedings of International Symposium on Fire Safety Science (2nd), Tokyo, Japan, June 13-17, 1988, p129-148 1989.

Keywords: *Fires, *Flow distribution, *Nuclear explosion effects, Nuclear fireball, Fire tests, Fluid flow, Velocity, Temperature, Reprints, Nuclear Winter.

The complete flow pattern induced by unconfined fires is studied theoretically and experimentally. The theoretical development is based on kinematic relationships between the velocity, vorticity, and heat release fields. The flow both inside and outside a single fire plume is related to plume centerline velocity and temperature measurements. Very large area fires, such as those hypothesized in the Nuclear Winter scenario, are represented as ensembles of individual fires of differing strengths distributed over randomly chosen sites within the burning area. The experimental data for fire plumes over a four order of magnitude size range is compared with these calculations and previously developed plume velocity and temperature correlations.

NATURAL RESOURCES & EARTH SCIENCES

Cartography

001,382
PB90-152430 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Compositional Mapping with a TV Camera-Based Imaging System on an Ion Microscope.
Final rept.
D. E. Newbury, and D. S. Bright. 1988, 4p
Pub. in Microbeam Analysis, p105-108 1988.

Keywords: *Mapping, *Television cameras, *Ion microscopes, Quantitative analysis, Optical scanners, Optical equipment, Photographic equipment, Field emission microscopes, Spectrometers, Reprints.

Quantitative imaging by secondary ion microscopy can be carried out with digital recording and processing of the ion images through a TV camera which views the channel plate/phosphor screen detector. The signal response of such a system, as calibrated by a pulse counting multiplier detector, is found to be a strong function of applied channel plate voltage and of the elemental ion species. A procedure is described for conversion of the gray level of the ion image into

equivalent multiplier count rate, followed by sensitivity factor correction to yield quantitative results.

Geology & Geophysics

001,383
PB90-136326 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
Tilt Observations Using Borehole Tiltmeters 2. Analysis of Data from Yellowstone National Park.
Final rept.
C. Meertens, J. Levine, and R. Busbv. 1989, 15p
Sponsored by Air Force Geophysics Lab., Hanscom
AFB, MA.
Pub. in Jnl. of Geophysical Research 94, nB1 p587-
601, 10 Jan 89.

Keywords: *Yellowstone National Park, *Boreholes,
*Site surveys, Wyoming, Mathematical models, Com-
parison, Revisions, Oceans, Reprints, *Tiltmeters,
*Earth tides, Attitude(Inclination), Finite element
method.

The authors had installed borehole tiltmeters at five sites in Yellowstone National Park, Wyoming, and have used these instruments to measure the spatial variation of the amplitude and phase of the principal semidiurnal tide. The measured tides vary both with position and azimuth and differ from the sum of the body tide and the ocean load by up to 50%. The difference predicted by a finite element model constructed from seismic, refraction, and gravity data has a maximum value of only 12%, although the discrepancy between observations and the model is only marginally significant at some sites. The disagreement between the model and their observations is much larger than they observed using the same instruments at other sites and cannot be attributed to an instrumental effect. They had been unable to modify the model to explain their results while keeping it consistent with the previous observations.

001,384
PB90-170408 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Ceramics Div.
Pyroxene-Melt Equilibria: An Updated Model.
Final rept.
R. L. Nielsen, P. M. Davidson, and T. L. Grove. 1988,
13p
Pub. in Contributions to Mineralogy and Petrology 100,
n3 p361-373 1988.

Keywords: *Mineralogy, *Lavas, *Basalt, *Melts,
*Chemical equilibrium, *Mathematical models, Phase
diagrams, Igneous petrology, Thermodynamics, Crystalline rocks, Regression analysis, Solid solutions, Reprints, *Pyroxenes.

An updated model for pyroxene-melt equilibria at 1 atm. has been developed and calibrated in order to refine calculations of liquid lines of descent, which simulate the effects of igneous differentiation processes. The Davidson and Lindsley (1985) model for activities of components in clino-pyroxene and orthopyroxene solid solutions were combined with the Nielsen and Drake (1979) expressions for component activities in the melt. Pyroxene compositions were projected to quadrilateral compositions with the method of Lindsley and Anderson (1983). The regression constants A(i), B(i), and C(i) were calculated from experimental data that consists of 82 pyroxene-melt pairs, including 33 orthopyroxene-melt pairs. The experiments were all performed at 1 atm. and represent natural compositions ranging from basalts (lunar and terrestrial) to dacites (46-66 wt.% SiO₂). The model is calibrated for 1000 < T(C) < 1300 and proxene 'others' (Ti, Mn, Al, Cr, Na) less than 10 mole %. Using the input data as unknowns, the model expressions reproduce the experimental results to within 10-15 C.

001,385
PB90-170705 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.
Fluorescence Technique for Determining the Porosity of Geologic Core Samples on a Macro- and Microscale.
Final rept.
R. A. Velapoldi, and N. Gjelsvik. 1987, 3p
Pub. in Microbeam Analysis, p202-204 1987.

Keywords: *Drill core analysis, *Geological surveys,
*Porosity, North Sea, Quantitative analysis, Micro-
structure, Rock properties, Structures, Reprints, *Fluo-
rescence spectroscopy, *Scanning light microscopy.

The authors present here a method for quantitatively measuring porosity of reservoir rocks on a spatial scale of a few micrometers using fluorescence microscopy. The procedure includes automated scanning of sandstone core thin sections from the North Sea and could be extended to other core rock types examined by geologists.

001,386
PB90-188582 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.
Interfacial Energy States of Moisture-Exposed Cracks in Mica.
Final rept.
K. T. Wan, N. Aïmaid, S. Lathabai, R. G. Horn, and
B. R. Lawn. 1990, 11p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Jnl. of Materials Research 5, n1 p172-182 Jan
90.

Keywords: *Mica, *Silicate minerals, *Crack propaga-
tion, *Surface energy, *Moisture, Brittleness, Inter-
faces, Loads(Forces), Hysteresis, Thermodynamic
equilibrium, Energy levels, Adhesion, Weathering, Re-
prints, Fracture mechanics, Crack closure.

Results of crack growth observations on mica in water-containing environments are described. The study focuses on equilibrium crack states for reversed loading cycles, i.e., for initial propagation through virgin solid and subsequent retraction-repropagation through healed or misoriented-healed interfaces. Departures from the equilibrium states are manifest as steady-state forward or backward crack velocities at specific applied loads. Hysteresis is observed in the forward-backward-forward crack propagation cycle, signifying a reduction in the adhesion energy on exposure of the open interface to environmental species prior to healing. The hysteresis is especially marked for those interfaces that are misoriented before healing, indicating that the structure of the underlying solid substrate as well as of the intervening fluid is an important consideration in the interface energetics. The equilibrium states for different environments can be represented on a simple energy-level diagram, as differences between thermodynamic end-point states. The significance of the diagram in relation to the fundamental atomic structure of interfaces in fracture and other adhesion geometries, including implications concerning kinetics, is discussed.

001,387
PB90-261249 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
Measurements of Tilt Using a Borehole Tiltmeter.
Final rept.
J. Levine. 1989, 8p
Pub. in Proceedings of Sensors EXPO International
1989, Cleveland, OH., September 12-14, 1989, p103B-
1-103B-7.

Keywords: Rock mechanics, Geological faults, Earth-
quakes, Seismic detection, Boreholes, Pendulums,
Yellowstone National Park, San Andreas Fault, Reprints,
*Tiltmeters.

A borehole tiltmeter based on a pair of horizontal pendulums is described. The tiltmeter was used to study the elastic properties of the Yellowstone National Park area by measuring the amplitude and phase of the earth tides there. Several of these instruments are being used in seismically active regions in Southern California to assess their usefulness in predicting earthquakes and measuring the distortion of the near-surface material near a fault zone.

001,388
PB90-261322 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.
Lithiomarsturite, a New Member of the Pyroxenoid Group, from North Carolina.
Final rept.
D. R. Peacor, P. J. Dunn, J. S. White, J. D. Grice,
and P. Chi. 1990, 6p
Pub. in American Mineralogist 75, p409-414 1990.

Keywords: *Silicate minerals, Lithium inorganic com-
pounds, Calcium silicates, Manganese inorganic com-

pounds, Crystal structure, North Carolina, Reprints,
*Lithiomarsturite, Foote Mine.

Lithiomarsturite, ideally LiCa₂Mn₂H₂Si₅O₁₅, is a new member of the p-p (pectolite-pyroxene) series of pyroxenoids (hydropyroxenoids). It has a structure based on 'funferketten', but chain-periodicity faults are common, causing a refinement of the structure to terminate with R = 18%. Its crystal structure is given. Lithiomarsturite occurs at the Foote mine in North Carolina as 1- to 3-mm-diameter euhedral crystals (forms in braces: 100, 010, and 001) in vugs in pegmatite with albite, fluorapatite, bavenite, brannockite, parsettensite, and tetrawickmanite crystals.

Mineral Industries

001,389
PB90-135781 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Metallurgy Div.
Reply to Discussion of Order-Disorder in Omphacitic Pyroxenes: A Model for Coupled Substitution in the Point Approximation.
Final rept.
B. P. Burton, and P. M. Davidson. 1988, 3p
Pub. in American Mineralogist 73, n7-8 p916-918
1988.

Keywords: *Order disorder transformation, Crystal
structure, Entropy, Clustering, Phase transformations,
Point defects, Hypotheses, Reprints, *Pyroxenes,
*Omphacite.

The GPA (generalized pair approxn. of R.E. Cohen, 1986) fails because its configurational entropy expression is inconsistent with the C2/c and P2/n pyroxene structures, not because additional contributions to the internal energy are required. The generalized point approximation (GPA of P.M. Davidson and B.P. Burton, 1987) succeeds because its configurational entropy expression is consistent with C2/c and P2/n pyroxene structures. An adequate treatment of the short-range order in omphacite pyroxene requires an approximation that is based on clusters larger than pairs.

001,390
PB90-136961 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Inorganic Analytical Research Div.
Developments in Atomic-Absorption, X-ray Fluorescence, and Plasma-Emission Spectrometry for the Analysis of Metals and Ores.
Final rept.
R. L. Watters. 1984, 4p
Pub. in Proceedings of MINTEK 50 International Conference on Mineral Science and Technology, Sandton, South Africa, March 26-30, 1984, v1 p87-90.

Keywords: *X-ray fluorescence, *Spectrometers,
*Emission spectroscopy, *Plasma radiation, *Chemical analysis, *Metals, *Metaliferous minerals, Precision, Accuracy, Reprints, *Absorption spectroscopy.

The routine analysis of metals and ores has traditionally involved either wet-chemical or instrumental spectrometric techniques. Instrumental analysis using the techniques of atomic-absorption spectrometry with electrothermal atomization, X-ray fluorescence, and inductively coupled plasma emission, have replaced the more classical approaches in many laboratories. Recent advances in the techniques have improved the precision and accuracy of the analysis of complex materials, but the attainment of the best accuracy can depend upon the chemical separation of the analyte from the matrix. The paper will discuss some of the developments in each of the fields that have led to improvements in the precision and accuracy of methods for the analysis of metals and ores. Instances where the combination of chemical separation and instrumental analysis might be advantageous will be suggested.

001,391
PB90-198433 PC A04/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Robot Systems Div.

Mineral Industries

Hierarchical Real-Time Control Task Decomposition for a Coal Mining Automation Project.
H. M. Huang. Mar 90, 61p NISTIR-90/4271
Sponsored by Bureau of Mines, Pittsburgh, PA.

Keywords: *Coal mining, *Excavating equipment, *Automatic control, *Mining equipment, Coal mines, Mining engineering, Computer applications.

The paper describes a systematic approach to hierarchical task decomposition and planning. In particular, the methodology can be used to design a complex system which receives goals from the external world, performs intelligent planning, and commands the actuators to achieve the goals. The document was written as a part of the 'Architecture for Internal Control of Mining Machines' project.

001,392
PB91-112797 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Unmanned Systems Group.

Application of Measurement Error Propagation Theory to Two Measurement Systems Used to Calculate the Position and Heading of a Vehicle on a Flat Surface.

J. A. Horst. Oct 90, 47p NISTIR-4434
Sponsored by Bureau of Mines, Pittsburgh, PA.

Keywords: *Surface navigation, *Position finding, *Coal mining, Dimensional measurement, *Robotics, Angle measurement, Length measurement.

The work applies known results on the propagation of measurement error statistics to two types of measurement systems, an angle measuring system and a length measuring system. Such systems can be used to measure the position and heading of a vehicle (or any rigid object) on a flat surface. For example, one might need to sense position and heading of a vehicle in order to control its motion. The functional relationships to go from angle and length measurements to position and heading are discussed and derived. Measurement error propagation theory is given in a way that can apply to any measurement system. The theory thus described is applied to the two types of measurement systems. Specific examples of these systems are given. The stated examples are currently being used by the US Bureau of Mines (BOM) to measure the position and heading of certain underground coal mining machines in an effort to move equipment operators away from the more dangerous areas of the mine. Simulation results for these specific examples in the form of density maps are given which plot the error in position and heading for various positions (heading constant) of the vehicle.

Natural Resource Management

001,393
PB91-120154 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Estimation of the Rate of Heat Release and Induced Wind Field in a Large Scale Fire.
T. J. Ohlemiller, and D. M. Corley. Oct 90, 58p NISTIR-4430
Sponsored by Defense Nuclear Agency, Washington, DC.

Keywords: *Forest fires, *Fire tests, *Burning rate, *Heat flux, Heat transmission, Estimating, Mathematical models, Combustion, Fire safety, Heat transfer, Convection.

Logging slash on a 486 hectare site in Ontario was burned as part of a Forestry Canada forest management program. A 100 hectare portion of this site was instrumented by several groups interested in large scale fires. The NIST Center for Fire Research utilized Forestry Canada data on mass loading before and after the fire, total burning area as a function of time and burning duration to estimate the spatial and temporal pattern of heat release during the burning of the instrumented section of the fire. Complete information necessary for making this estimate is lacking; the necessary assumptions and their accuracy (when known) are discussed. Heat release rate is reported for three different assumptions regarding the temporal behavior of flaming and smoldering phases of the combustion. This information is utilized in the context of a flow model due to Baum and McCaffrey to calculate the

near-ground flow field induced by this heat release pattern and the results are compared to the point measurements made in the field.

NAVIGATION, GUIDANCE, & CONTROL

Navigation Systems

001,394
PB90-152703 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Positioning of GPS (Global Positioning System) Antennas in Time-Keeping Laboratories of North America.

Final rept.
W. Lewandowski, R. J. Douglas, W. J. Klepczynski, W. Strange, J. Suter, and M. A. Weiss. 1989, 7p
Sponsored by National Geodetic Survey, Rockville, MD.
Pub. in Proceedings of Annual Symposium on Frequency Control (43rd), Denver, CO., May 31-June 2, 1989, p218-224.

Keywords: *Antennas, Telecommunication, Time measuring instruments, Time measurement, Electronics laboratories, Navigation satellites, Navigational aids, Position(Location), *Global positioning systems.

One of the problems with the use of the Global Positioning System (GPS) for time transfer is that it is a one-way system. In addition, most of the time-keeping laboratories of the world use only the L1 frequency. However, the use of GPS in the common view approach diminishes the impact of some of the errors such as orbit error, GPS clock error and ionospheric error, in the one-way system, but does not cancel the antenna coordinate error. The Bureau International des Poids et Mesures (International Bureau of Weights and Measures) has developed a method of differential positioning using the data of time comparisons themselves. The principles of the technique and the results of its application to the North American time laboratories are presented in the paper. Work on differential position by geodetic double-frequency receivers, between U.S. Naval Observatory and Maryland Very Long Baseline Interferometry point, are reported.

used in cryogenic structures for the superconducting magnets of fusion energy power plants and prototypes. Its purpose is to facilitate their design and development. The program was developed jointly by the staffs of the National Institute of Standards and Technology and the Office of Fusion Energy of the Department of Energy; it is managed by NIST and sponsored by DOE. Research is conducted at NIST and at other laboratories through subcontracts with NIST. Research results for 1988 are presented in technical papers under four headings that reflect the main program areas: Structural Alloys, Welding, Technology Transfer, and United States-Japan Development of Test Standards. Objectives and research highlights are summarized in the introduction to each program area.

001,396
PB91-107086 PC A17/MF A02
National Inst. of Standards and Technology, Boulder, CO.

Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures-XIII.

R. L. Tobler, and R. P. Reed. Sep 90, 382p NISTIR-3944
See also PB90-157553. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.

Keywords: *Cryogenics, *Superconducting magnets, *Technology transfer, Research projects, Structural forms, Welding, Tests, Standards, Low temperature research, Mechanical properties, Stainless steels, Alloys, Crack propagation, Toughness, Copper, Aluminum, *Thermonuclear reactor materials, Fracture mechanics.

The report contains the results of research to determine the properties of materials that may be used in cryogenic structures for the superconducting magnets of fusion energy power plants and prototypes. Its purpose is to facilitate design and development. The program was developed jointly by the staffs of the National Institute of Standards and Technology (NIST) and the Office of Fusion Energy of the Department of Energy (DOE); it is managed by NIST and sponsored by DOE. Research is conducted at NIST and at other laboratories through cooperative agreements with NIST. Research results for 1989-90 are presented in technical papers under four headings that reflect the main program areas: Structural Alloys, Welding, Test Standards, and Technology Transfer. Objectives and research highlights are summarized in the introduction to each program area.

Isotopes

001,397
DE89004816 PC A02/MF A01
National Bureau of Standards, Gaithersburg, MD.
2.5 MeV Neutron Source for Fission Cross Section Measurement.

K. C. Duvall, O. A. Wasson, and H. Ma. 1988, 4p CONF-880546-43
Contract A101-86ER40275
International conference on nuclear data for science and technology, Mito, Japan, 30 May 1988.
Portions of this document are illegible in microfiche products.

Keywords: *Deuterium Target, *Neutron Sources, *Uranium 235 Target, Design, Deuteron Reactions, Fission, Measuring Methods, *Neutron Fluence, Neutron Reactions, Target Chambers, ERDA/070201, ERDA/651220, ERDA/652020, Fission cross section.

A 2.5 MeV neutron source has been established on the beamline of a 100 kV, 0.5 ma ion accelerator. The ion accelerator provides a 100 kV deuteron beam of about 200 mu a into a 3 mm beam spot at the target position. The neutron source is produced by the D(d,n) sup 3 He reaction with a yield of about 10 sup 7 n/sec. The time-correlated associated particle method (TCAP) is utilized for the neutron fluence determination and for neutron background elimination. The sup 3 He associated particles are detected at 90 degrees behind a thin aluminum foil and the corresponding neutrons are emitted at 73.5 degrees with an energy near 2.5 MeV. Also, the protons from the competing D(d,p)T reaction are monitored at 135 degrees for normalization and diagnostic purposes. A fission chamber containing six uranium tetrafluoride deposits has been de-

NUCLEAR SCIENCE & TECHNOLOGY

Fusion Devices (Thermonuclear)

001,395
PB90-157553 PC A13/MF A02
National Inst. of Standards and Technology, Boulder, CO.

Materials Studies for Magnetic Fusion Energy Applications at Low Temperatures--XII.

Technical rept.
R. P. Reed, and R. L. Tobler. Nov 89, 280p NISTIR-89/3931
See also PB89-100556. Portions of this document are not fully legible. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.

Keywords: *Superconducting magnets, Austenitic stainless steels, Composite materials, Elastic properties, Welded joints, Standards, Cryogenics, Technology transfer, Tests, *Thermonuclear reactor materials.

The report contains the results of a research program to determine the properties of materials that may be

signed for use in the sup 235 U(n,f) cross section measurement at 2.5 MeV. The 5 cm diameter deposits range in thickness from 230-300 mu g/cm sup 2 and are expected to have good uniformity. A description of the 2.5 MeV neutron source facility is presented along with details of the associated particle detection and neutron beam characteristics. Preparations for the fission cross section measurement are discussed. 6 refs., 4 figs. (ERA citation 14:007516)

001,398

PB90-187568 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Measurement Quality Assurance through a National System of Secondary Laboratories.

Final rept.
E. H. Eisenhower. 1987, 13p
Pub. in Proceedings of NCSL Workshop and Symposium on Innovation, Key to the Future, Denver, CO., July 12-16, 1987, p30-1-30-13.

Keywords: *Ionizing radiation, *Measurement, *Quality assurance, *Laboratories, Standards, Reprints.

The achievement and demonstration of adequate accuracy in measurements of ionizing radiation is becoming increasingly desirable and necessary. Measurement accuracy is commonly interpreted as the agreement between measurement results and the appropriate national standard. The extent of agreement has been difficult to demonstrate because the necessary mechanisms have not existed. Available mechanisms have generally been limited to calibrations, which provide only assumed agreement with the national standard. The growing divergence of one NBS with limited resources and an increasing number of radiation users who need measurement support services will be resolved by a national system of secondary standards laboratories. Those laboratories will operate in accordance with established general criteria, will follow documented procedures for routine quality control and for providing services to customers, and will periodically demonstrate agreement with NBS by participation in a performance test. The secondary laboratories will, in turn, provide services to achieve agreement between themselves and radiation users. This can provide documented evidence of adequate measurement performance at the user level, in terms of agreement with NBS through the secondary level. The paper will describe the basic concepts of measurement quality assurance and its achievement through secondary laboratories. Relevant programs that are operating and under development will be described, as well as plans for additional programs that will constitute the secondary laboratory system.

001,399

PB90-192378 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Sensitive Dichromate Dosimeter for the Dose Range, 0.2-3 kGy.

Final rept.
W. L. McLaughlin, M. Al-Sheikhly, M. Farahani, and M. H. Hussmann. 1990, 8p
Pub. in Radiation Physics and Chemistry 35, n4-6 p716-723 1990.

Keywords: *Dosimeters, *Chromates, Food processing, Reducing agents, Reprints.

The response of aqueous dichromate dosimeters can be enhanced by adding small controlled amounts of organic reducing agents, however, such additives cause instabilities before and after irradiation. A choice is made of combinations of potassium dichromate, silver dichromate, perchloric acid, with the organic agent, acetic acid, to enhance appreciably the radiation chemical yield G(-Cr2O7)(sup -2) and still have sufficient stability for practical use in dosimetry in the food irradiation range. The reduction yield is thereby increased from the reported value for the classic K-Ag dichromate dosimeter (G approximately = 0.04 micromol/J) to G approximately = 0.17 micromol/J. The enhancement allows the dosimeter to be used with good precision down to the upper part of the dose range of the Fricke dosimeter (nearly = to 200 Gy) up to the lower part of the dose range of the conventional K-Ag dichromate dosimeter (nearly = to 3000 Gy). Because of instability of the solutions containing acetic acid, however, there is the limitation that spectrophotometry should not be made until at least three hours after irradiation.

001,400

PB90-192386 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Development of a Stable Tritium (HT) Generation System for Testing Atmospheric HT Monitors.

Final rept.
W. R. Miller, E. E. Hughes, and B. M. Coursey. 1990, 11p
Pub. in Nuclear Instruments and Methods in Physics Research A286, p334-344 1990.

Keywords: *Tritium, Radioactive contaminants, Atmospheric composition, Monitors, Sources, Tests, Reprints, *Gas generators, *Hydrogen tritide, Tritium meters, Calibration.

A stable tritium (HT) generation system that can be used to test atmospheric HT monitors has been developed at the National Institute of Standards and Technology. The system produces HT in air at concentrations between one and ten times the current atmospheric background level (about 8 x 10 to the -10 power microCi per liter of air). This has been accomplished by the precise mixing of two controlled gas flows, one from a gravimetrically prepared argon-tritium mixture of known tritium activity concentration, and the other from a stream of clean (tritium-free) air. The system has a total output flow of about 1 l/min and was designed and evaluated to test atmospheric HT monitors that have an input flow of less than or equal to 0.85 l/min.

Nuclear Instrumentation

001,401

DE89004814 PC A02 National Bureau of Standards, Gaithersburg, MD.

Monte Carlo Calculated Response of the Dual Thin Scintillation Detector in the Sum Coincidence Mode.

K. C. Duvall, and R. G. Johnson. 1988, 3p CONF-880546-45
Contract A101-86ER40275
International conference on nuclear data for science and technology, Mito, Japan, 30 May 1988.
Paper copy only, copy does not permit microfiche production.

Keywords: *Neutron Detectors, Efficiency, Monte Carlo Method, Neutron Fluence, Numerical Data, Operation, Proton Recoil Detectors, Response Functions, Solid Scintillation Detectors, ERDA/440101.

The Dual Thin Scintillator (DTS) is a unique neutron detector that is being developed for improved fluence and spectrum measurement. Current attention has been directed towards understanding some details of the detector response in the sum coincidence mode of operation where a peaked pulse height response is exhibited throughout the energy region of interest. As a result of the peaked distribution, the detector efficiency is a weak function of the pulse height bias, allowing the number of recorded events above the bias to be determined with greater certainty. A Monte Carlo code has been used to calculate the sum coincidence pulse height response at several energies within the 1 to 15 MeV region. The detector efficiency as a function of neutron energy has also been calculated. The results of the Monte Carlo calculations, which include the effect of multiple scattering on the shape of the response function and efficiency curve are presented. (ERA citation 14:011659)

001,402

PB90-169780 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Measurement Quality Assurance through a National System of Secondary Laboratories.

Final rept.
E. H. Eisenhower. 1987, 13p
Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p30-1-30-13.

Keywords: *Quality assurance, *Ionizing radiation, *Radiological laboratories, Reprints, *Calibration.

The achievement and demonstration of adequate accuracy in measurements of ionizing radiation is becoming

increasingly desirable and necessary. Measurement accuracy is commonly interpreted as the agreement between measurement results and the appropriate national standard. The extent of agreement has been difficult to demonstrate because the necessary mechanisms have not existed. Available mechanisms have generally been limited to calibrations, which provide only assumed agreement with the national standard. The growing divergence of one standards agency with limited resources and an increasing number of radiation users who need measurement support services will be resolved by a national system of secondary standards laboratories. Those laboratories will operate in accordance with established general criteria, will follow documented procedures for routine quality control and for providing services to customers, and will periodically demonstrate agreement with the National Institute of Standards and Technology by participation in a performance test. The secondary laboratories will, in turn, provide services to achieve agreement between themselves and radiation users.

001,403

PB90-190752 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Review of Scattering Corrections for Calibration of Neutron Instruments.

Final rept.
C. M. Eisenhauer. 1989, 10p
Pub. in Radiation Protection Dosimetry 28, n4 p253-262 1989.

Keywords: *Neutron scattering, Monte Carlo method, Correction, Reviews, Reprints, *Neutron dosimetry, *Calibration, Radiation doses, Remmeters, Personnel dosimetry.

Scattering corrections are considered that must be made when neutron personnel instruments are calibrated with a point source of neutrons near the center of a calibration room. Three basic types of scatter are considered: scattering from a plane slab, scattering from walls of an enclosed room, and air scatter. In each case one proceeds from an idealized situation, where the correction can be predicted analytically, to an actual calibration room, where predictions must be checked by Monte Carlo calculations or experiment. Calculations show that the postulation of an image source provides a good model for predicting the fluence of neutrons scattered from aluminum and concrete slabs. Calculations also show how the fluence of neutrons scattered from the walls of an enclosed room relates to the case of neutron fluence in a spherical cavity and how the neutron fluence is increased by scattering in the air around source and detector. Finally, calculations are compared with experiments on the response of a neutron dose equivalent monitor.

001,404

PB90-190786 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Neutron Sensitivity of LiF Chip Gamma Dosimeters at Megagray Doses.

Final rept.
D. M. Gilliam, D. Hocken, J. C. Humphreys, and G. P. Lamaze. 1989, 6p
Pub. in Reactor Dosimetry: Methods, Applications, and Standardization, ASTM STP 1001, p206-211 1989.

Keywords: *Dosimeters, *Neutron irradiation, Lithium fluorides, Color centers, Sensitivity, Spectrophotometry, Chips, Tests, Reprints, Thermoluminescent dosimeters, Gamma dosimetry, NBSR reactor.

A lithium fluoride 'chip' gamma dosimeter has been tested for neutron sensitivity by irradiation in the cavity fission neutron field at the NBS reactor. Previous neutron sensitivity tests of these crystals had been made only for the F color center, which saturates at gamma doses of about 0.1 MGy. The present work extends these neutron sensitivity checks to the M, R, and N color centers which are useful for gamma doses in the 0.1 - 10 MGy range. The useful range of these centers was extended by reducing the thickness of the crystal to 1 mm. All irradiations in the Co-60 calibration irradiator were made using the same encapsulation as will be employed in ex-vessel cavity exposures at power plants.

001,405

PB90-190828 Not available NTIS

Nuclear Instrumentation

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div. **Calorimetry of Electron Beams and the Calibration of Dosimeters at High Doses.** Final rept. J. C. Humphreys, and W. L. McLaughlin. 1990, 6p. Pub. in *Radiation Physics and Chemistry* 35, n4-6 p744-749 1990.

Keywords: *Electron beams, *Dosimeters, Reprints, *Electron dosimetry, *Calorimetry, *Calibration, Film dosimetry, Alanine dosimeters, Intercomparison.

Graphite or metal calorimeters are used to make absolute dosimetric measurements of high-energy electron beams. These calibrated beams are then used to calibrate several types of dosimeters for high-dose applications such as medical-product sterilization, polymer modification, food processing, or electronic-device hardness testing. The calorimeters are used over an absorbed dose range of 100 to 10,000 Gy. Intercomparison studies are reported between National Institute of Standards and Technology (NIST) and UK National Physical Laboratory (NPL) graphite disk calorimeters at high doses, using the NPL 10-MeV linac, and agreement was found within 1.5%. It was also shown that the electron-beam responses of radiochromic film dosimeters and alanine pellet dosimeters can be accurately calibrated by comparison with calorimeter readings.

001,406
PB90-192360 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Physics Div. **New Dosimetry Systems.** Final rept. W. L. McLaughlin. 1990, 6p. Pub. in *Radiation Physics and Chemistry* 35, n4-6 p693-698 1990.

Keywords: *Dosimeters, Food processing, Ionizing radiation, Standards, Sugars, Calorimeters, Reprints.

During the past two years there have been significant advances in several forms of radiation measurement systems for radiation processing, covering dose ranges of 1-10(sup 6) Gy. Calorimeters as reference standards for both ionizing photon and electron fields have become well-established. In addition to the older ceric-cerous dosimetry solution analyzed potentiometrically, new liquid-phase dosimeters include those analyzed by spectrophotometry, e.g., improved forms of acidic aqueous solutions of K-Ag dicromate and organic radiochromic dye solutions. It has recently been demonstrated that by using certain refined sugars, e.g., D-(-)ribose, optical rotation response in aqueous solutions can be enhanced for dosimetry at doses > 10(sup 4) Gy. There has been expanded development, use, and formulation (rods, tablets, and thin films) of the amino acid, alanine, as a solid-phase dosimeter analyzed by either ESR spectrometry or by glutamine or alanine spectrophotometry of complexes with ferric ion in the presence of a sulfonphthalein dye (xlenol orange). New commercial types of radiochromic plastic dosimeters, e.g., GafChromic, Riso B3, GAM-MACHROME YR, Radix, and Gammex, have been introduced and applied in practice.

001,407
PB90-193335 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div. **Initial Color Development in Radiochromic Dye Films After a Short Intense Pulse of Accelerated Electrons.** Final rept. R. M. Uribe, M. Barcelo, W. L. McLaughlin, A. E. Buenfil, and J. Rios. 1990, 4p. Pub. in *Radiation Physics and Chemistry* 35, n4-6 p724-727 1990.

Keywords: *Dyes, *Electron irradiation, Photochromism, Absorption spectra, Polyamide resins, Optical density, Reaction kinetics, Reprints, *Film dosimetry, radiation detection.

The radiation response of different dye precursors in several host plastics has been investigated after a single short-pulse irradiation with 2.5-MeV electrons. It was observed that in most films the radiation-initiated color development proceeds mainly during the first 300 seconds, after such high dose-rate irradiation (approximately 10(sup 12) Gy/s). Absorption spectra show that the main absorption band increases at the expense of a shorter-wavelength precursor absorption

band, showing an isosbestic point approximately midway between the two absorption bands. It was found that a certain combination of dye precursor and host plastic (namely a polyamide containing an aromatic group) constitutes a film which shows a very fast increase in optical density of the main absorption band, making it suitable for immediate dosimetric analysis in very high dose-rate installations.

001,408
PB90-206780 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div. **Niobium as a Neutron Dosimeter.** Final rept. T. G. Williamson, and G. P. Lamaze. 1987, 2p. Pub. in *Transactions of the American Nuclear Society* 55, p553-554 1987.

Keywords: *Pressure vessels, Monte Carlo method, Neutron irradiation, Radioactive contaminants, Fission cross sections, Induced radioactivity, Impurities, X rays, Tantalum, Reprints, *Neutron dosimetry, *Niobium 93, Radioactivation.

The neutron inelastic scattering reaction $(93)\text{Nb}(n,n')(93\text{m})\text{Nb}$ has many desirable features as a fast neutron dosimeter for pressure vessel dosimetry. The cross section, with a threshold near 100 keV, approximates the damage function in many metals, and the product isotope has a half life of 16.1 years which will integrate over a significant fraction of the pressure vessel lifetime. The metal is easily fabricated into thin foils and is stable in the pressure vessel environment. The niobium reaction has not been used extensively because of difficulties in measuring $(93\text{m})\text{Nb}$ activity. Recently niobium foil material with less than 10 ppm tantalum impurity and better measurements of the cross section have become available. In the paper a measurement of the fission spectrum averaged cross section and techniques for counting activated foils will be reported.

001,409
PB90-207002 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div. **Optical Waveguide Dosimetry for Gamma-Radiation in the Dose Range 10(-1)-10(4) Gy.** Final rept. W. L. McLaughlin, H. M. Khan, W. Warasawas, M. Al-Sheikhly, and B. B. Radak. 1989, 8p. Pub. in *Radiation Physics and Chemistry* 33, n1 p39-46 1989.

Keywords: *Food irradiation, Fiber optics, Quality control, Reprints, *Gamma dosimetry, Optical waveguides.

Two types of liquid-core optical waveguide (OWG) dosimeters are commercially available for dosimetry in the irradiation of foods and other products. Opti-chromic type FWT-70-40M has a useful range of about 10 to 10,000 Gy and type FWT-70-83M about 100 to 10,000 Gy. Within the limits of random uncertainty of the reading of the absorbed dose the response to gamma rays is independent of dose rate over the range 0.1 to 10,000 Gy/h, when measured at the peak of the spectrum (absorption band max. (600 nm wavelength)). Both dosimeter types, when measured at 600 nm, are temperature dependent over the temperature ranges of -40 to 60 deg during irradiation. The dosimeters cannot be used when exposed to temperatures > 60 deg because of bubble formation and loss of light propagation. A special, sensitive OWG dosimeter (50-cm coil), designed for doses down to 0.1 Gy, shows a linear response up to at least 15 Gy, a temperature dependence of response only at temperatures below about 20 deg, and no dose-rate dependence.

001,410
PB90-254467 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div. **Perspectives on Detection Limits for Nuclear Measurements in Selected National and International Programs.** Final rept. L. A. Currie, and R. M. Parr. 1988, 23p. Pub. in *ACS (American Chemical Society) Symposium Series Detect. Anal. Chem.*, v361 p171-193 1988.

Keywords: *Chemical analysis, *Trace elements, Biochemistry, Limit, Measurement, Dead band, Reprints, *Radioactive effluents, *Radiation detection, *Envi-

ronmental materials, Radioecological concentration, US NRC, International cooperation, IAEA.

Issues involving the definition and practical significance of Detection Limits will be discussed in the light of US and international programs in which the concept plays a central role. The US program relates to the 'Lower Limit of Detection' (LLD) which forms a part of the Technical Specifications for nuclear power reactors, as required by the US Nuclear Regulatory Commission for measurements of effluent and environmental radioactivity. The programs of the International Atomic Energy Agency, which are oriented toward coordinated research and technical cooperation, similarly require common understanding and use of the 'Limit of Detection' (LOD) as a practical and meaningful performance characteristic for measurements of trace elements in bioenvironmental matrices. Efforts to meet the needs of the two programs to formulate realistic and practicable detection limits will be reviewed, with special focus on problems-in-common such as the treatment of the blank, decision criteria, algorithm and assumption dependence, and the reporting of subliminal results.

001,411
PB90-255266 PC A06
 National Inst. of Standards and Technology, Gaithersburg, MD. **Journal of Research of the National Institute of Standards and Technology. March-April 1990. Volume 95, Number 2. Special Issue: Radon Measurement Standards and Calibration.** 1990, 116p. Also available from Supt. of Docs. as SN703-027-00033-4. See also PB90-255274 through PB90-255373 and PB90-235243.

Keywords: Alpha particle spectroscopy, Ionization chambers, Scintillation counters, Nuclear fission, *Foreign technology, *Radon 222, *Calibration, Radiation monitoring, Indoor air pollution, Daughter products, Data processing security, Reaction kinetics.

Contents: Calibration of Radon-222 Reference Instrument in Sweden; Bureau of Mines Method of Calibrating a Primary Radon Measuring Apparatus; A Calibration and Quality Assurance Program for Environmental Radon Measurements; U.K. National Radiological Protection Board Radon Calibration Procedures; ENEA Reference Atmosphere Facility for Testing Radon and Daughters Measuring Equipment; Calibration of Scintillation Cells for Radon-222 Measurements at the U.S. Environmental Protection Agency; ICARE Radon Calibration Device; The NIST Primary Radon-222 Measurement System; The Closed-Can Exhalation Method for Measuring Radon; Standardization of Rn-222 at the Australian Radiation Laboratory; Standardization of Radon Measurements. Also included in the report are sections devoted to Conference Reports, News Briefs, Standard Reference Materials, Standard Reference Data, and Calendar.

001,412
PB90-255274 (Order as PB90-255266, PC A06)
 Statens Straalskyddsinstiut, Stockholm (Sweden). **Calibration of Radon-222 Reference Instrument in Sweden.** R. Falk, H. Moere, and L. Nyblom. 1990, 6p. Included in *Jnl. of Research of the National Institute of Standards and Technology*, v95 n2 p115-120 Mar-Apr 90.

Keywords: Alpha particle spectroscopy, Radioactive contaminants, Sweden, *Surface barrier detectors, *Radon 222, *Calibration, Polonium 218, Polonium 214, Indoor air pollutions, Intercomparison.

A simple procedure to calibrate and characterize a recently developed radon-222 reference instrument is described. The system, which is now used as the official national Swedish reference, is quick and easy to use. Systematic as well as radom errors are smaller than in an earlier system and compare well with other systems, as has been shown in a number of international intercomparison measurements.

001,413
PB90-255282 (Order as PB90-255266, PC A06)
 Bureau of Mines, Denver, CO.

Bureau of Mines Method of Calibrating a Primary Radon Measuring Apparatus.

R. F. Holub, and W. P. Stroud. 1990, 6p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p121-126 Mar-Apr 90.

Keywords: Radio contaminants, Alpha particle detectors, Transferring, *Radon 222, *Calibration, US Bureau of Mines, Standard reference materials, Radiation monitoring, Radium 226.

One important requirement for accurate monitoring of radon in working environments, dwellings, and outdoors is to ensure that the measurement instrumentation is properly calibrated against a recognized standard. To achieve this goal, the U.S. Department of Interior Bureau of Mines (BoM) Radiation Laboratory has participated since 1983 in a program to establish international radon measurement standards. While the National Institute of Standards and Technology (NIST) radium solution ampules are acceptable to all participating laboratories as a primary standard, a method of transferring radon from the NIST source into each laboratory's primary counting apparatus is a critical problem. The Bureau's method transfers radon from the primary solution by bubbling 3 L of air through it into a steel cylinder. After homogenizing the radon concentrations in the cylinder, eight alpha-scintillation cells are filled consecutively and measured in a standard counting system. The resulting efficiency is 81.7 + or - 1.2%.

001,414
PB90-255290

(Order as PB90-255266, PC A06)

Department of Energy, New York. Environmental Measurements Lab.

Calibration and Quality Assurance Program for Environmental Radon Measurements.

I. M. Fisenne, A. C. George, and H. W. Keller. 1990, 8p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p127-133 Mar-Apr 90.

Keywords: *Ionization chambers, Radioactive contaminants, Quality assurance, Test facilities, *Radon 222, *Calibration, Radium 226, Indoor air pollution, Radiation monitoring.

The ideal facility for assessing the quality of radon measurements at environmental levels consists of: (1) an instrument whose response to radon and its progeny is determined from measurements of a certified or standard (²²⁶Ra source, and (2) a calibration room with a known radon concentration. The linkage between these two elements and additional quality control requirements are discussed here for some Environmental Measurements Laboratory radon measurements programs.

001,415
PB90-255308

(Order as PB90-255266, PC A06)

National Radiological Protection Board, Harwell (England).

U.K. National Radiological Protection Board Radon Calibration Procedures.

K. D. Cliff. 1990, 4p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 Mar-APR 90.

Keywords: *Alpha particle spectroscopy, *Radon 222, *Calibration, United Kingdom organizations, NRPB, Radioactive aerosols, Daughter products, Polonium 218, Uncertainty.

A procedure for the calibration of instruments for the detection of (²²²Rn) in air is described. The method is based on the alpha-spectrometric determination of the concentration in air of (²¹⁸Po) in the calibration chamber. The calibration chamber is described, together with the method of maintaining a high aerosol concentration. The (²¹⁸Po) concentration at steady state in the chamber is found to be 98% of the (²²²Rn) concentration typically. An assessment of the sources of uncertainty in the method presented indicate that the (²²²Rn) concentration in the chamber can be determined with an overall uncertainty of about 7% at the 95% confidence level.

001,416
PB90-255316

(Order as PB90-255266, PC A06)

ENEA, Rome (Italy).

ENEA Reference Atmosphere Facility for Testing Radon and Daughters Measuring Equipment.

G. Sciocchetti, F. Scacco, S. Tosti, P. G. Baldassini, and E. Soldano. 1990, 4p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p139-142 Mar-Apr 1990.

Keywords: *Test facilities, Radioactive contaminants, Measurement, *Radon 222, *Radon 220, *Reference atmospheres, Italian organizations, Daughter products.

The paper gives the technical characteristics of the Italian Committee for Research and Development of Nuclear Energy and Alternative Energy (ENEA) radon chamber and the operational procedures developed for testing radon and daughters measuring equipment. Runs were carried out under different experimental conditions defined in terms of radon and daughter concentrations, equilibrium ratio. (F-factor), and aerosol concentration and size distribution. Stable radon reference atmospheres with known equilibrium factors were obtained using standard aerosols.

001,417
PB90-255324

(Order as PB90-255266, PC A06)

Eastern Environmental Radiation Facility, Montgomery, AL.

Calibration of Scintillation Cells for Radon-222 Measurements at the U.S. Environmental Protection Agency.

E. L. Sensintaffar, and S. T. Windham. 1990, 3p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p143-145 Mar-Apr 90.

Keywords: *Scintillation counters, Zinc sulfides, Radioactive contaminants, *Radon 222, Calibrations, US EPA, Uncertainty, Indoor air pollution.

Zinc sulfide coated scintillation cells are the primary method for measuring radon-222 at the U.S. Environmental Protection Agency (EPA), Office of Radiation Programs (ORP), Eastern Environmental Radiation Facility (EERF). These cells are used to measure concentrations of radon in exposure chambers that are used to calibrate or test other devices or instruments. Calibrations of individual cells are discussed in the paper.

001,418
PB90-255332

(Order as PB90-255266, PC A06)

CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses (France).

ICARE Radon Calibration Device.

P. Zettwoog. 1990, 7p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p147-153 Mar-Apr 90.

Keywords: Metrology, Standards, *Radon 222, *ICARE device, *Calibration, French organizations, Daughter products.

An aerodynamic calibration device called ICARE is briefly described. ICARE is currently being used at the Nuclear Research Center of Saclay in France for the certification of instruments employed in measurement of artificial radioactive particulate airborne contamination. ICARE is essentially a blower. To extend ICARE's field of application to the case of instruments employed in measurement of (²²²Rn) and of its decay products, a new line of injection has been designed and is under construction, in the frame of a contract financed by the European Community Commission. The main effort is presently oriented toward the development of a reliable (²²²Rn) source, based on a solid deposit of (²²⁶Ra) on organic fibers, and of a reference method for the measurement of (²²²Rn) activity per unit volume of air. This reference is based on a modified version of standard containers being used in the French reference method for calibrated measurements of (¹³³Xe) and (⁸⁵Kr) by gamma spectroscopy.

001,419
PB90-255340

(Order as PB90-255266, PC A06)

National Inst. of Standards and Technology, Gaithersburg, MD.

NIST Primary Radon-222 Measurement System.

R. Colle, J. M. R. Hutchinson, and M. P. Unterweger. 1990, 11p

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p155-165 Mar-Apr 90.

Keywords: Ionization chambers, Measurement, *Radon 222, *Calibration standards, Radium 226, US NIST.

Within the United States, the national standard for radon measurements is embodied in a primary radon measurement system that has been maintained for over 50 years to accurately measure radon (²²²Rn) against international and national radium (²²⁶Ra) standards. In turn, all of the radon measurements made at the National Institute of Standards and Technology (NIST) and the radon transfer calibration standards and calibration services provided by NIST are directly related to this national radon standard. This primary radon measurement system consists of pulse ionization chambers and ancillary gas handling and gas purification equipment. The system is currently undergoing a significant upgrading and expansion which will replace the extant outdated system.

001,420
PB90-255357

(Order as PB90-255266, PC A06)

Lund Univ. (Sweden). Dept. of Radiation Physics.

Closed-Can Exhalation Method for Measuring Radon.

C. Samuelsson. 1990, 3p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p167-169 Mar-Apr 90.

Keywords: Outgassing, Measurement, *Radon 222, Closed can method, Exhalation.

Results from closed-can radon exhalation experiments must be interpreted bearing the time-dependent radon diffusion theory in mind. A rapid change from the free to final steady-state exhalation rate will take place for all samples that are thin compared with the radon diffusion length. The radon gas accumulating in a closed can corresponds to a free exhalation rate only if the outer volume of air is much larger than the pore volume of the enclosed sample, or the thickness of the sample is much larger than the radon diffusion length.

001,421
PB90-255365

(Order as PB90-255266, PC A06)

Australian Radiation Lab., Melbourne.

Standardization of Rn-222 at the Australian Radiation Laboratory.

T. H. Gan, S. B. Solomon, and J. R. Peggie. 1990, 5p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p171-175 Mar-Apr 90.

Keywords: Scintillation counters, Standardization, *Radon 222, *Calibration, Australian organizations, Radium 226, Uncertainty.

The standardization of Rn-222 at the Australian Radiation Laboratory involves the calibration of scintillation cells by two methods using standard Ra-226 solutions traceable to the National Institute of Standards and Technology. One of these methods, namely the injection method, involves direct transfer of Rn-222 into a scintillation cell. In the other method, known as the volumetric method, the Rn-222 is flushed into a large container and the scintillation cell calibrated by sampling from this container. A comparison of the two methods showed that similar results were obtained, with the overall random uncertainty being 3.4% for one standard deviation. Using better estimates of the true calibration factors, the overall random uncertainty was reduced to 1.8% for one standard deviation.

001,422
PB90-255373

(Order as PB90-255266, PC A06)

New York State Dept. of Health, Albany. Wadsworth Center for Labs. and Research.

Standardization of Radon Measurements: 2. Accuracy and Proficiency Testing.

J. M. Matuszek. 1990, 5p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n2 p177-181 Mar-Apr 90.

Nuclear Instrumentation

Keywords: Alpha particle detector, Standardization, Accuracy, Measurement, *Radon 222, Charcoal detectors, Electret detectors, Radiation monitoring, Indoor air pollution, Uncertainty.

The accuracy of in situ environmental radon measurement techniques is reviewed and new data for charcoal canister, alpha-track (track-etch) and electret detectors are presented. Deficiencies reported at the 1987 meeting in Wurenlingen, Federal Republic of Germany, for measurements using charcoal detectors are confirmed by the new results. Accuracy and precision of the alpha-track measurements laboratory were better than in 1987. Electret detectors appear to provide a convenient, accurate, and precise system for the measurement of radon concentration. The need for a comprehensive, 'blind' proficiency-testing programs is discussed.

Radiation Shielding, Protection, & Safety

001,423
PB90-190794 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Derivation of Neutron Exposure Parameters from Threshold Detector Measurements.
 Final rept.
 J. A. Grundl. 1989, 10p
 Sponsored by Armed Forces Radiobiology Research Inst., Bethesda, MD.
 Pub. in Reactor Dosimetry: Methods, Applications, and Standardization, ASTM STP 1001, p450-459 1989.

Keywords: Adjusting, Reprints, *Neutron dosimetry, Threshold detectors.

A procedure will be outlined which is appropriate for threshold detector measurements that have limited uncertainty information and/or are benchmark referenced. The derivation focuses on individual detector results and the option of coarse group spectrum adjustment when observed spectral indexes are in modest disagreement with the prediction of an a priori neutron spectrum of unknown accuracy. Characteristics of the procedure include a simple choice of error components, exclusion of intrinsic spectrum interpolations, and an explicit diagnosis of the effect upon the adjustment of individual detector response parameters. A sample problem is worked out in detail.

001,424
PB90-193509 Not available NTIS
 National Bureau of Standards, Gaithersburg, MD. Occupational Health and Safety Div.
Quality Assurance and Spent Fuel Shipments for Research Reactors.
 Final rept.
 J. C. Wang, M. Bell, D. Brown, and T. Raby. 1987, 1p
 Pub. in Transactions of the American Nuclear Society 55, p197 1987.

Keywords: *Quality assurance, *Radioactive wastes, *Nuclear research and test reactors, *Shipping containers, Transportation, Regulations, Licenses, Reprints, *Radiation protection laws, *Spent fuel casks, Spent fuel elements, US DOT, US NRC, NBSR reactor.

There is an increasing regulatory concern for spent fuel shipments on the parts of the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Transportation (DOT), demonstrated by the increasing frequency of inspections of shipments, approaching 50%, and the revision of regulations to conform to the International Atomic Energy Agency guidelines for nuclear transportation. The National Bureau of Standards Reactor (NBSR) faced substantially different constraints for a spent fuel shipment in 1987 than in 1978. For the 1987 shipment, a quality assurance (QA) program was developed that assured compliance with Title 10, Code of Federal Regulations, Part 71, Subpart H. A cask was acquired that had already received licensing approval for spent fuel transport. An evaluation was made and approval obtained for the new liner for the cask. A QA plan for the cask user's transport responsibilities was developed. Specific problems such as cask 'weeping' and transport safeguard were addressed.

001,425
PB91-134981 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.
Iron and Cadmium Capture Gamma Ray Photofission Measurement.
 Final rept.
 T. G. Williamson, G. P. Lamaze, D. M. Gilliam, and C. M. Eisenhauer. 1987, 8p
 See also PB90-206772.
 Pub. in Proceedings of Topical Conference on Theory and Practices of Radiation Protection and Shielding, Knoxville, TN., April 22-24, 1987, p325-332.

Keywords: *Iron, *Cadmium, *Photofission, *Absorption cross sections, Gamma cross sections, Measurement, Comparison, Computation, Reprints, *Capture, Uranium 238, Thorium 232, Neptunium 237, NBSR Reactor.

Photofission measurements have been made in U-238, Th-232 and Np-237 in iron and cadmium capture gamma ray spectra in cylindrical neutron driven gamma ray sources in the thermal column of the National Bureau of Standards Reactor. The gamma ray source strength was measured with neutron activation foils and by direct counting of activations produced in the metal cylinders. Photofission measurements were made with NBS miniature fission chambers. The integral photofission cross sections were compared with differential measurements by integrating the capture gamma ray spectra with measured cross section shapes. The integral cross sections measured in the capture gamma ray fields are lower than the cross sections calculated from measured differential data.

Radioactive Wastes & Radioactivity

001,426
NUREG/CR-4735-V5 PC A08/MF A01
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Evaluation and Compilation of DOE (Department of Energy) Waste Package Test Data. Biannual Report: February 1988-July 1988.
 Technical rept.
 C. Interrante, E. Escalante, A. Fraker, and E. Plante. Oct 89, 158p
 Also available from Supt. of Docs. See also PB88-246426. Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Material Safety and Safeguards.

Keywords: *Packaging, *Containers, *Reviews, Austenitic stainless steels, Copper alloys, Corrosion resistance, Failure, Borosilicate glass, Dissolving, Water chemistry, *Radioactive waste management, *High-level radioactive wastes, *Spent fuels, Tuff, Underground disposal.

The report summarizes evaluations by the National Institute of Standards and Technology of Department of Energy (DOE) activities on waste packages designed for containment of radioactive high-level nuclear waste at a tuff site for the six-month period February 1988 through July 1988. Activities for the DOE Materials Characterization Center are reviewed for the period January 1988 through June 1988. A summary is given of the Yucca Mountain, Nevada, tuff disposal site activities. Short discussions are given relating to the publications reviewed and complete reviews and evaluations are included.

001,427
PB90-207291 PC A03/MF A01
 National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.
Corrosion of Zircaloy Spent Fuel Cladding in a Repository.
 A. C. Fraker. Jul 89, 25p NISTIR-89/4114
 Sponsored by Nuclear Regulatory Commission, Washington, DC. Office of Nuclear Material Safety and Safeguards.

Keywords: *Nuclear fuel claddings, *Zircalloys, Corrosion, Underground storage, Radioactive wastes, Reviews, *Spent fuels, Fuel-cladding interactions.

The report is a brief review of selected aspects of corrosion and technology of zirconium and Zircaloy. Corrosion of zirconium and Zircaloy in various media is

discussed as well as the susceptibility of the materials to various forms of corrosion. Recommendations are given for some areas of Zircaloy corrosion pertinent to the durability of spent fuel cladding that need further study.

001,428
PB91-107219 PC A06/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Building Technology.
Models of Transport Processes in Concrete.
 J. M. Pommersheim, and J. R. Clifton. Sep 90, 102p NISTIR-4405
 Prepared in cooperation with Bucknell Univ., Lewisburg, PA. Sponsored by Nuclear Regulatory Commission, Washington, DC. Div. of Engineering.

Keywords: *Transport properties, *Concrete durability, *Service life, Diffusion, Mathematical models, Convection, Concretes, Corrosion, Cement aggregate reactions, Chlorides, *Radioactive waste storage, Low-level radioactive wastes.

An approach being considered by the U.S. Nuclear Regulatory Commission for disposal of low-level radioactive waste is to place the waste forms in concrete vaults buried underground. The vaults would need a service life of 500 years. Approaches for predicting the service life of concrete of such vaults include the use of mathematical models. Mathematical models are presented in the report for the major degradation processes anticipated for the concrete vaults, which are corrosion of steel reinforcement, sulfate attack, acid attack, and leaching. The models mathematically represent rate controlling processes including diffusion, convection, and reaction and sorption of chemical species. These models can form the basis for predicting the life of concrete under in-service conditions.

Reactor Materials

001,429
PB90-170770 Not available NTIS
 National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Wide-Plate Crack-Arrest Tests Utilizing a Prototypical Pressure Vessel Steel.
 Final rept.
 C. E. Pugh, D. J. Naus, B. R. Bass, R. K. Nanstad, R. deWit, R. J. Fields, and S. R. Low. 1988, 21p
 Sponsored by Nuclear Regulatory Commission, Washington, DC.
 Pub. in International Jnl. of Pressure Vessels and Piping 31, n3 p165-185 1988.

Keywords: *Steels, *Metal plates, *Pressure vessels, Toughness, Notch tests, Temperature gradients, Reprints, *Crack arrest, *Fracture mechanics, Temperature dependence, Charpy impact test.

Wide-plate crack-arrest tests are being performed at the National Bureau of Standards under the Heavy-Section Steel Technology Program and are designed to provide fracture toughness measurements at temperatures approaching or above the onset of the upper-shelf regime, in a rising toughness region and with increasing driving force. The test specimens are 1 by 1 by 0.1 m and possess a single-edge notch (crack) that initiates in cleavage propagation at low temperature and arrests in a region of increased fracture toughness. The toughness is achieved through a linear transverse temperature profile across the plate. Results obtained using a prototypical reactor pressure vessel steel (A533 grade B class 1 material) exhibit a significant increase in toughness at temperatures near and above the onset of Charpy upper shelf. Additionally, cleavage crack propagation and arrest at temperatures above the onset of Charpy upper shelf have been demonstrated.

001,430
PB90-261314 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electrosystems Div.

Review of Candidate Methods for Detecting Incipient Defects Due to Aging of Installed Cables in Nuclear Power Plants.

Final rept.
F. D. Martzloff. 1988, 12p
See also PB88-215140. Sponsored by Electric Power Research Inst., Palo Alto, CA.
Proceedings of Workshop on Power Plant Cable Condition Monitoring, San Francisco, CA., February 16-18, 1988, p25-1 - 25-11 Jul 88.

Keywords: *Nuclear power plants, *Cable insulation, Defects, Aging tests(Materials), Methodology, Reflectometers, Spectrometers, Detectors, Preventive maintenance, Reprints, In-situ testing, Reactor maintenance, In-service inspection.

Several types of test methods have been proposed for detecting incipient defects due to aging in cable insulation systems, none offering certainty of detecting all possible types of defects. Some methods apply direct detection of a defect in the cable; other methods detect changes in electrical or non-electrical parameters from which inferences can be drawn on the integrity of the cable. The paper summarizes the first year of a program conducted at the National Bureau of Standards to assess the potential of success for in situ detection of incipient defects by the most promising of these methods.

001,431
PB91-112466 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.
Time Domain Spectroscopy to Monitor the Condition of Cable Insulation.
Final rept.
F. I. Mopsik, and F. D. Martzloff. 1989, 20p
Sponsored by Nuclear Regulatory Commission, Washington, DC.
Pub. in Proceedings of Water Reactor Safety Information Meeting (16th), Gaithersburg, MD., October 24-27, 1988, p21-40.

Keywords: *Nuclear reactor materials, *Aging tests(Materials), *Electrical insulation, Dielectric properties, Transmission lines, Reprints, *Time domain spectroscopy, *Electric cables, Physical radiation effects.

The use of Time Domain Spectroscopy, the measurement of dielectric constant and loss using time-domain response, for monitoring the aging of reactor cable insulation is examined. The method is presented, showing its sensitivity, accuracy and wide frequency range. The method's ability to acquire a great deal of information in a short time and its superiority to conventional single frequency data is shown. Different cable samples are examined before and after exposure to radiation and changes with exposure are clearly seen to occur. Also it is shown that a wide range of behavior can be found in different insulation systems. The requirements for performing valid measurements are presented. The need for controlled samples and correlation with other criteria for aging is discussed.

Reactor Physics

001,432
PB90-206772 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.
Iron and Cadmium Capture Gamma Ray Photofission Measurements.
Final rept.
T. G. Williamson, G. P. Lamaze, D. M. Gilliam, and C. M. Eisenhauer. 1990, 7p
Pub. in Nuclear Science and Engineering 104, n1 p46-52 1990.

Keywords: *Nuclear cross sections, *Photofission, Iron, Cadmium, Gamma ray spectra, Absorption cross sections, Measurement, Neutron activation analysis, Reprints, Uranium 238, Thorium 232, Neptunium 237, NBSR reactor.

Photofission measurements have been made for (238)U, (232)Th, and (237)Np using iron and cadmium capture gamma ray spectra from cylindrical neutron-capture-gamma-ray sources in the thermal column of the National Bureau of Standards Reactor. The gamma ray source strength was measured with neu-

tron activation foils and by direct counting of activations produced in the metal cylinders. The photofission measurements were made with NBS miniature fission chambers. The integral photofission cross sections obtained were compared with differential measurements by folding the capture gamma ray spectra with the measured cross section shapes. The integral cross sections measured in the capture gamma ray fields are lower than the cross sections calculated from measured differential data.

OCEAN TECHNOLOGY & ENGINEERING

Biological Oceanography

001,433
PB90-254533 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Inorganic Analytical Research Div.
Determination of Iodine in Oyster Tissue by Isotope Dilution Laser Resonance Ionization Mass Spectroscopy.
Final rept.
J. D. Fassett, and T. J. Murphy. 1990, 4p
Pub. in Analytical Chemistry 62, n4 p386-389, 15 Feb 90.

Keywords: *Iodine, *Oysters, *Chemical analysis, Mass spectroscopy, Reprints, Iodine 127, Iodine 129, Isotope dilution, Laser resonance ionization, Tissue distribution, Standard reference materials.

The technique of laser resonance ionization mass spectrometry has been combined with isotope dilution analysis to determine iodine in oyster tissue. The long-lived radioisotope, (sup 129)I, was used to spike the samples. Samples were equilibrated with the (sup 129)I, wet ashed under controlled conditions, and iodine separated by coprecipitation with silver chloride. The analyte was dried as silver ammonium iodide upon a tantalum filament from which iodine was thermally desorbed in the resonance ionization mass spectrometry instrument. A single-color, two-photon resonant plus one-photon ionization scheme was used to form positive iodine ions. Long-lived iodine signals were achieved from 100 ng of iodine. The precision of (sup 127)I/(sup 129)I measurement has been evaluated by replicate determinations of the spike, the spike calibration samples, and the oyster tissue samples and was 1.0%.

Dynamic Oceanography

001,434
AD-A222 068/9 PC A03/MF A01
Woods Hole Oceanographic Institution, MA.
Report on Sediment Transport Events on Shelf and Slope (STRESS) Field Season 1: Winter 1988-1989 Benthic Acoustic Stress Sensor (BASS) Component.
Technical rept.
E. T. Montgomery, C. V. Dunn, and A. J. Williams.
Dec 89, 38p WHOI-89-56
Contract N00014-89-J-1058

Keywords: *Oceanographic data acquisition, Marine biology, Oceanographic equipment.

Data on the effects of winter conditions on the transport of sediment on the continental shelf off Northern California were collected during the first year of the Sediment Transport Events on Shelves and Slopes (STRESS) Experiment. This experiment was done in conjunction with Shelf Mixed Layer Experiment (SMILE) and Biological Effects on Coastal Ocean Sediment Transport (BECOST) to provide a complete suite of measurements of nearshore dynamics, sediment transport, and biological interactions. This report includes a general description of the work accomplished during the STRESS field season, carried out in

the winter of 1988-1989 off the Northern California coast. Three cruises were completed, one each for deployment, turnaround, and recovery of the instruments. This created two back-to-back sections of data, one from December 4, 1988 to January 23, 1989, and the other from January 29 to March 17, 1989. This report also documents the use of the Benthic Acoustic Stress Sensor (BASS), and the associated acoustic data telemetry link in STRESS. BASS had been used in different configurations previously, but the acoustic telemetry system is new.

Marine Engineering

001,435
PB90-152885 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Overview of MAUV (Multiple Autonomous Undersea Vehicles).
Final rept.
M. Herman, and J. S. Albus. 1989, 17p
Pub. in Unmanned Systems 7, n1 p36-52 1989.

Keywords: *Underwater vehicles, *Artificial intelligence, Robotics, Planning, Control theory, Adaptive systems, Reprints.

The goal of the Multiple Autonomous Undersea Vehicles (MAUV) project is to have multiple underwater vehicles exhibiting intelligent, autonomous, cooperative behavior. The MAUV control system is hierarchically structured and incorporates sensing, world modeling, planning and execution. The levels in the hierarchy include a mission level, a group level, a vehicle task level, and an elemental action level. Issues of real-time planning and dynamic replanning in unstructured environments are discussed. A multi-level world model that supports real-time planning is also described.

001,436
PB90-218017 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Overview of the Multiple Autonomous Underwater Vehicles (MAUV) Project.
Final rept.
M. Herman, and J. S. Albus. 1988, 3p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Robotics and Automation, Philadelphia, PA., April 24-29, 1988, p618-620.

Keywords: *Underwater vehicles, Models, Systems engineering, Planning, Artificial intelligence, Reprints, *Control systems, Multiple Autonomous Underwater Vehicles project, Robotics.

The goal of the Multiple Autonomous Underwater Vehicles (MAUV) project is to have multiple underwater vehicles exhibiting intelligent, autonomous, cooperative behavior. The MAUV control system is hierarchically structured and incorporates sensing, world modeling, planning and execution. The levels in the hierarchy include a mission level, a group level, a vehicle task level, and an elemental action level. Issues of real-time planning and dynamic replanning in unstructured environments are discussed. A multi-level world model that supports real-time planning is also described.

001,437
PB90-254475 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Stiffness Study of a Parallel Link Robot Crane for Shipbuilding Applications.
Final rept.
N. G. Dagalakis, J. S. Albus, B. L. Wang, J. Unger, and J. D. Lee. 1988, 9p
Pub. in Proceedings of International Offshore Mechanics and Arctic Engineering Symposium (7th), Houston, TX., February 7-12, 1988, p29-37.

Keywords: *Shipbuilding, *Robots, *Cranes(Hoists), *Stiffness, *Manipulators, Booms(Equipment), Computerized simulation, Loads(Forces), Moments, Mathematical models, Reprints.

The report describes the first phase of an effort to develop a robot crane for shipbuilding applications. The

Marine Engineering

focus of this phase is on the study of the stiffness characteristics of this robot as a function of its geometry payload and height. A brief description of the design of the main part of the robot crane consisting of a six wire parallel link manipulator is given. The stiffness of the manipulator to side loads and moments was studied. The nonlinear and linearized mathematical model of the manipulator stiffness matrix is derived. Stiffness measurement tests were conducted using a small size laboratory model. The results of these tests for various external loads, heights, and payloads are given. Computer simulation and theoretical results are also discussed.

001,438
PB91-111930 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Robot Systems Div.
Control System Architecture for Multiple Autonomous Undersea Vehicles (MAUV).
 Final rept.
 J. S. Albus, and D. R. Blidberg. 1987, 23p
 Sponsored by New Hampshire Univ., Durham. Marine Systems Engineering Lab.
 Pub. in Proceedings of International Symposium on Unmanned Untethered Submersible Technology (5th), Merrimack, NH., June 22-24, 1987, v2 p444-466 1987.

Keywords: *Underwater vehicles, Artificial intelligence, Real time operations, Systems engineering, Reprints, *Self adaptive control systems, Autonomy, Expert systems, Knowledge bases(Artificial intelligence).

A pair of intelligent autonomous undersea vehicles based on the EAVE-EAST vehicle design and the NASA/NBS standard reference model control system architecture (NASREM) is being developed. The issues being addressed are: hierarchical distributed control, knowledge based systems, real-time planning, world modeling, value-driven reasoning, intelligent sensing and communication, and cooperative problem solving by two intelligent vehicles in a natural and potentially hostile environment. In short, the project represents basic research on the nature of intelligent behavior.

PHOTOGRAPHY & RECORDING DEVICES

Photographic Techniques & Equipment

001,439
PB90-160342 PC A03/MF A01
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Towards an Understanding of Camera Fixation.
 D. Raviv, and M. Herman. Jan 90, 25p NISTIR-89/4217
 Prepared in cooperation with Florida Atlantic Univ., Boca Raton.

Keywords: *Cameras, Robots, Distance, Research projects, Resolution, Optical equipment, *Fixation point, Image processing, Motion stability, Computer vision.

A fixation point is a point in 3-D space that projects to zero optical flow in an image over some period of time while the camera is moving. The paper deals with quantitative aspects of fixation for a static scene. For the case where the rotation axis of the camera is perpendicular to the instantaneous translation vector it is shown that there is an infinite number of points that produce zero instantaneous optical flow. These points lie on a circle (called the Zero Flow Circle or simply ZFC) and a line. The ZFC changes its location and radius as a function of time, and the intersection of all the AFCs is a fixation point. Points inside the ZFC produce optical flow that is opposite in sign to those that are outside the ZFC. This fact explains in a more quantitative way phenomena due to fixation. In particular, points in the neighborhood of the fixation point may change the sign of their optical flow as the camera moves. A set of experiments shows how the concept

of the AFC can be used to explain the optical flow produced by 3-D points near the fixation point.

001,440
PB90-218025 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.
New Approach to Accurate X-ray Mask Measurements in a Scanning Electron Microscope.
 Final rept.
 M. T. Postek, R. D. Larrabee, and W. J. Keery. 1989, 6p
 Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electron Devices 36, n11 p2452-2457 Nov 89.

Keywords: *Lithography, *Masking, *X ray apparatus, Performance evaluation, Metrology, Reprints, *Scanning electron microscopy.

The paper presents the basic concept and some preliminary experimental data on a new method for measuring critical dimensions on masks used for x-ray lithography. The method uses a scanning electron microscope in a transmitted-electron imaging mode and can achieve nanometer precision. Use of this technique in conjunction with measurement algorithms derived from electron beam interaction modeling may ultimately enable measurements of these masks to be made to nanometer accuracy. Furthermore, since a high contrast image results, this technique lends itself well to automated mask defect recognition and inspection.

001,441
PB90-254863 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Robot Systems Div.
Towards an Understanding of Camera Fixation.
 Final rept.
 D. Raviv, and M. Herman. 1990, 6p
 See also PB90-160342.
 Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) International Conference on Robotics and Automation, Cincinnati, OH., May 13-18, 1990, p28-33.

Keywords: Reprints, *Camera fixation, Zero flow circle, Three dimensional.

A fixation point is a point in 3-D space that projects to zero optical flow in an image over some period of time while the camera is moving. The paper deals with quantitative aspects of fixation for a static scene. For the case where the rotation axis of the camera is perpendicular to the instantaneous translation vector the authors show that there is an infinite number of points that produce zero instantaneous optical flow. These points lie on a circle (called the Zero Flow Circle or simply ZFC) and a line. The ZFC changes its location and radius as a function of time, and the intersection of all the ZFCs is a fixation point. Points inside the ZFC produce optical flow that is opposite in sign to those that are outside the ZFC. In a set of experiments, the authors show how the concept of the ZFC can be used to explain the optical flow produced by 3-D points near the fixation point.

001,442
PB90-254962 Not available NTIS
 National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Pinhole Camera Imaging Without Lenses or Mirrors.
 Final rept.
 M. Young. 1989, 8p
 Pub. in the Physics Teacher, p648-655 Dec 89.

Keywords: Gratings(Spectra), Far field, Reprints, *Pinhole cameras, Fresnel diffraction, Near field, Imaging techniques.

The pinhole camera is an interesting and useful device. The pinhole focuses as a result of diffraction, and the camera displays an optimum focal length equal to the square of the pinhole radius divided by the wavelength. The paper discusses the history and the physics of the pinhole camera and some of its relatives, the Fresnel zone plate, cascaded apertures, the pin-spec camera, and the pinhead mirror.

Recording Devices

001,443
PB90-217829 Not available NTIS
 National Inst. of Standards and Technology (NEL), Gaithersburg, MD. ElectroSystems Div.
Step and Frequency Response Testing of Waveform Recorders.
 Final rept.
 T. M. Souders, D. R. Flach, and J. J. Blair. 1990, 7p
 Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Instrumentation and Measurement Technology Conference, San Jose, CA., February 13-15, 1990, p214-220.

Keywords: *Waveforms, *Recording instruments, *Step response, Measurement, Instructional materials, Frequency response, Transition points, Standards, Reprints, Impulse response.

Tutorial material is presented to aid in measuring the step response of waveform recorders, and to compute other parameters which may be derived from it. Parameters considered include impulse response, transition duration, settling time, and complex frequency response. The measurement approaches follow those recommended in the IEEE 'Trial Use Standard for Digitizing Waveform Recorders.' Illustrated examples are given, and guidelines on the choice of step generators are also included.

PHYSICS

Acoustics

001,444
AD-A201 133/6 PC A03/MF A01
 National Bureau of Standards (NEL), Gaithersburg, MD. Ultrasonic Standards Group.
Ultrasonic Measurements Research: Progress in 1988.
 Annual summary rept. 1 Oct 87-31 Sep 88.
 F. R. Breckenridge, T. M. Proctor, N. N. Hsu, S. E. Fick, and D. G. Eitzen. 29 Jul 88, 13p
 Contract N00014-88-L-0006

Keywords: *Acoustic emissions, Acoustics, Calibration, Electroacoustic transducers, Experimental data, Greens function, Impact tests, Inversion, Measurement, Physical properties, Secondary, Simulation, *Sound generators, Sources, Theory, Transducers, Transfer, Ultrasonics, Waveforms.

Progress is described on the design of a system for secondary calibration of acoustic emission transducers. Experimental secondary calibrations indicate that a 3.3 cm thick steel plate is not a suitable transfer block, and that the transfer block should be more like a semi-infinite medium. Simulated acoustic emission sources have been studied theoretically and experimentally. Hertzian impact experiments have been carried out, and source waveforms have been reconstructed from experimental data using an inverse Green's function for the plate. Moderate agreement was obtained between Hertzian theory and the experimental results. Ultrasonics, Physical acoustics, Acoustic emission, Transducers, Calibration.

001,445
PB90-193418 Not available NTIS
 National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Microscopic Origins of Acoustic Emission.
 Final rept.
 H. N. G. Wadley, and J. A. Simmons. 1987, 26p
 Pub. in Nondestructive Testing Handbook, v5. Acoustic Emission Testing, sec3, p63-88 1987.

Keywords: *Acoustic measurement, *Nondestructive tests, *Dislocations(Materials), Fracture, Elastic properties, Acoustics, Microstructures, Sound transducers.

The microscopic origins of acoustic emission are examined within the framework of elastodynamics. Criteria are developed for the detectability of acoustic emission (AE) from dislocation motion and crackgrowth and

used to deduce the mechanisms responsible for AE during the plastic deformation and fracture of metals. A predictive theory for martensitic transformations is also developed and used to explain the origins of acoustic emission during phase transformations.

001,446
PB90-217985 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Point Source/Point Receiver Ultrasonic Wave Speed Measurement.
Final rept.

N. N. Hsu, and D. G. Eitzen. 1987, 5p
Pub. in Proceedings of Ultrasonics International Conference, London, UK., July 6-9, 1987, p509-513.

Keywords: *Ultrasonic radiation, *Metrology, *Phase velocity, Detectors, Waveform generators, Longitudinal waves, Secondary waves, Computerized simulation, Greens function, Calibration, Reprints, *Ultrasonic wave transducers.

The paper reports a simple technique in which the echo waveform generated by a point impulse and received by a point normal displacement transducer is used to determine the longitudinal, shear wave, and the Rayleigh wave speeds. A computer program to calculate the Green's function of a plate is used to formulate and extract the wave speed information, select proper source, select test configuration and calibrate transducers. An example of using conical transducers as a point source generator and a point displacement echo detector is given.

001,447
PB90-218413 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg, MD. Automated Production Technology Div.
Characterization of a Piezoelectric Transducer Coupled to a Solid.
Final rept.

N. N. Hsu, G. Chen, and M. Sansalone. 1987, 5p
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Ultrasonics Symposium, Denver, CO., October 14-16, 1987, p689-692.

Keywords: *Ultrasonic radiation, Piezoelectric transducers, Photoelasticity, Finite element analysis, Solids, Characteristics, Reprints, Ultrasonic wave transducers.

The authors report on an approach to characterize the ultrasonic fields inside a solid produced by a piezoelectric transducer coupled to a solid. Their approach consists of three parts: photoelastic visualization of the moving pulse in a transparent solid; point displacement field measurement at the epicenter of the plate; and dynamic transient wave field analysis using a finite element technique.

001,448
PB91-118521 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Automated Production Technology Div.
Calibration of High-Frequency Accelerometers by Conventional Methods.
Final rept.

M. R. Serbyn. 1990, 5p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Proceedings of the Annual Technical Meeting of the Institute of Environmental Sciences (36th), New Orleans, LA., April 23-27, 1990, p460-464.

Keywords: *Accelerometers, Ultrasonic radiation, Optical interferometers, Sensitivity, Reprints, *Vibration measurement, *Calibration.

The needs for measuring vibration in the frequency range 10-100 kHz are discussed in the context of existing applications and intrinsic high-frequency phenomena. Several measurement techniques are evaluated for suitability in implementing a reliable method to calibrate vibration pickups in the frequency range 10-30 kHz. Results obtained by conventional methods on typical high-frequency accelerometers are presented as examples.

001,449
PB91-118539 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Automated Production Technology Div.

Calibration of Vibration Pickups at Low Ultrasonic Frequencies.

Final rept.
M. R. Serbyn. 1989, 4p
Sponsored by Naval Sea Systems Command, Washington, DC.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Ultrasonics Symposium, Montreal, Quebec, Canada, October 3-6, 1989, p797-800.

Keywords: *Accelerometers, Piezoelectric transducers, Ultrasonic radiation, Sensitivity, Reprints, *Vibration measurement, *Calibration.

The requirements for, and peculiarities of, vibration measurements at low ultrasonic frequencies are discussed in the context of existing practice and needs. A method for calibrating vibration pickups in the frequency range 10-30 kHz is described and illustrated with examples. The method requires two types of measurements: (1) the driving-point impedance of the vibration exciter loaded by the test pickup and a known mass; (2) the voltage ratio of pickup output to driver input. The calibration formula is based on the Moebius transformation of two-port impedances and the product relationship of cascaded systems. The sensitivity of a pickup, in both magnitude and phase, is determined from three sets of observations, using calibrated masses and a programmable impedance/gain analyzer.

001,450
PB91-135053 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Thermophysics Div.
Sound Speed Measurements on Gas Mixtures of Natural Gas Components Using a Cylindrical Resonator.
Final rept.

B. A. Younglove, and N. V. Frederick. 1990, 14p
Sponsored by Gas Research Inst., Chicago, IL.
Pub. in International Jnl. of Thermophysics 11, n5 p897-910 Sep 90.

Keywords: *Acoustic resonators, *Methane, *Ethane, *Propane, *Carbon dioxide, *Nitrogen, *Sound waves, *Acoustic velocity, Natural gas, Sound transducers, Isotherms, Mixtures, Sound generators, Reprints, *Binary mixtures.

A description of a fixed-path length acoustic resonator which uses electrostatic transducers for sound generation and detection is given. Also, a summary of the measurements on 13 binary and 4 multicomponent gas mixtures of natural gas components is given. Data were obtained at pressures to 10 MPa for five isotherms at 25 K increments from 250 to 350 K. The binary mixtures are primarily methane-rich, with either ethane, nitrogen, carbon dioxide, or propane as the second constituent. The multicomponent mixture compositions represent four naturally occurring natural gas mixtures.

Fluid Mechanics

001,451
AD-A178 668/0 PC A06/MF A01
Arnold Engineering Development Center, Arnold AFS, TN.
Interaction of a Three-Dimensional Roughness Element with a Laminar Boundary Layer.
Final rept. 1 Jun 82-31 Jan 87.

P. S. Klebanoff, W. G. Cleveland, and K. D. Tidstrom. Mar 87, 120p Rept no. AEDC-TR-87-7
Prepared in cooperation with National Bureau of Standards, Gaithersburg, MD.

Keywords: *Roughness, *Turbulent flow, *Boundary layer transition, Aspect ratio, Reynolds number, Flat plate models, Laminar boundary layer, Steady flow, Unsteady flow, Three dimensional, Evolution(General), Hemispheres, Mean, Velocity, Data bases, Variations, Velocity, Wind tunnel tests.

An experimental investigation is described that is directed toward extending the technical database and furthering our understanding of boundary layer transition induced by three-dimensional roughness elements. The investigation was carried out in an unsteady wind tunnel, principally with hemispherical roughness elements, in a well characterized zero-pressure gradient laminar boundary layer on a flat plate.

Attention was directed toward the following aspects of the behavior of a three dimensional roughness element: (1) the critical Reynolds number of transition and the effect of aspect ratio thereon, (2) eddy generation is steady and unsteady flows, (3) is the fundamental process stability governed, and (4) the evolutionary change in mean velocity and intensity of the velocity fluctuation associated with the transition to fully developed turbulent flow.

001,452
DE89003281 PC A02/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.
Thermophysical Property Measurements in Fluid Mixtures: Final Report, Prepared for the Period Ending October 31, 1987.

20 Sep 88, 6p DOE/PR/06010-T37
Contracts A101-76PR06010, AT01-82ER12045
Portions of this document are illegible in microfiche products.

Keywords: *Fluids, *Mixtures, Measuring Instruments, *Physical Properties, Progress Report, *Thermodynamic Properties, ERDA/360603, ERDA/440300, Fluids.

Five years ago, the Center for Chemical Engineering of the National Bureau of Standards began a major program to upgrade its experimental capability in fluid property measurement. During the past five years great strides have been taken in improving and upgrading measurement capability at the two NBS sites. The apparatus that have been built under DOE sponsorship and that are now in routine operation are listed. (ERA citation 14:004757)

001,453
DE90001197 PC A03/MF A01
National Inst. of Standards and Technology, Boulder, CO. Thermodynamics Div.
Integrated Theoretical and Experimental Study of the Thermophysical Properties of Fluid Mixtures: Summary Report, 1987-1988.

W. M. Haynes. Aug 88, 17p DOE/ER/13668-T1
Contract A101-87ER13668
Portions of this document are illegible in microfiche products.

Keywords: *Hydrocarbons, *Mixtures, Biological Materials, *Chemical Feedstocks, Computerized Simulation, Efficiency, Equilibrium, Liquids, Mixing, Progress Report, Shear, Tetrahydrofuran, Thermodynamic Properties, ERDA/320302, ERDA/360603, Fluid dynamics.

The objective is to assist the chemical process and fuel industries to improve efficiency and thereby reduce the use of energy and feedstocks and to aid them in the utilization of unconventional feedstocks and energy sources. This objective can be satisfied by carrying out the following specific efforts: (1) development of predictive procedures for the properties of fluids and fluid mixtures; (2) basic understanding of fluid behavior with advances in theory; and (3) acquisition of experimental data to support theoretical modeling efforts. Emphasis is placed on increasing basic understanding of fluid behavior which will lead to the development of predictive models in the form of computer codes which can be readily transported to engineering users and are easily incorporated into industrial design and control packages. The results of all of the work, including the validation of predictive packages such as TRAPP and SUPERTRAPP, are published in refereed journals.

001,454
DE90001505 PC A03/MF A01
National Inst. of Standards and Technology, Boulder, CO. Thermodynamics Div.
Integrated Theoretical and Experimental Study of the Thermophysical Properties of Fluid Mixtures: Annual Report.

W. M. Haynes. Sep 87, 21p DOE/ER/13668-T2
Contract A101-87ER13668
Portions of this document are illegible in microfiche products.

Keywords: *Hydrocarbons, *Mixtures, Atom Transport, Biological Materials, *Chemical Feedstocks, Computerized Simulation, Efficiency, Equilibrium, Liquids, Mixing, Progress Report, Shear, Tetrahydrofuran, Thermodynamic Properties, ERDA/320302, ERDA/360603, Fluid dynamics.

PHYSICS

Fluid Mechanics

The objective is to assist the chemical process and fuel industries to improve efficiency and thereby reduce the use of energy and feedstocks and to aid them in the utilization of unconventional feedstocks and energy sources. This objective can be satisfied by carrying out the following specific efforts: (1) development of predictive procedures for the properties of fluids and fluid mixtures; (2) basic understanding of fluid behavior with advances in theory; and (3) acquisition of experimental data to support theoretical and modeling efforts. Emphasis is placed on increasing basic understanding of fluid behavior which will lead to the development of predictive models in the form of computer codes which can be readily transported to engineering users and are easily incorporated into industrial design and control packages. The results of all of the work, including the validation of predictive packages such as TRAPP and SUPERTRAPP, are published in refereed journals. 17 refs., 1 fig.

001,455

DE90003848 PC A02/MF A01
National Bureau of Standards (NEL), Boulder, CO. Chemical Engineering Science Div.
Residence Time Distribution Approach to the Study of Free Convection in Porous Media.
M. C. Jones, and R. A. Perkins. 8 Jun 88, 8p DOE/ER/13770-11
Contract AI05-87ER13770
Portions of this document are illegible in microfiche products.

Keywords: *Functional Models, *Porosity, Darcy Law, Data Acquisition, Distribution Functions, Experimental Data, Fiber Optics, Fluid Flow, Heat Exchangers, Heat Transfer, Hydrodynamics, Illuminance, Lasers, Mapping, Materials Testing, Measuring Methods, Natural Convection, Nusselt Number, Performance Testing, Planning, Probes, Rayleigh Scattering, Rhodamines, Task Scheduling, Thermal Equilibrium, Tracer Techniques, ERDA/580000, ERDA/420500, ERDA/426002, *Free convection, Time domain.

In this project the object is to apply the principles of Residence Time Distribution (RTD) analysis to the study of free convection in porous media. The advantages of this technique are that it is non-intrusive, the data are quickly generated, and a large amount of information, distributed in the time domain, is obtained. The disadvantage is that a model must be used to infer the flow pattern from the RTD. It is proposed to apply the same modeling approaches that have been used successfully in mixing tank studies and to interpret the flow patterns in terms of similar mixing tank model parameters. Correlations would then be sought with global parameters of the porous medium like Rayleigh, Peclet and Nusselt numbers. 2 refs., 3 figs.

001,456

PB90-170218 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Some Performance Comparisons for a Fluid Dynamics Code.
Final rept.
D. W. Lozier, and R. G. Rehm. 1989, 16p
Pub. in Parallel Computing 11, n3 p305-320 1989.

Keywords: Comparison, Parallel processors, Reprints, *Computational fluid dynamics, *Computer applications, *Computer performance evaluation, Supercomputers, Workstations, Array processors, Vector processing.

The 3D transient motion of a buoyancy-driven perfect gas in an enclosure is computed by a Fortran program (BF3D). A combustion model for eventual inclusion in the program is under development. BF3D changes slowly, has a long lifetime, and is run fairly infrequently. Typical runs have large storage and moderate CPU requirements. BF3D runs on large supercomputers but the newer mini-supercomputers appear to be suitable also and may be advantageous for ease of access and usage. Scientific workstations are convenient for development. Comparisons of BF3D on selected supercomputers, mini-supercomputers, scientific workstations and conventional mainframes are presented.

001,457

PB90-170374 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Tomographic Reconstruction of Two-Dimensional Vector Fields: Application to Flow Imaging.

Final rept.
S. J. Norton. 1989, 8p
Pub. in Geophysical Jnl. 97, n1 p161-168 Apr 89.

Keywords: *Two dimensional flow, *Vector analysis, Gradients, Vectors(Mathematics), Numerical analysis, Acoustic measurement, Fluid flow, Boundary layer flow, Fluid dynamics, Reprints, *Tomography.

The problem of reconstructing a two-dimensional vector field $v(x,y)$ from the line-integrals of v is considered. The problem arises in the two-dimensional mapping of fluid flow from acoustic time-of-flight measurements. A vector central-slice theorem is derived, which is a generalization of the well-known central-slice theorem that plays a fundamental role in conventional 'scalar' tomography. When the vector field $v(x,y)$ is decomposed into rotational and irrotational components the vector reconstruction problem simplifies. The authors show that the rotational component can be uniquely reconstructed from the line integrals of v , whereas the irrotational component cannot. When the field is divergenceless, however, the scalar potential is a solution to Laplace's equation and can be determined by the values of v on the boundary of the domain under reconstruction. An explicit formula for the scalar potential from the boundary values of v is derived. Consequently, $v(x,y)$ can be uniquely recovered over the region of reconstruction from the following information: line-integral measurements of v through this region and v measured on the boundary of this region.

001,458

PB90-219130 PC A03/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.
Stabilization of Taylor-Couette Flow Due to Time-Periodic Outer Cylinder Oscillation.
B. T. Murray, G. B. McFadden, and S. R. Coriell. Apr 90, 31p NISTIR-90/4283

Keywords: *Couette flow, *Stability, *Bodies of revolution, Rotation, Mathematical models, Differential equations, Numerical analysis, Steady flow, Two dimensional flow, Vortices, Oscillations, Floquet theorem.

The linear stability of circular Couette flow between concentric infinite cylinders is considered for the case when the inner cylinder is rotated at a constant angular velocity and the outer cylinder is driven sinusoidally in time with zero mean rotation. This configuration was studied experimentally by Walsh and Donnelly. The critical Reynolds numbers calculated from linear stability theory agree well with the experimental values, except at large modulation amplitudes and small frequencies. The theoretical values are obtained using Floquet theory implemented in two distinct approaches: a truncated Fourier series representation in time, and a fundamental solution matrix based on a Chebyshev-pseudospectral representation in space. For large amplitude, low frequency modulation, the linear eigenfunctions are temporally complex consisting of a quiescent region followed by rapid change in the perturbed flow velocities.

001,459

PB90-221847 PC A04/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.
Summary Report of NIST's (National Institute of Standards and Technology's) Industry-Government Consortium Research Program on Flowmeter Installation Effects with Emphasis on the Research Period November 1988-May 1989.
G. E. Mattingly, and T. T. Yeh. May 90, 60p NISTIR-4310

Keywords: *Flowmeters, *Pipe flow, Flow measurement, Pipelines, Research programs, Turbulence, Orifice meters, Velocity, Orifices.

The report presents results produced in a consortium-sponsored research program on flowmeter installation effects. The objective of the research program is to produce improved flowmeter performance when meters are installed in non-ideal conditions. The objective is being attained via a strategy to (1) measure, understand, and quantify the salient features of non-ideal pipe flows from such pipeline elements as elbows, reducers, valves, flow conditioners, etc. or combinations of these, (2) to correlate meter-factor shifts for selected types of flowmeters, relative to the features of

these non-ideal pipe flows so as to be able to predict meter performance accurately in non-ideal installations, and (3) disseminate the resulting technology through appropriate channels such as publishing the authors' results in pertinent journals and upgrading paper standards for flow measurement.

001,460

PB90-235276 (Order as PB90-235243, PC A06)
National Inst. of Standards and Technology, Gaithersburg, MD.

Dynamics of the Bell Prover, II.

Bi-monthly rept.
F. W. Ruegg, and F. C. Ruegg. 27 Oct 89, 17p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n1 p15-31 Jan-Feb 90.

Keywords: *Gas flow, *Test equipment, Measurement, Accuracy, Equations of motion, Fluid dynamics, *Calibration standards, *Bell provers.

The bell prover is widely used for gas flowrate measurements by timing a known stroke of the bell as it rises, presumably with a constant speed, from a bath of sealing liquid. A differential equation for the bell motion (from the previous paper of the same title) is used together with the previous equations of motion for the gas and sealing liquid modified here to provide the basis for a computer simulation of the prover performance. Examples of the results of the computations show substantial fluctuations in all of the motions and modified measurement procedures for improved accuracy are discussed. Proposed modifications to the prover itself are shown by the computations to dampen the fluctuations and to improve the measurement accuracy. Only a limited number of changes of the prover design and of the initial conditions were researched for their effect.

001,461

PB90-254657 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Thermophysics Div.
Non-Newtonian Molecular Dynamics and Thermophysical Properties.
Final rept.
H. J. M. Hanley, and D. J. Evans. 1990, 19p
Sponsored by Department of Energy, Washington, DC. Pub. in International Jnl. of Thermophysics 11, n2 p381-398 Mar 90.

Keywords: *Non-Newtonian fluids, *Molecular flow, *Thermophysical properties, Computerized simulation, Rheological properties, Molecular structure, Equations of motion, Shear properties, Reprints.

The main theme of the paper is to review computer simulation as a tool to study mechanisms in fluids and to understand better fluid behavior. The relationship between molecular dynamics and thermophysical properties of fluids is reviewed very briefly. The standard simulation algorithms that are available are listed. The authors emphasize, however, the importance of the recent molecular dynamics techniques that incorporate non-Newtonian equations of motion. Two topics are introduced as examples. First, the evidence of a transient solid-like structure observed from simulations of a dense model two-dimensional liquid is reported: the authors speculate that the transient structure influences the density dependence of many thermophysical properties of the real liquid. Second, a discussion of the structure factor of a system under shear, and its relation to the properties of the fluid, is given.

Optics & Lasers

001,462

AD-A201 170/8 PC A07/MF A01
National Bureau of Standards, Gaithersburg, MD.
Free-Electron Laser Driven by the NBS (National Bureau of Standards) CW Microtron.
Annual rept. 1 Apr 87-31 Mar 88.
31 Mar 88, 149p
Contract N00014-87-F-0066

Keywords: Continuous waves, Diffraction, Electric current, Electron accelerators, Electron beams, Electron

transport, *Free electron lasers, Infrared lasers, Laser cavities, Losses, Optics, Peak power, Radiation shielding, Stabilization, Racetrack microtrons.

The overall goal of this project is to construct and bring into operation a free-electron laser (FEL) driven by the racetrack microtron (RTM) electron accelerator at NBS. NBS is providing the RTM, radiation shielded laboratory space for the RTM and FEL, and experimental areas. The scope of the project includes: modifying the RTM injector for increased peak current; developing electron beam transport from the RTM to the FEL: developing a wiggler and optical cavity; and developing optical beam transport and diagnostics. Keywords: Electron beam phase stabilization; Laser cavities; Diffraction loss; Infrared lasers. (edc)

001,463

AD-A201 778/8 PC A03/MF A01
National Bureau of Standards, Gaithersburg, MD.

Reflection Matrix for Optical Resonators in FEL (Free Electron Lasers) Oscillators.

S. Riyopoulos, P. Sprangle, C. M. Tang, and A. Ting. Sep 87, 26p
Contract N00014-87-F-0066
Prepared in cooperation with Science Applications Intl. Corp., McLean, VA and Berkeley Research Assoc., Springfield, VA.

Keywords: Angles, Coefficients, Computations, Corrections, Deflection, *Free electron lasers, Functions, Light, Mirrors, Optical properties, Oscillators, Parabolic bodies, Radiation, Ratios, Reflection, *Resonators, Sizes(Dimensions), Sources, Surfaces, *Optical resonators, Matrices.

The transformations of Gaussian radiation beams caused by reflection off mirrors is an important issue for FELs operating as oscillators. The reflected radiation from a single incident Gaussian mode will contain other modes due to the finite mirror size, the deflection of the beam and mismatches in the curvature. A method for analytic computation of the reflection matrix is developed by taking the convolution of the source function at the surface of the mirror with the paraxial propagator. The mirror surface that reflects spherical incoming wavefronts into spherical outgoing is found to be a paraboloid. Integral expressions for the reflection coefficients R superscript (mn) subscript (pq) for any incoming mode $u(mn)$ into the outgoing $u(pq)$ are obtained as functions of the deflection angle ϕ , the reflected beam spot size $W(\phi)$ and the mirror size. The coefficient R superscript (00) subscript (00) for the lowest-to-lowest mode reflection is determined analytically. The spot size $W(0)$ can then be selected, depending on the mirror size, to maximize R superscript (00) subscript (00). The ratio of the mirror size to the spot size is the dominant factor determining the reflection coefficient. The effects of deflecting the light beam enter as small corrections, of first order in diffraction angle $\theta(d) 1. (rh)$

001,464

AD-A212 335/4 PC A03/MF A01
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Cooled Ion Frequency Standard (FY 89).

Annual rept. 1 Oct 88-31 Sep 89.

D. J. Wineland. 10 Sep 89, 27p

Contract N00014-89-F-0001

Keywords: *Atomic spectroscopy, Cooling, Doppler effect, *Electromagnetism, *Frequency standards, High resolution, Ions, Laser applications, Radiation pressure, Residuals, Storage, Transitions, Traps, *Laser spectroscopy, *Penning traps.

The purpose of this work is to develop techniques to overcome the fundamental limits of present frequency standards--the second order and residual first-order Doppler shifts. To this end suitable frequency reference transitions are studied in ions which are stored on electromagnetic traps and cooled by radiation pressure to less than 1K. Keywords: Atomic spectroscopy, Doppler narrowing; Doppler shifts; Frequency standards; High resolution spectroscopy; Ion storage; Laser spectroscopy; Penning trap; Laser cooling. (JHD)

001,465

DE86006919 PC A02/MF A01
Joint Inst. for Lab. Astrophysics, Boulder, CO.

Experimental Investigations of the Role of Laser Field Fluctuations in Non-Linear Optical Absorption Processes.

S. J. Smith. 1985, 11p CONF-8509245-1

Contract AC02-80ER10736

International conference on coherent optics, Ustron, Poland, 19 Sep 1985.

Keywords: *Laser Radiation, *Multi-Photon Processes, Energy Spectra, Fourier Transformation, Mathematical Models, Mode Control, Steady-State Conditions, ERDA/640302.

In the experimental program described, we deliberately broaden a well-stabilized single mode laser beam by introducing fluctuations to the laser frequency, in order to synthesize laser power spectra for which the fluctuations are well-characterized to all orders in a statistical sense. With this technique we are able to produce single mode laser fields which have nearly Lorentzian power spectra at one limit, essentially Gaussian power spectra at the other limit, and which may be varied continuously between these two limits. 16 refs., 6 figs. (ERA citation 11:021231)

001,466

N89-13323/5

(Order as N89-13310/2, PC A14/MF A01)

National Inst. of Standards and Technology, Gaithersburg, MD.

Optical Heterodyne Densitometer.

A. L. Migdall, Y. C. Zheng, J. Hardis, and J. J.

Snyder. Sep 88, 5p

In NASA, Ames Research Center, Second Workshop on Improvements to Photometry p 249-253.

Keywords: Attenuators, *Densitometers, Heterodyning, *Light scattering, Mach-Zehnder interferometers, *Optical measuring instruments, Accuracy, Design analysis, Sensitivity.

Researchers are developing an optical heterodyne densitometer with the potential to measure optical density over an unprecedented dynamic range with high accuracy and sensitivity. This device uses a Mach-Zehnder interferometer configuration with heterodyne detection to make direct comparisons between optical and RF attenuators. Researchers expect to attain measurements of filter transmittance down to 10 to the minus 12th power with better than 1 percent uncertainty. In addition, they intend to extend the technique to the problem of measuring low levels of light scattering from reflective and transmissive optics.

001,467

PATENT-4 907 237

Not available NTIS

National Inst. of Standards and Technology, Gaithersburg, MD.

Optical Feedback Locking of Semiconductor Lasers.

Patent.

B. Dahmani, and L. W. Hollberg. Filed 18 Oct 88, patented 6 Mar 90, 14p PB90-198797, PAT-APPL-7-259 088

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$: 50.

Keywords: *Semiconductor lasers, *Frequency stability, *Patents, Stabilization, Line width, Feedback control, Optical resonators, PAT-CL-372-32.

An optical method and apparatus is disclosed for stabilizing the frequency of semiconductor lasers. The basic system includes only the optical elements of a conventional semiconductor laser optically coupled to a separate, external resonator having an optical cavity with a particular resonance frequency. The optical geometry is configured such that the output from the resonator is fed back to the laser only when the laser frequency matches or substantially matches the resonance frequency. In other disclosed embodiments, optical electronic feedback loops are used to modulate the laser injection current to stabilize the frequency and to adjust the phase of the optical feedback signal.

001,468

PATENT-4 939 744

Not available NTIS

Department of Commerce, Washington, DC.

Method and Apparatus for Producing a Photo-pumped VUV Laser in MO6+ Ion-Containing Plasma.

Patent.

U. Feldman. Filed 15 Nov 89, patented 3 Jul 90, 2p

PB90-238320, PAT-APPL-7-436 839

This Government-owned invention available for U.S. licensing and, possibly, for foreign licensing. Copy of patent available Commissioner of Patents, Washington, DC 20231 \$150.

Keywords: *Ultraviolet lasers, *Patents, Optical pumping, Molybdenum ions, Multicharged ions, Vacuum ultraviolet radiation, Plasma, PAT-CL-732-76.

The invention relates to a method and an apparatus for producing a photopumped VUV laser in an Mo(6+) ion-containing plasma comprise photopumping the Mo(6+) ion-containing plasma with radiation from Mo(11+) ions. In one embodiment, the Mo(6+) ion-containing plasma has an electron density of less than about 10 to the 18 power/cc and the Mo(11+) ions are contained in a plasma having an electron density greater than about 10 to the 20 power/cc.

001,469

PB90-136458

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Tunable Far Infrared Laser Spectroscopy.

Final rept.

K. M. Evenson, D. A. Jennings, and M. D. Vanek.

1988, 9p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Frontiers of Laser Spectroscopy of Gases, p43-51 1988.

Keywords: *Far infrared radiation, *Spectroscopy, Spectral emittance, Electromagnetic radiation, Stimulated emission devices, Carbon dioxide lasers, Spectrum analysis, Calibrating, Reprints.

Tunable far-infrared (FIR) radiation has been generated using CO2 laser difference generation in metal-insulator-metal diodes either from the difference between a fixed frequency CO2 laser and a tunable waveguide laser, or from the difference between two fixed frequency CO2 lasers plus microwave sidebands. Our tunable FIR source is being used to make highly accurate FIR frequency measurements of stable species to serve as frequency and wavelength calibration standards; to measure frequencies of transient species (including molecular ions) for astronomical searches; and to study line broadening and line shape parameters especially for atmospheric spectroscopy applications.

001,470

PB90-152521

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Mode-Locked, Long Cavity, Erbium Fiber Lasers with Subsequent Soliton-Like Compression.

Final rept.

J. B. Schlager, Y. Yamabayashi, D. L. Franzen, and

R. I. Juneau. 1989, 3p

Sponsored by Naval Ocean Systems Center, San Diego, CA.

Pub. in IEEE (Institute of Electrical and Electronics Engineers) Photonics Technology Letters 1, n9 p264-266 Sep 89.

Keywords: Near infrared radiation, Infrared lasers, Pulse compression, Reprints, *Erbium lasers, *Fiber lasers, Model locked lasers, Solitons, Picosecond pulses.

Erbium fiber lasers are mode-locked at the fundamental cavity frequency using an integrated-optic intensity modulator driven by a novel pulse generator. Resulting optical pulses at 1536 nm are recorded with a synchroscan streak camera and have durations of 18-80 ps with peak powers over 6 W. The shorter cavities yield nearly transform-limited pulses which are narrowed by soliton-like compression to approximately 5 ps after propagation through an external 14 km fiber.

001,471

PB90-152687

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

New Compensation Method for Bulk Optical Sensors with Multiple Birefringences.

Final rept.

K. S. Lee. 1989, 11p

Pub. in Applied Optics 28, n11 p2001-2011, 1 Jun 89.

Keywords: *Optical detection, *Birefringence, *Crystals, *Anisotropy, Tensor analysis, Electromagnetic properties, Optical properties, Electrooptics, Dielectrics, Wave propagation, Fiber optics, Reprints.

The dielectric tensor of an anisotropic crystal with multiple perturbations is presented to include the effects of multiple perturbations. To study electromagnetic wave propagation in anisotropic crystals subject to various influences the perturbed dielectric tensor is substituted into Maxwell's equation. Then, a 2×2 transmission matrix formalism, based on a normal-mode approach, is extended to anisotropic crystals possessing multiple birefringences to develop compensation schemes for ac optical sensors employing the crystal. It is shown that a new compensation method utilizing two analyzers can eliminate the effects of both unwanted linear birefringences and unwanted circular birefringences on the stability of the ac bulk polarimetric optical sensor. The conditions (here referred to as the quenching condition) in which the compensation method becomes important are also derived for both the voltage (or electric field) and current (or magnetic field) sensors.

001,472

PB90-153396

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Radiometric Physics Div.

National Scales of Spectrometry in the U.S.

Final rept.

J. J. Hsia. 1987, 11p

Pub. in Advances in Standards and Methodology in Spectrophotometry, p99-109 1987.

Keywords: *Spectrometers, *Spectroscopy, *Standards, Optical density, Reflectance, Luminous intensity, Calibrating, Spectrophotometers, Transmittance, Reprints, *National Institute of Standards and Technology.

U.S. national scales of regular transmittance, regular reflectance, total reflectance factor, 45 degrees/0 degrees diffuse reflectance factor, coefficient of luminous intensity of retroreflectance, gloss, haze and optical density are established from basic principles with reference instruments. The scales are disseminated by means of reference and transfer instruments through calibration services and calibrated standard reference materials. Presented is a discussion of the hierarchy of spectrophotometric standards and measurement capabilities at the U.S. National Bureau of Standards.

001,473

PB90-161670

PC A04/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.

Metrology for Electromagnetic Technology: A Bibliography of NIST (National Institute of Standards and Technology) Publications.

M. E. DeWeese. Aug 89, 56p NISTIR-89/3921

Also available from Supt. of Docs. Supersedes PB89-147847.

Keywords: *Electromagnetic radiation, *Cryogenics, *Bibliographies, *Metrology, Optical communication, Electrooptics, Superconductors, Lasers, Standards.

The bibliography lists the publications of the personnel of the Electromagnetic Technology Division of NIST during the period from January 1970 through publication of the report. A few earlier references that are directly related to the present work of the Division are also included. The Electromagnetic Technology Division was formed during the reorganization of the National Bureau of Standards (now the National Institute of Standards and Technology) in April 1978 by combining parts of the former Electromagnetics and Cryogenics Divisions. It develops measurement methods and standards and provides metrological support for laser systems, optical communication equipment, cryoelectronics, superconductors, and other unusual electrical engineering materials.

001,474

PB90-163932

(Order as PB90-163874, PC A04)

National Inst. of Standards and Technology, Gaithersburg, MD.

Search for Optical Molasses in a Vapor Cell: General Analysis and Experimental Attempt.

A. L. Migdall. 1989, 6p

Office of Naval Research, Arlington, VA.

Included in Jnl. of Research of the National Institute of Standards and Technology, v94 n6 p373-378.

Keywords: *Lasers, *Cooling, Viscosity, *Optical molasses, *Vapor cells, Cold atoms.

The authors analyze the application of optical molasses to a thermal vapor cell to make and collect cold atoms. Such an arrangement would simplify the production of cold atoms by eliminating the difficulty of first having to produce and slow an atomic beam. The authors present the results of our calculations, computer models, and experimental work.

001,475

PB90-170135

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Source and Instrumentation Div.

NIST/NRL (National Institute of Standards and Technology/Naval Research Laboratory) Free-Electron Laser Facility.

Final rept.

P. H. Debenham, R. L. Ayres, J. B. Broberg, R. I.

Cutler, B. C. Johnson, R. G. Johnson, E. R.

Lindstrom, D. L. Mohr, J. E. Rose, J. K. Whittaker, N.

D. Wilkin, M. A. Wilson, C. M. Tang, P. Sprangle, and

S. Penner. 1989, 8p

Grant N00014-87-F-0066

Sponsored by Office of Naval Research, Arlington, VA.

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Free-Electron Lasers II, v1133 p89-96 1989.

Keywords: Reprints, *Free electron lasers, Racetrack microtrons, Laser oscillators, Tunable lasers, Picosecond pulses, National Institute of Standards and Technology.

A free-electron laser (FEL) user facility is being constructed at the National Institute of Standards and Technology (NIST) in collaboration with the Naval Research Laboratory. The FEL, which will be operated as an oscillator, will be driven by the electron beam of the racetrack microtron (RTM) that is nearing completion. Variation of the electron kinetic energy from 17 MeV to 185 will permit the FEL wavelength to be tuned from 200 nm to 10 micrometers. The FEL will emit a continuous train of 3-ps pulses at 66 MHz with an average power of 10-200 W, depending on the wavelength, and a peak power of up to several hundred kW. An experimental area is being prepared with up to five stations for research using the FEL beam. Initial operation is scheduled for 1991.

001,476

PB90-170846

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Ultraviolet and Soft X-ray Measurement Services at NBS (National Bureau of Standards).

Final rept.

W. R. Ott. 1987, 12p

Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p69-1-69-12.

Keywords: *Ultraviolet radiation, Ultraviolet detectors, Radiometry, Standards, Reprints, *Soft x rays, X-ray detection, X-ray sources, Calibration, National Institute of Standards and Technology.

In the wavelength region between 4-350 nm, NBS offers a variety of standard sources and detectors which may be used to calibrate the radiant power of unknown sources or the response of radiation detectors and spectral radiometers. A brief review of the available services is given. In addition, several current projects which are meant to improve the accuracy, performance, and variety of ultraviolet and soft x-ray radiometric standards are mentioned.

001,477

PB90-187634

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Optical Fiber Measurements: Results of Interlaboratory Evaluations.

Final rept.

D. L. Franzen. 1988, 3p

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Fiber Optics Reliability:

Benign and Adverse Environments II, v992 p242-244 1988.

Keywords: *Fiber optics, Optical measurement, Attenuation, Bandwidth, Reprints, *Optical fibers, Numerical aperture, Cutoff wavelength, Multimode.

Results of industry-wide round robin comparisons administered by the National Bureau of Standards and the Electronic Industries Association are presented. Multimode fiber parameters include attenuation, bandwidth, core diameter, and numerical aperture. Single-mode fiber parameters include cut-off wavelength and mode-field diameter.

001,478

PB90-188384

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Soliton-Like Compression of Pulses from Erbium-Fiber Lasers.

Final rept.

J. B. Schlager, Y. Yamabayashi, and D. L. Franzen.

1989, 4p

Pub. in Proceedings of European Conference on Optical Communication (15th), Gothenburg, Sweden, September 10-14, 1989, p62-65.

Keywords: Light pulses, Reprints, *Erbium lasers, *Fiber lasers, *Mode locked lasers, Picosecond pulses, Solitons, Compression.

Erbium-fiber lasers with cavity lengths of 5 to 5000 m are mode-located at the fundamental cavity frequency. Pulse durations vary from 13 to 80 ps; the shorter pulses exhibit soliton-like compression and higher order effects when propagated through external fibers.

001,479

PB90-188590

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Current Status of Frequency Calibration Tables (0 to 3000 cm⁻¹) for Tunable Diode Lasers from Heterodyne Frequency Measurements.

Final rept.

J. S. Wells, M. D. Vanek, A. G. Maki, M. Schneider,

and A. Hinz. 1989, 16p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in Proceedings of International Symposium on Monitoring of Gaseous Pollutants by Tunable Diode Lasers (2nd), Freiburg, F.R.G., October 17-18, 1988, p122-137 1989.

Keywords: *Frequency measurement, *Carbon disulfide, Nitrogen oxide(N2O), Infrared spectra, Heterodyning, Semiconductor lasers, Tables(Data), Molecular spectroscopy, Reprints, *Carbonyl sulfide, *Nitrous oxides, *Calibration, Tunable lasers.

The research involves the use of heterodyne frequency measurements as well as the analysis and fitting of the infrared spectra of selected molecules. Of major interest are the linear triatomic molecules OCS and N2O, which together cover a sizeable portion of the 0 to 3000/cm region. Some heterodyne frequency measurements can be made by locking a tunable diode laser (TDL) to an absorption feature of OCS, for example, and comparing the TDL frequency directly against a CO2 laser frequency standard. The transfer oscillator techniques and calibration tables resulting from the new frequency measurements on OCS and CS2 are presented. Current status of calibration tables is given for an interim OCS atlas, an N2O atlas, and several other molecules of interest.

001,480

PB90-192576

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiometric Physics Div.

Tunable Dye Laser Spectrometry.

Final rept.

A. R. Schaefer, and N. P. Fox. 1987, 19p

Pub. in Advances in Standards and Methodology in Spectrophotometry, p325-343 1987.

Keywords: *Spectrophotometry, *Spectroradiometers, Interference filters, Irradiance, Transmittance, Reprints, *Laser spectroscopy, Continuous wave lasers, Tunable lasers, Dye lasers, Intercomparison.

The method of using a CW dye laser for spectroradiometric and spectrophotometric measurements as developed and practiced at NBS and NPL is described. A

brief review of the development of this concept at NBS is given, followed by a description of the present system and a proof of concept measurement with the NBS High Accuracy Spectrophotometer. The paper goes on to describe several intercomparisons which have relied on the use of dye laser spectrometry. These are an NBS electron storage ring - silicon detector - spectral irradiance scale intercomparison and an improved accuracy intercomparison of two primary radiometric standards: the NPL cryogenic radiometer and the PTB electron storage ring BESSY. Transmittance intercomparisons of NBS and NPS interference filters are also presented. Finally, a brief description is made of suggested proposals of future directions for research.

001,481
PB90-205956 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Radiometric Physics Div.
International Intercomparison of Regular Transmittance Scales.

Final rept.
K. L. Eckerle, E. Sutter, G. H. C. Freeman, G. Andor,
and L. Fillingim. 1990, 6p
Pub. in *Metrologia* 27, p33-38 1990.

Keywords: *Transmittance, Optical filters, Spectrophotometers, Glass, Reprints, Interlaboratory comparisons, Uncertainty.

An intercomparison of the regular spectral transmittance scales of NIST, Gaithersburg, MD (USA); PTB, Braunschweig (FRG); NPL, Teddington, Middlesex (UK); and OMH, Budapest (H) was accomplished using three sets of neutral glass filters with transmittances ranging from approximately 0.92 to 0.001. The difference between the results from the reference spectrophotometers of the laboratories was generally smaller than the total uncertainty of the interchange. The relative total uncertainty ranges from 0.05% to 0.75% for transmittances from 0.92 to 0.001. The sample-induced error was large, contributing 40% or more of the total except in a few cases.

001,482
PB90-206087 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg,
MD. Building Equipment Div.

Calculation of Metameric Reflectances.
Final rept.
J. A. Worthey. 1988, 9p
Pub. in *Color Research and Application* 13, n2 p76-84
Apr 88.

Keywords: *Color, *Illuminating, Reflectance, Luminaires, Reprints, *Metamerism.

Object-color metamerism becomes visually apparent if two objects match under one light, but not under a second. In the present paper, a method if derived by which metameric object colors can be calculated, given the light under which they are to match, and the light under which they are to mismatch. While the method may not give the greatest possible mismatch under the second light, it comes close to doing so. It gives practical guidance for avoiding or achieving metamerism. The method is not primarily a matter of trial-and-error and statistics, but depends on a simple calculation that operates on the spectral power distributions of the two lights, and the sets of color-matching functions under the two lights. For a given person, of course, color-matching functions should remain constant, but the method can as well deal with 'observer metamerism,' meaning the effects of observer difference.

001,483
PB90-231150 PC A11/MF A02
Quick, Finan and Associates, Washington, DC.
U.S. Investment Strategies for Quality Assurance.
Planning rept. 90-1.
Apr 90, 237p NIST/GCR-90/576
Contract NANB-8C5033
Sponsored by National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.

Keywords: *Semiconductor devices, *Quality assurance, *Investments, *Fiber optics, Industries, Trends, Case studies, Japan, Surveys, Corporations, Competition, Technology innovation, Optical fibers.

Investment trends and overall industrial strategies for quality assurance are analyzed. Case studies of the semiconductor and optical fiber industries are undertaken. Data collection for the case studies is accom-

plished through analysis of the relevant literature and telephone and mail surveys. Industrial quality is defined in terms of its major components to allow more detailed analysis of the foci of corporate strategies and the shifts in these strategies over time. Adoption of individual components as part of corporate strategy is not related to company size but rather to commitment to competing successfully in global markets. International comparisons of strategies are made. The U.S. optical fiber industry invests relatively more in quality than do its foreign competitors, but the industry defines quality in a narrower, more traditional way compared to the semiconductor industry. The latter has adopted, in response to intense foreign competition, adopted a broader, systems view of quality similar to that of the Japanese. NIST is judged by respondents to play a significant role in providing measurement technology that is relevant for quality-related strategies.

001,484
PB90-241662 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Atomic and Plasma Radiation Div.

Wavelengths and Intensities of a Platinum/Neon Hollow Cathode Lamp in the Region 1100-4000 A.
Final rept.

J. Reader, N. Acquista, C. J. Sansonetti, and J. E. Sansonetti. 1990, 36p
Pub. in the *Astrophysical Jnl. Supplement Series* 72, p831-866 Apr 90.

Keywords: *Ultraviolet spectra, *Platinum, Frequency standards, Neon, Intensity, Reprints, Wavelength standards, Hollow cathode lamps.

The spectrum of a platinum hollow cathode lamp containing neon carrier gas was recorded photographically and photoelectrically with a 10.7 m normal-incidence vacuum spectrograph. Wavelengths and intensities were determined for about 3000 lines in the region 1100-4000 A. The uncertainty of the measured wavelengths is estimated to be ± 0.0020 A. Ritz-type wavelengths are given for about 550 classified lines of Pt II with uncertainties varying from ± 0.0004 A to ± 0.0025 A. The uncertainty of the relative intensities is estimated to be about 20%.

001,485
PB90-254392 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Atomic and Plasma Radiation Div.

Laser Produced Plasma X-ray Ultraviolet (XUV) Radiation Source.

Final rept.
J. M. Bridges, C. L. Cromer, and T. J. McIlrath. 1986, 7p
Pub. in *Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - X-ray Calibration: Techniques, Sources and Detectors*, v689 p19-25 1986.

Keywords: Ultraviolet spectroscopy, Radiometry, Reprints, *Light sources, *Extreme ultraviolet radiation, Laser-produced plasma, Soft x rays, Laser targets.

XUV radiation from a laser-produced plasma was investigated using a 1.5 m grazing incidence monochromator with a channel electron multiplier array detector. This instrument provides relatively high spectral resolution as well as linear response over a large dynamic range. Spectra from 8 to 40 nm were obtained from plasmas generated by a 0.5 J Nd:YAG laser focused on the following different target materials: Al, Cu, Fe, Sn, Sm, Hf, Yb, W and Pb. Reproducibility of emission and effects of laser energy and focus on the output were measured.

001,486
PB90-254541 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg,
MD. Ceramics Div.

Modeling Refractive Index in Mixed Component Systems.
Final rept.

A. Feldman. 1988, 4p
Pub. in *Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Modeling of Optical Thin Films*, v821 p129-132 1988.

Keywords: *Optical materials, Refractivity, Thin films, Mixtures, Mathematical models, Measurement, Meetings, Optical coatings, Microstructure, Reprints, *Optical models, Predictive equations.

The refractive index of an optical film composed of a mixture of more than one constituent is a function of

the microstructure of the film. Even films that are nominally of a single material have refractive index values that require interpretation on the basis of mixed component models because the values differ significantly from the values in equivalent bulk materials. In the latter case, the film is usually a mixture of bulk material and voids, or bulk material, voids, and adsorbed water. Many models have been used to explain the refractive indices of mixed component systems. The Lorentz-Lorentz model, the Drude model, and the effective media approximation (EMA or Bruggeman model) are the most common models used to estimate isotropic refractive indices of mixtures of isotropic materials. Films composed of anisotropic microstructures, however, require other models such as the Bragg and Pippard model. One use of mixed component models would be to predict the porosity of optical films. Another would be to predict the refractive index of coevaporated films. However, no one model is applicable to all situations. Therefore, the prediction of refractive index becomes difficult. Usually, the model is chosen after the set of measurements has been done.

001,487
PB90-254624 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Technology Div.

Bent Planar Waveguides and Whispering Gallery Modes: A New Method of Analysis.

Final rept.
I. C. Goyal, R. L. Gallawa, and A. K. Ghatak. 1990, 8p
Pub. in *Jnl. of Lightwave Technology* 8, n5 p768-774
May 90.

Keywords: Matrix methods, Bending tests, Losses, Reprints, *Optical waveguides, Whispering gallery modes.

A new matrix method is used to analyze bent planar optical waveguides. The method is a modification of an earlier method and may therefore be used with absorbing or leaky structures. The new method is a refinement of the old matrix method inasmuch as a non-uniform refractive index is approximated by a series of linear profiles rather than a series of uniform profiles. The method is used to analyze a bent planar waveguide, yielding bend loss directly. The effect of whispering gallery modes has also been studied. It appears that a whispering gallery explanation given earlier may not be adequate.

001,488
PB90-254749 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Temperature and Pressure Div.

Stimulated Raman Scattering and Coherent Anti-Stokes Raman Spectroscopy in High-Pressure Oxygen.

Final rept.
W. R. Lempert, B. Zhang, R. B. Miles, and J. P. Looney. 1990, 8p
Sponsored by Air Force Office of Scientific Research,
Bolling AFB, DC.
Pub. in *Jnl. of the Optical Society of America B* 7, n5
p715-721 May 90.

Keywords: *Oxygen, *Raman spectroscopy, Reprints, Vibrational states, Raman effect, High pressure.

A high-pressure oxygen cell has been used to generate vibrational stimulated Raman scattering, using a Q-switched laser. Peak first-Stokes conversion efficiencies of 6% are reported, and direct use of the cell output for stimulated Raman pumping of oxygen in room air to the first vibrationally excited level is demonstrated. Coherent anti-Stokes Raman spectroscopy is used to study the density dependence of the 298-K Q-branch line shape in the 5-31-amagat range, with the results compared with spectral models that incorporate the effects of intermolecular rotational energy transfer.

001,489
PB90-254897 Not available NTIS
National Inst. of Standards and Technology (NEL),
Boulder, CO. Electromagnetic Technology Div.

Integrated-Optic Laser Fabricated by Field-Assisted Ion Exchange in Neodymium-Doped Soda-Lime-Silicate Glass.

Final rept.
N. A. Sanford, K. J. Malone, and D. R. Larson. 1990, 3p
Pub. in *Optics Letters* 15, n7 p366-368, 1 Apr 90.

Keywords: Near infrared radiation, Infrared lasers, Argon lasers, Reprints, *Waveguide lasers, Integrated optics, Glass lasers, Laser pumping, Neodymium lasers.

A continuous-wave integrated-optic channel waveguide laser operating at 1.057 micrometers has been fabricated in neodymium-doped soda-lime-silicate laser glass. The device was end-fire pumped with the 0.528 micrometer line of an argon-ion laser. Threshold for laser action occurs for an absorbed pump power of 31 mW. The slope efficiency for the integrated-optic laser is estimated to be 0.5%. Field-assisted ion exchange in a eutectic melt of CaNO₃ and KNO₃ was used to form the waveguide.

001,490
PB90-256843

(Order as PB90-256793, PC A08)

National Inst. of Standards and Technology, Gaithersburg, MD.

Scattered Light and Other Corrections in Absorption Coefficient Measurements in the Vacuum Ultraviolet: A Systems Approach.

R. Klein, W. Braun, A. Fahr, A. Mele, and H. Okabe. 1990, 8p
Prepared in cooperation with Rome Univ. (Italy), and Howard Univ., Washington, DC.
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n3 p337-344 May-Jun 90.

Keywords: Ultraviolet spectrometers, Light scattering, Data acquisition, Error analysis, Correction, *Vacuum ultraviolet radiation, Absorption coefficients.

A systems approach in which computer automation is applied to a vacuum ultraviolet spectrometer and auxiliary components is described. The errors associated with the measurement of gaseous absorption coefficients in the vacuum ultraviolet are considered. The presence of scattered light introduces large errors particularly at those wavelengths where the source used is characterized by low intensity. In the case of a D2 light source this occurs in the region 120 to 130 nm. Simple considerations explain the variation of the absorption coefficient determinations in the presence of scattered light and lead to an appropriate treatment of the data to eliminate the error. Experimental results are presented illustrating the efficiency and precision obtainable with the present approach.

001,491
PB90-257619 PC A06/MF A01

National Inst. of Standards and Technology (NML), Boulder, CO. Electromagnetic Technology Div.
Scanning System for Measuring Uniformity of Laser Detector Response and Laser Beam Dimensions.

A. L. Rasmussen, W. E. Case, and A. A. Sanders. Apr 90, 101p NISTIR-90/3937

Keywords: *Optical scanners, *Laser beams, Dimensional measurement, Infrared detectors, Computer graphics, Optical measurement, Power measurement, Variability, Computerized control systems, High resolution, Optical detectors, Computer software.

The reliability of detector calibration depends upon the uniformity of detector response and the dimensions of the interacting laser beam. The report describes a computer-controlled scanning system for measuring these parameters. Appendixes A through J present many important details needed to understand and use the system. Appendix J describes the linear detector (ROSY 7-1) that monitors the detector under calibration in the scanning system. The device to be measured is scanned in a plane perpendicular to the axis of a stationary laser beam. Software using output and position data give surface graphics and information, and beam radius and shape. To determine linearity, measurements are made at two or more power densities. The user may determine experimentally the effect of changing beam size on uniformity measurements. Uniformity scans in the report fluctuated more for smaller beams than larger ones. They were smoothed and rounded for beams larger than coordinate steps. The remainder of the report describes system layout and interfacing parts, software, measurement procedures, examples, applications, and conclusions.

001,492
PB90-261025 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Optically Pumped Primary Frequency Standard.
Final rept.

R. E. Drullinger, J. H. Shirley, D. J. Glaze, and L. Hollberg. 1989, 5p
Pub. in Frequency Standards and Metrology, p116-119 1989.

Keywords: *Frequency standards, *Standards, Optical pumping, Reprints, Laser applications, US NIST.

An optically pumped primary frequency standard is being constructed at the National Institute for Science and Technology. To achieve the potential accuracy of this new technology, a thorough reconsideration of all the potential systematic errors has been undertaken. Based on the needs of the optical pumping process and other improved technologies (ovens and cavities), a unique beam tube has been designed and fabricated. The laser performance necessary to allow full realization of the optically pumped clock's potential has been achieved by an optical feedback technique. The design goal includes a total frequency uncertainty of no more than 10 to the -14 power.

001,493
PB90-261090 Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Optical Waveguide Attenuation Measured by Photothermal Displacement.

Final rept.
R. K. Hickernell, J. A. Aust, and D. R. Larson. 1989, 3p
Sponsored by Johns Hopkins Univ., Baltimore, MD., and Army Research Office, Research Triangle Park, NC.
Pub. in Proceedings of International Topical Meeting on Photoacoustic and Photothermal Phenomena (6th), Baltimore, MD., July 31-August 3, 1989, p310-311.

Keywords: Near infrared radiation, Absorption, Attenuation, Losses, Reprints, *Optical waveguides, Integrated optics, Photothermal displacement.

The photothermal displacement technique is applied to the study of propagation loss in optical channel waveguides. Thermal expansion of the substrate surface due to the absorption of guided light is probed with a laser beam reflected from the surface. The technique is non-contact, has a high spatial resolution, and is applicable to a wide variety of waveguides, including packaged devices. Attenuation is measured in ion-exchanged glass waveguides at a wavelength of 1.3 micrometers.

001,494
PB90-261108 Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Ultra Stable Cavity-Stabilized Lasers with Sub-Hertz Linewidth.

Final rept.
D. Hils, and J. L. Hall. 1989, 13p
Contract NASA-NAGW-822, Grant NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of International Symposium on Frequency Standards and Metrology (4th), Ancona, Italy, September 1988, p162-173 1989.

Keywords: *Frequency standards, Interferometers, Reprints, *Laser stability, Laser applications, Phase stability.

The authors found that it is readily possible to lock to an interferometer resonance with a noise level of about 50 mHz. Experiments reported elsewhere show that the authors are locking onto the 80 kHz linewidth cavity resonances with an accuracy of 1 or 2 Hz. The long-term stability of these suspended reference interferometers is surprisingly good. The observed length change of about -2 x 10 to the -10 power/day appears to be pure uniform drift which can be predicted with 1% accuracy or better for a day. There is preliminary evidence that, as far as aging is concerned, ULE may be a more attractive interferometer material than Zerodur. Finally, the authors are somewhat disappointed in the first experiments directly heterodyning two such cavity stabilized lasers.

001,495
PB90-261140 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Sulfurlike Spectra of Copper through Molybdenum.

Final rept.
V. Kaufman, J. Sugar, and W. L. Rowan. 1990, 8p
Sponsored by Department of Energy, Washington, DC. Pub. in Jnl. of the Optical Society of America B 7, n7 p1169-1175 Jul 90.

Keywords: *Atomic spectra, Arsenic, Bromine, Copper, Gallium, Germanium, Krypton, Molybdenum, Niobium, Rubidium, Selenium, Strontium, Yttrium, Zinc, Zirconium, Atomic energy levels, Reprints, Laser-produced plasma, Multicharged ions, Isoelectronic sequence.

The sulfurlike spectra of copper through molybdenum have been identified from observations in tokamak and laser-generated plasmas. Wavelengths of electric-dipole transitions of the 3s(2) 3p(4)-(3s3p(5)+3s(2) 3p(3)3d) array in the range 75 to 305 A are given. The wavelength uncertainty is estimated to be + or - 0.007 A. These data have been combined with previously reported wavelengths of magnetic-dipole transitions to determine energy levels for the isoelectronic sequence Cu XIV through Mo XXVII including Pb and Sr for which no observations were made. Ground configuration intervals obtained from magnetic-dipole transitions are compared with Dirac-Fock calculations to predict unknown values and to correct misidentifications. Wavelengths previously classified as chlorine-like in Cu through Zr are now classified as sulfurlike lines. A new set of observed and interpolated wavelengths for that transition is presented for Cu through Kr.

001,496
PB90-261199 Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.
Characterization of a Pt-Ne Hollow Cathode Spectral Line Source.

Final rept.
J. Z. Klose, G. F. Hartig, and W. J. Rosenberg. 1990, 10p
Pub. in Applied Optics 29, n19 p2951-2959, 1 Jul 90.

Keywords: *Spectral lines, *Radiometry, *Standards, Ultraviolet radiation, Radiance, Chromium, Neon, Platinum, Reprints, Hollow cathodes.

A source which produces a rather uniform distribution of spectral lines over the wavelength range from 115 to about 350 nm is being investigated as a secondary radiometric standard for use in space. The source is a sealed lamp with a hollow cathode of platinum and a fill gas of neon. A version of the lamp has already been flown in space but only as a wavelength standard. The following properties were studied: warmup time, stability, emission as a function of current, repeatability, spatial characteristics, impurities, angular dependence, long term behavior, and radiance.

001,497
PB90-261439 Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Electromagnetic Technology Div.
Scratch Standard Is Only a Cosmetic Standard.

Final rept.
M. Young. 1989, 7p
See also PB86-242013.
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Surface Characterization Testing II, v1164 p185-190 1989.

Keywords: *Optical measurement, *Standards, Reprints, *Optical surfaces, *Scratch and dig standards, Laser damage.

The author presents a history of the scratch-and-dig standard for optical surface quality and shows that this standard has since its inception been recognized as a cosmetic standard and not as an objective or performance standard. In addition, the author attempts to dispel the myth that the scratch standard was changed during the 1960s and shows that scratch number cannot be related to scratch width. Finally, the author describes a preliminary aging experiment that suggests that the scratch standards have not aged with time and are, in fact, extremely stable.

001,498
PB90-269572 PC A03/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiometric Physics Div.

Absolute Specular Reflectometer with an Autocollimator Telescope and Auxiliary Mirrors.

Technical note (Final).

T. M. Wang, K. L. Eckertle, and J. J. Hsia. Aug 90, 32p NIST/TN-1280

Also available from Supt. of Docs. as SN003-003-03032-5.

Keywords: *Reflectometers, Infrared spectrophotometers, Reflection, Alignment, Mirrors, Strong method, Uncertainty.

The Strong method for measuring reflectance is used in many laboratories. However, an uncertainty in the angular position of the sample can lead to large errors. A novel use of an autocollimator telescope with two auxiliary mirrors (ACTAM) can reduce this angular uncertainty and lead to more accurate measurement of reflectance. The instrumentation, its adjustment, measurement procedure, results, and uncertainties are discussed. The total uncertainty for the reflectance measurement of a gold mirror was found to be less than 0.0025 over the wavelength region 2 to 22 micrometers.

001,499

PB90-271180

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Building Environment Div.

Categorical Color Rendering of Four Common Light Sources.

Final rept.

R. M. Boynton, L. Fargo, and B. L. Collins. 1990, 9p Sponsored by National Eye Inst., Bethesda, MD.

Pub. in COLOR Research and Application 15, n4 p222-230 Aug 90.

Keywords: *Color, Sodium, Mercury, Tungsten, Incandescent lamps, Comparison, Reprints, Light sources, Metal halides.

Subjects were asked to sort samples from the Optical Society of America (OSA) Uniform Color Scales set into 33 color categories under four separate illuminants: tungsten-incandescent, metal halide, high-pressure sodium, and clear mercury. Sorting required that each color sample be designated as a 'good,' 'acceptable,' or 'poor' example within one of the eleven basic color categories specified by Berlin and Kay. Three indices of the categorical color-rendering capacity of the sources were developed. Assuming tungsten-incandescent as the reference illuminant, all three measures rated the color-rendering quality of the tested illuminants from best to worst in the order listed above, in agreement with the CIE color-rendering index.

001,500

PB91-101238

Not available NTIS

National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Semiconductor Electronics Div.

Shape of the Silicon Absorption Coefficient Spectrum Near 1.63 eV.

Final rept.

J. Geist, A. Migdall, and H. Baltes. 1990, 7p

Pub. in Applied Optics 29, n24 p3548-3554, 20 Aug 90.

Keywords: *Silicon, Near infrared radiation, Absorption spectra, Energy gap, Reprints, Absorption coefficients, High resolution, Room temperature.

The authors report high precision, high spectral resolution measurements of the absorption coefficient of silicon in the spectral region from 1.61 to 1.65 eV. Their data show a smooth absorption spectrum with no discernible features in this spectral region where structure has been reported previously. Their data and analysis suggest that the second indirect transition in silicon has yet to be detected in absorption coefficient spectra.

001,501

PB91-101402

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Quantum Physics Div.

Redistributed Spectrum of Scattered Light.

Final rept.

E. L. Lewis, and D. Szebesta. 1990, 8p

Pub. in Physical Review A 42, n3 p1424-1430, 1 Aug 90.

Keywords: *Light scattering, Rayleigh scattering, Fluorescence, Calcium, Argon, Excitation, Reprints, Atom-atom collisions, Redistribution functions.

The spectrum of redistributed light that results from excitation by monochromatic near-resonant incident light

has been observed in calcium perturbed by argon. The two components were found to be well described by the astrophysical redistribution functions R(II) and R(III) for the Rayleigh and fluorescent peaks, respectively. The Doppler width of the Rayleigh component was observed to be (square root of 2) larger than that of the fluorescent component, when observed at right angle to the incident beam, clearly demonstrating the coherence of this part of the scattering. The ratio of fluorescent to Rayleigh intensity was independent of detuning within the range examined, which was well within the impact region, and increased linearly with argon pressure in a manner that is consistent with an identification of the cross section for redistributing collisions with that for line broadening.

001,502

PB91-111955

Not available NTIS

National Bureau of Standards (NIST), Gaithersburg, MD. Semiconductor Materials and Processes Div.

ADC Errors in Quantitative FT-IR Spectroscopy.

Final rept.

A. Baghdadi, and W. K. Gladden. 1985, 3p

Pub. in Proceedings of International Conference on Fourier and Computized Infrared Spectroscopy, SPIE 553, p207-209 1985.

Keywords: *Analog to digital converters, *Infrared spectroscopy, Error analysis, Reprints, *Fourier transform spectroscopy.

Analog-to-digital converters (ADCs) are the interface between the analog data actually collected by a Fourier transform infrared (FT-IR) spectrophotometer and the digital computer which processes these data. In the typical case of absorption spectra obtained using a broadband source, interferograms with a very wide dynamic range (typically on the order of one million:1) are required in order to produce spectra with adequate signal-to-noise ratios. This is a very demanding application, especially for a high-speed ADC. A numerical model of the effect of ADC errors, of + or - 1 least significant bit (LSB) shows that they can produce errors as large as 50% on the height of peaks in an absorbance spectrum at low signal levels. The result is consistent with the authors' experimental observations. They tested four ADC circuit boards (all the same model) in their FT-IR spectrometer. At low signal levels, the disagreement between peak heights in spectra collected using the different ADC boards ranged as high as 30%, even though none of them produced the low-wavenumber distortions characteristic of inadequate ADC performance.

001,503

PB91-118505

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Electromagnetic Technology Div.

Recirculating Pulse Erbium-Fiber Ring Amplifier.

Final rept.

J. B. Schlager, D. L. Franzen, and Y. Yamabayashi.

1990, 1p

Pub. in Proceedings of OFC (Optical Fiber Communication) Conference, San Francisco, CA., January 22-26, 1990, 1p.

Keywords: Reprints, *Light amplifiers, Light modulators, Picosecond pulses, Erbium fibers, Laser radiation, Acoustooptics.

Sub-milliwatt pulses from a laser diode are injected into an erbium-fiber ring amplifier gated by an acousto-optic modulator; 90 ps duration pulses experience an internal gain of 46 dB giving a peak output power of 4 W at a repetition rate of 40 kHz.

001,504

PB91-134098

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Time and Frequency Div.

Optical Stabilization of Semiconductor Lasers.

Final rept.

L. Hollberg. 1989, 5p

Pub. in Proceedings of Symposium on Frequency Standards and Metrology (4th), Ancona, Italy, September 5-9, 1988, p231-235 1989.

Keywords: *Semiconductor lasers, *Frequency stability, Stabilization, Line width, Reprints, Line narrowing, Optical feedback.

The method of using resonant optical feedback to stabilize the frequency of semiconductor lasers has proved valuable for a number of applications. It is one of a number of possible optical stabilization methods, as opposed to electronic stabilization methods, and

contrasts from other optical methods in that the optical feedback comes from a high Q (quality factor) optical resonator. This technique for frequency stabilization uses commercially available lasers and Fabry-Perot cavities and can reduce diode laser linewidths to as low as 3 kHz. The resonance of the Fabry-Perot cavity serves as the frequency reference which stabilizes the lasers oscillation frequency and narrows its linewidth.

001,505

PB91-134809

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Time and Frequency Div.

Far Infrared Lasing Frequencies of CH2DOD.

Final rept.

E. C. C. Vasconcellos, and K. M. Evenson. 1990, 5p Pub. in International Jnl. of Infrared and Millimeter Waves 11, n7 p785-789 1990.

Keywords: *Frequency measurement, Far infrared radiation, Optical pumping, Infrared lasers, Deuterium compounds, Reprints, *Methanol lasers, *Laser frequencies.

The authors obtained laser action from the CH2DOD molecule optically pumped by CO2 laser radiation. Eight lasing transitions were identified as originating from CH2DOD; an additional 21 transitions also lased, but were assigned to the CH2DOH molecule, and 2 to CH3OH, even though the isotopic purity of the sample was given as 98%. The relative intensity, relative polarization and frequency of all the lines were measured. The eight lines are distributed between 145.8 and 479.2 micrometers.

001,506

PB91-144451

PC A05/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Journal of Research of the National Institute of Standards and Technology. September-October 1990. Volume 95, Number 5.

1990, 90p

Also available from Supt. of Docs. as SN003-003-703-027-00036-9. See also PB91-144469 through PB91-144527 and PB91-107656. Portions of this document are not fully legible.

Keywords: *Research, Fundamental constants, Laser radiation, Power measurement, Radiometry, Radiometers, Photodetectors, Photodiodes, Silicon, Radiography, Calorimetry, Photometry, Standards, Absorption coefficients, Tomography, Electrical measurement, Superconductivity, X ray microscopes, Microradiography, Microtomography.

Contents:

- Recommended Values of the Fundamental Physical Constants--A Status Report;
- An International Comparison of Absolute Radiant Power Measurement Capabilities;
- Results of a CIE Detector Response Intercomparison;
- Effects of the International Temperature Scale of 1990 (ITS-90) on CIE Documentary Standards for Radiometry, Photometry, and Colorimetry;
- An Accurate Value for the Absorption Coefficient of Silicon at 633 nm;
- Hard X-Ray Microscope with Submicrometer Spatial Resolution;
- Software Techniques to Improve Data Reliability in Superconductor and Low-Resistance Measurements.

Plasma Physics

001,507

PB90-188608

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Time and Frequency Div.

Liquid and Solid Ion Plasmas.

Final rept.

D. J. Wineland, W. M. Itano, J. C. Bergquist, S. L.

Gilbert, and J. J. Bollinger. 1988, 18p

Pub. in AIP (American Institute of Physics) Conference Proceedings 175 on Non-Neutral Plasma Physics, Washington, DC., March 28-29, 1988, p93-110.

Keywords: Atomic spectroscopy, Reprints, *Ion plasmas, Ion traps, Laser cooling, Coupling.

Plasma Physics

Experiments on strongly-coupled nonneutral ion plasmas, performed at the National Bureau of Standards, are summarized. The authors first discuss strong coupling of small numbers (<100) of macroscopic and atomic ions confined in Paul (electrodynamic) traps, in which crystalline structures are observed. They then discuss experiments in which shell structure is observed for up to 10,000 atomic ions confined in static electric and magnetic fields. In their experiments, they have progressed from working with very small numbers of ions up to an intermediate value. Future experiments are suggested, including some where infinite volume behavior might be observable.

001,508

PB90-241605

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

ELENDIF: A Time-Dependent Boltzmann Solver for Partially Ionized Plasmas.

Final rept.

W. L. Morgan, and B. M. Penetrante. 1990, 26p

Pub. in Computer Physics Communications 58, p127-152 1990.

Keywords: *Boltzmann equation, *Plasmas(Physics), Electron energy, Ionized gases, Distribution functions, Time dependence, Mixtures, Reprints, *ELENDIF computer program, Electron transport.

ELENDIF calculates the time evolution of the electron energy distribution function in a mixture of partially ionized gases with or without an applied electric field. The code can treat inelastic and superelastic processes, electron-electron and electron-ion collisions, photon-electron (free-free) processes, attachment and recombination, ionization including a distribution of secondary electrons, and an external source of electrons (e.g. an electron beam). The code also computes the mean electron energy, drift velocity, diffusion coefficient, rate coefficients and energy flow rates for the processes being included in the calculation.

001,509

PB91-107672

(Order as PB91-107656, PC A06)

Joint Inst. for Lab. Astrophysics, Boulder, CO.

Diffusion of Charged Particles in Collisional Plasmas: Free and Ambipolar Diffusion at Low and Moderate Pressures.

A. V. Phelps. 1990, 24p

Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n4 p407-431 Jul-Aug 90.

Keywords: *Gas discharges, Space charge, Afterglows, Boundaries, Walls, *Collisional plasmas, Electron diffusion, Ionic diffusion, Ambipolar diffusion.

The interpretation of measurements of the properties of weakly ionized plasmas in terms of diffusion of electrons and ions is reviewed both critically and tutorially. A particular effort is made to tie together various aspects of charged particle diffusion phenomena in quiescent, partially ionized plasmas. The concepts of diffusion length and effective diffusion coefficient and the treatment of partially reflecting boundaries are developed in the limit of the space-charge-free motion of the electrons or ions. A simplified derivation of the screening length for space charge electric fields is followed by a review of the conventional derivation of diffusion in the ambipolar limit. The role of diffusion in the decay of charged particle densities and wall currents during the afterglow of a discharge is considered. The effects of collapse of the space charge field and of diffusion cooling are reviewed. Finally, the application of the diffusion models to a number of different discharges is discussed.

001,510

PB91-118455

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div. **Measurements on the NIST GEC Reference Cell.**

Final rept.

J. R. Roberts, J. K. Olthoff, R. J. Van Brunt, and J. R. Whetstone. 1990, 9p

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Symposium on Advanced Techniques for Integrated Circuit Processing, Santa Clara, CA., October 1-5, 1990, 9p.

Keywords: Electrical measurement, Power measurement, Reprints, *Discharge cells, Reference cells, Interlaboratory comparisons, Plasma currents, Voltage, RF systems.

Measurements performed on the NIST Gaseous Electronics Conference (GEC) Reference Cell are described. The purpose of the discharge cell is to provide an affordable experimental platform for researchers that is physically identical from laboratory to laboratory, so that reference data can be generated and various experimental techniques and models can be cross correlated. Four laboratories agreed to conduct identical initial measurements on four cells manufactured at the same time. This would ensure the greatest possible uniformity and allow direct comparison of results. The experimental conditions for the present measurements are those specified for intercomparison and include 1 inch interelectrode spacing, grounded lower electrode, capacitively coupled RF power, cooled electrodes (20 C), electrode ground shields and 99.999% argon. The specific measurements to be made were: (1) the waveforms of the fundamental through the fifth harmonic of the RF voltage and current, including their magnitude and phase; (2) the gas flow rate and pressure; and (3) the DC self-bias voltage.

Radiofrequency Waves

001,511

PB90-136292

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

How High is the Level of Electromagnetic Fields Radiated by an ESD (Electrostatic Discharge).

Final rept.

M. T. Ma. 1989, 5p

Pub. in Proceedings of International Zurich Symposium and Technical Exhibition on Electromagnetic Compatibility (8th), Zurich, Switzerland, March 7-9, 1989, 5p.

Keywords: *Electrostatic charge, *Electromagnetic fields, Electric charge, Electric fields, Electromagnetic radiation, Field strength, Computers.

Quantitative estimation of the electromagnetic fields radiated by electrostatic discharges (ESD) is of importance to the users and computer industry. Analytical and experimental results, based on a new theoretical model and specific measurement system, are presented to achieve the objective. The ESD spark is modeled as an electrically short, time dependent, linear dipole situated above an infinite ground plane. The specific measurement system consists of a newly designed broadband, time-domain TEM horn antenna, a wide-band digitizing oscilloscope, and a desktop computer.

001,512

PB90-217845

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Fields Div.

Standard Field Generation for Microwaves and Millimeter Waves.

Final rept.

J. Randa, and M. Kanda. 1989, 4p

Pub. in Navy Metrology Research and Development Program Conference Report, Corona, CA., April 3-6, 1989, p97-100.

Keywords: *Metrology, *Electromagnetic fields, *Microwave frequencies, *Millimeter waves, Calibrating, Accuracy, Anechoic chambers, Electrostatic probes, Reprints, National Institute of Standards and Technology(NIST).

The requirements for electromagnetic field measurements at microwave and millimeter wave frequencies in both the laboratory and the field are discussed. Current National Institute of Standards and Technology (NIST) capabilities and intended extensions are presented. The NIST anechoic chamber facility can generate calibrated fields up to 18 GHz and will soon be extended to 40 GHz. Future extensions will be 2 GHz bands centered at 60 GHz and 95 GHz. Transfer standard probes developed by NIST are available up to 18 GHz, and work is in progress to develop probes which would operate to 110 GHz. It is not clear whether these probes (if successfully developed) would be suitable for field use, as hazard meters, for example. For measurement in the field, electric-field probes which are claimed to operate to 40 GHz are available commercially. Small, transportable facilities for calibration of probes in the field are not readily available. The paper discusses the present situation in these areas,

presents current NIST work to extend the relevant capabilities, and notes present and probable future deficiencies.

Solid State Physics

001,513

DE88000591

PC A02

Tennessee Univ., Knoxville.

Soft X-Ray Emission Spectra and the Bonding of Aluminum.

T. A. Callcott, K. L. Tsang, C. H. Zhang, D. L. Ederer, and E. T. Arakawa. 1987, 5p CONF-8709135-3 Contract AC05-84OR21400

14. international conference on X-ray and inner-shell processes, Paris, France, 14 Sep 1987.

Paper copy only, copy does not permit microfiche production.

Keywords: *Aluminium, *Aluminium Alloys, *Aluminium Arsenides, *Aluminium Oxides, *Lithium Alloys, *Magnesium Alloys, *Manganese Alloys, *Nickel Alloys, *Chemical Bonds, Comparative Evaluations, Electronic Structure, Emission Spectra, Intermetallic Compounds, Photon Emission, Soft X Radiation, Spectral Density, Symmetry, X-Ray Spectra, ERDA/360104, ERDA/400201, *Aluminum gallium arsenides.

The L/sub 2,3/ soft x-ray emission (SXE) spectra of Al in metallic Al, Al-Mn alloys, dilute Al-Mg alloys, the intermetallic compounds LiAl and Ni sub 3 Al, the semi-conducting alloy (Al-Ga)As and insulating Al sub 2 O sub 3 are presented. The spectra provide a measure of the s-like partial density of states (PDOS) localized at the Al atoms and show prominent qualitative features that may be identified with each of the major types of bonding in solids, i.e., metallic, covalent and ionic. The spectra of metallic Al and of the Al-Mn alloys have parabolic densities of states characteristic of nearly free electron PDOS's. Al in Mg alloys have metallic PDOS's with a strong enhancement of the low energy region of the spectrum which is associated with screening of the extra charge on the Al ion core. In LiAl, the Al has tetragonal local symmetry, the spectrum is similar to that of silicon, and the bonding is a combination of covalent and metallic. In Al/sub x/Ga/sub 1-x/As alloys, the Al has tetragonal local symmetry, but the spectrum is strongly modified from the characteristic covalent form by the presence of a strong ionic component in the bonding. Finally, the spectrum of Al sub 2 O sub 3 shows features characteristic of localized electronic orbitals and ionic bonding. 15 refs., 6 figs. (ERA citation 13:003687)

001,514

DE88002609

PC A02/MF A01

Tennessee Univ., Knoxville.

Soft X-Ray Absorption and Emission Spectra and the Electronic Structure of the Ba sub 2 YCu sub 3 O/sub 7-x/ Superconductor.

K. L. Tsang, C. H. Zhang, T. A. Callcott, L. R. Canfield, and D. L. Ederer. 1987, 6p CONF-8709135-6

Contract AC05-84OR21400

14. international conference on X-ray and inner-shell processes, Paris, France, 14 Sep 1987.

Portions of this document are illegible in microfiche products.

Keywords: Barium Oxides, Copper Oxides, Yttrium Oxides, Electronic Structure, Emission Spectra, Energy-Level Density, Energy-Level Transitions, Quantum Efficiency, Soft X Radiation, Superconductivity, Valence, ERDA/360204, ERDA/656100, *Barium copper yttrium oxides, *Superconductors.

We present e-beam excited soft x-ray emission spectra and total photoelectron yield spectra in the 20 to 600 eV photon energy range for the Ba sub 2 YCu sub 3 O/sub 7-x/ superconductor. We confirm the 2+ valency of Cu in the compound by total yield measurements. In soft x-ray emission, the N/sub 2,5/ spectrum of Ba, the M/sub 4,5/ spectrum of Y, and the K spectrum of O provide measures of the p-type partial density of states (p-PDOS) localized on the respective atomic sites. In each case the p-PDOS is very small at the Fermi energy with the first peak in the p-PDOS lying 3.5 to 4 eV below the Fermi energy. The K spectra of O confirm the interpretation that the structure observed in the photoemission measurements are as-

sociated with the O 2p orbitals. Finally no changes are observed between spectra taken above and below T_c / sub c/. 20 refs., 4 figs. (ERA citation 13:009099)

001,515
N90-27796/3

(Order as N90-27792/2, PC A07/MF A02)
National Inst. of Standards and Technology, Gaithersburg, MD.
Pinning, Flow and Plastic Deformation of Flux Vortices in High T(Sub c) Superconductors. (Abstract Only).

A. Roytburd. Apr 90, 1p
In NASA, Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 4.

Keywords: Crystal structure, *High temperature superconductors, Pinning, Plastic deformation, Plastic flow, *Superconductors, Defects, Grain boundaries, Magnetic flux.

In high temperature superconductor (HTSC) materials the vortices are highly mobile and flexible. This is reflected in different models of melt of a vortex lattice. Another aspect of the problem is stressed: an easy nucleation and high mobility of dislocations in the vortex lattice. Some models of plastic deformation of vortex lattice are considered as a result of its interaction with a real crystal structure. Depinning is interpreted as yield of plastic flow is vortex medium. Effect of macroscopic defects in crystal structures (pores, inclusions, grain and domain boundaries) is being considered in detail. Available experimental facts on magnetization and a critical current in HTSC and conventional superconductors are discussed from the points of view of depinning to vortices vs. plastic flow of vortices vs. plastic flow of vortices medium.

001,516
N90-27797/1

(Order as N90-27797/1, PC A07/MF A02)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.
Flux Flow and Flux Dynamics in High-T(Sub c) Superconductors.(Abstract Only).

L. H. Bennett, M. Turchinskaya, A. Roytburd, and L. S. Swartzendruber. Apr 90, 1p
In NASA, Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 5.

Keywords: *High temperature superconductors, Hysteresis, *Magnetic flux, Magnetization, Defects, Electric current, Impurities, Time dependence, *Superconductors.

Because high temperature superconductors, including YBCO and BSCCO, are type 2 superconductors with relatively low $H(\text{sub } c \text{ 1})$ values and high $H(\text{sub } c \text{ 2})$ values, they will be in a critical state for many of their applications. In the critical state, with the applied field between $H(\text{sub } c \text{ 1})$ and $H(\text{sub } c \text{ 2})$, flux lines have penetrated the material and can form a flux lattice and can be pinned by structural defects, chemical inhomogeneities, and impurities. A detailed knowledge of how flux penetrates the material and its behavior under the influence of applied fields and current flow, and the effect of material processing on these properties, is required in order to apply, and to improve the properties of, these superconductors. When the applied field is changed rapidly, the time dependence of flux change can be divided into three regions, an initial region which occurs very rapidly, a second region in which the magnetization has a $1/n(t)$ behavior, and a saturation region at very long times. A critical field is defined for depinning, $H(\text{sub } c, p)$ as that field at which the hysteresis loop changes from irreversible to reversible. As a function of temperature it is found that $H(\text{sub } c, p)$ is well described by a power law with an exponent between 1.5 and 2.5. The behavior of $H(\text{sub } c, p)$ for various materials and its relationship to flux flow and flux dynamics are discussed.

001,517
N90-27860/7

(Order as N90-27792/2, PC A07/MF A02)
National Inst. of Standards and Technology, Gaithersburg, MD.
Processing Bi-Pb-Sr-Ca-Cu-O Superconductors From Amorphous State.(Abstract Only).

C. K. Chiang, S. W. Freiman, W. Wong-Ng, N. M. Hwang, and A. J. Shapiro. Apr 90, 1p
In NASA, Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 110.

Keywords: *Superconductors, Amorphous materials, Ceramics, Glass, Superconductivity, Alternating current, Aluminum, Bismuth, Calcium, Copper oxides, Heat, *High temperature superconductors, *Bismuth strontium, Calcium cuprates.

Researchers produced superconducting ceramics of the Bi-Pb-Sr-Ca-Cu-O system started from a glass. To form the glass, the mixed oxide powder was melted at 1200 C in air. The liquid was quenched rapidly by pouring it onto an aluminum plate and rapidly pressing with another plate. The quenched compound was in the form of black amorphous solid, whose x-ray powder pattern has no crystalline peaks. After heat treatment at high temperatures, the glass crystallized into a superconductor. The crystalline phases in the superconductor identified using x-ray diffraction patterns. These phases were that associated with the superconducting phases of $T(\text{sub } c) = 80$ K ($\text{Bi}_2\text{Ca}_1\text{Sr}_2\text{Cu}_2\text{O}_x$) and of $T(\text{sub } c) = 110$ K ($\text{Bi}_2\text{Ca}_2\text{Sr}_2\text{Cu}_3\text{O}_x$). The dc resistivity and the ac susceptibility of these superconductors were studied.

001,518
N90-27864/9

(Order as N90-27792/2, PC A07/MF A02)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.

Measurement of H(Sub c1) in a Single Crystal of YBa2Cu3O7 with Low Pinning.(Abstract Only).

D. L. Kaiser, F. W. Gayle, L. J. Swartzendruber, and L. H. Bennett. Apr 90, 1p
In NASA, Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 116.

Keywords: Abrikosov theory, Crystal structure, Demagnetization, Magnetization, Pinning, Single crystals, *High temperature superconductors, *Yttrium barium cuprates, *Superconductors, Flux pinning.

The measurement of $H(\text{sub } c \text{ 1})$ in barium yttrium copper oxide (YBCO) is often ambiguous because the presence of large pinning forces makes it difficult to discern exactly where the first deviation from linearity occurs. In addition there are complications because demagnetizing factors are often not well known. By utilizing a single crystal of YBCO with a nearly cubic shape, the uncertainty in the demagnetizing factor was minimized. In addition, the crystal used exhibited a very small amount of pinning with H applied perpendicular to the c axis, and a sharp break in the initial magnetization vs. field curve could be observed over a wider range of temperature. This allowed a precise determination of $H(\text{sub } c \text{ 1})$. The measured values of $H(\text{sub } c \text{ 1})$ could be well described by the Abrikosov relation with a Ginzburg-Landau parameter which varied linearly with temperature.

001,519
N90-27865/6

(Order as N90-27792/2, PC A07/MF A02)
National Inst. of Standards and Technology (MSEL), Gaithersburg, MD.

Studies of Iron Impurities in Y(x)Pr(1-x)Ba2Cu3O(7-delta).(Abstract Only).

L. J. Swartzendruber, L. H. Bennett, J. Ritter, M. Rubinstein, and M. Z. Harford. Apr 90, 1p
In NASA, Goddard Space Flight Center, Amsahts 1990: Advances in Materials Science and Applications of High Temperature Superconductors p 117.

Keywords: Antiferromagnetism, Crystal structure, Impurities, Iron, *Superconductivity, Neel temperatures, Hypotheses, Oxides, Oxygens, *High temperature superconductors, Yttrium barium cuprates.

Pr is the only rare earth which, when substituted for Y in $\text{YBa}_2\text{Cu}_3\text{O}_7$, significantly alters the superconducting transition temperature $T(\text{sub } c)$ without changing the crystal structure. For $\text{Y}_x\text{Pr}_{1-x}\text{Ba}_2\text{Cu}_3\text{O}_{7-\delta}$ with delta approx. equal to 0, $T(\text{sub } c)$ is reduced rapidly as x is increased, reaching zero for x about 0.5. For x above 0.5 the compound is antiferromagnetic with a Neel temperature that increases with increasing x, rising to above room temperature for x near 1. A similar behavior is observed when the oxygen deficit delta is increased from zero to 1 with $x=0$. For the case of Pr substitution, the drop in $T(\text{sub } c)$ is believed due to magnetic interactions. For the case of varying delta with $x=0$, the drop can be attributed to a combination of magnetic interactions, band filling, and changes in crystal structure. To study these effects, the Mossbauer effect of 57 Fe atoms substituted for the Cu atoms has been observed as a function of delta, x, and temperature. The observed spectra are well described

by a two quadrupole-split pairs, a central singlet, and a six-line magnetic hyperfine field pattern. For several Pr compositions both delta and temperature were varied, and the results support the hypothesis that a magnetic interaction exists between the Fe in the Cu lattice and the substitutional Pr atoms.

001,520

PB90-135807 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.

Influence of Equilibrium Shape on Heterogeneous Nucleation Textures.

Final rept.
J. W. Cahn, and J. Taylor. 1988, 5p
Pub. in Phase Transformations 1987, p545-549 1988.

Keywords: *Crystal growth, *Nucleation, Surfactants, Substrates, Texture, Anisotropy, Reprints, *Crystal orientation.

The authors explore a factor that affects the orientation of crystals nucleated onto a substrate, and discover that it leads to predictions of abrupt orientation changes (bifurcations) under certain conditions that are amenable to experimental control. They also find conditions of continuous orientation changes as well as a locking into orientation of high symmetry. A two-dimensional example is worked out in detail.

001,521

PB90-135880 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Kim Model for Magnetization of Type-II Superconductors.

Final rept.
D. X. Chen, and R. B. Goldfarb. 1989, 12p
Sponsored by Department of Energy, Washington, DC.
Pub. in Jnl. of Applied Physics 66, n6 p2489-2500, 15 Sep 89.

Keywords: *Superconductors, Magnetic hysteresis, Magnetization, Reprints, Critical current, Kim model, Bean model, One-dimensional calculations.

The authors have calculated the initial magnetization curves and complete hysteresis loops for hard type-II superconductors. The critical-current density J_c is assumed to be a function of the internal magnetic field $H(i)$ according to Kim's model, as is the case for other critical-state models, additional assumptions are that bulk supercurrent densities are equal to J_c and that the lower critical field is zero. The authors' analytic solution is for an infinite orthorhombic specimen with finite rectangular cross section, $2a \times 2b$ (a less than b), in which a uniform field H is applied parallel to the infinite axis. Assuming equal flux penetration from the sides, the authors reduced the two-dimensional problem to a one-dimensional calculation.

001,522

PB90-135906 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Ceramics Div.

Low Temperature Thermal Processing of Ba(sub 2)YCu(sub 3)O(sub 7-x) Superconducting Ceramics.

Final rept.
C. K. Chiang, L. P. Cook, S. S. Chang, J. Blendell, and R. S. Roth. 1987, 9p
Pub. in Advanced Ceramic Materials 2, n3B p530-538 1987.

Keywords: *Barium oxides, *Yttrium oxides, *Copper oxides, *Superconductors, *Ceramics, *Differential thermal analysis, Temperature, Oxidation, Processing, Reprints, Thermal gravimetric analysis.

Thermal processing of superconducting ceramics, $\text{Ba}_2\text{YCu}_3\text{O}_{7-x}$ was studied in the temperature range below 750 deg C. The ceramic was reversible under thermal treatment. The optimized temperature for oxidizing the ceramics was discussed.

001,523

PB90-135914 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

PHYSICS

Solid State Physics

Orientation Distribution of Fiber-Axes and Neutron Powder Diffraction Profiles.

Final rept.
C. S. Choi, and H. J. Prask. 1988, 7p
Pub. in Proceedings of ICOTOM: International Conference on Textures of Materials (8th), Santa Fe, NM., September 20-25, 1987, p215-221 1988.

Keywords: *Crystallites, *Orientation, *Neutron diffraction, *Fiber metallurgy, Extruding, Tungsten, Texture, Metals, Uranium alloys, Metal swaging, Rods, Distribution functions, Depleted uranium, Rietveld method.

Crystallite orientation distributions of extruded tungsten rod and cold-worked depleted uranium alloys were studied by neutron diffraction. The orientation distribution profile of the fiber-axis of an extended W-rod was obtained directly from the rocking-curve measurement of the fiber-axis reflection, (110). The distribution of the fiber-axes could be described quite satisfactorily by either of two distribution functions and the crystallite orientation distribution functions of the depleted uranium alloys were determined by an iterative profile-fitting of model structures to the four pole figures, (200) (111) (112) and (131). The textures were found to be (252)/(041) duplex fiber texture for the 60% swaged samples and (252)/(051) for the 75% swaged samples. The Rietveld profile refinement program was modified to correct for the fiber-texture type orientation distributions, and used for the final adjustment of the texture parameters and the structural parameters.

001,524
PB90-136284 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effect of Electron-Hole Plasmas on the Density of States of Silicon and GaAs.
Final rept.
J. R. Lowney. 1989, 5p
Pub. in Jnl. of Applied Physics 66, n9 p4279-4283, 1 Nov 89.

Keywords: *Gallium arsenides, *Silicon, *Energy gap, Conduction bands, Valence bands, Photoluminescence, Reprints, Narrow gap semiconductors, Density of states.

The densities of states of the conduction and valence bands of silicon and GaAs have been calculated at 300 K for the case of an electron-hole plasma, which can occur at high-injection levels in bipolar devices or in bulk material under intense optical excitation. The results show considerable narrowing of the band gap, which needs to be included in the analysis of device measurements or the interpretation of photoluminescence data. Furthermore, the band-gap narrowing that results from dopant ions is reduced by excess carriers because of the reduced free-carrier screening radius.

001,525
PB90-136334 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Break Junction Measurement of the Tunneling Gap of a Thallium-Based High-Temperature Superconductor Crystal.
Final rept.
J. Moreland, D. S. Ginley, E. L. Venturini, and B. Morosin. 1989, 3p
Pub. in Applied Physics Letters 55, n14 p1463-1465, 2 Oct 89.

Keywords: *Superconductors, *Electron tunneling, *Energy gap, Single crystals, Reprints, *High temperature superconductors, *Thallium calcium barium cuprates, Barium calcium thallium cuprates.

The authors have used the break junction method to measure the tunneling gap of a thallium-based high-temperature superconductor crystal in liquid helium at 4 K. The crystal was predominantly $Tl_2CaBa_2Cu_2O_7$ and had a superconducting onset temperature of 105 K. Tunneling data showed a symmetric gap about zero bias between two well-defined conductance peaks in the conductance versus voltage curve. The gap is consistent with a Bardeen-Cooper-Schrieffer energy gap (Δ) of 30 meV assuming a superconductor-insulator-superconductor electrode configuration. In addition, a supercurrent could be detected when the break junction was operated in a point-contact mode at temperatures as high as 95 K.

001,526
PB90-136466 Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Physics Div.
Metallicity and Gap States in Tunneling to Fe Clusters on GaAs(110).
Final rept.
P. N. First, J. A. Stroschio, R. A. Dragoset, D. T. Pierce, and R. Celotta. 1989, 4p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Physical Review Letters 63, n13 p1416-1419, 25 Sep 89.

Keywords: *Gallium arsenides, *Iron, Energy gap, Interfaces, Substrates, Clumps, Reprints, *Metallicity, *Tunnel effect, Band theory, Clusters.

The authors report the characteristics of tunneling to a GaAs(110) substrate with distinct, nanometer-size Fe clusters, as a function of distance from, and size of, the clusters. It is shown that Fe clusters of volumes about 150 \AA^3 cubed, corresponding to about 13 atoms, are observed to be nonmetallic with a gap at the Fermi level. Larger clusters with > 35 atoms begin to show metallic characteristics. A continuum of cluster-induced gap states is observed in tunneling to the GaAs substrate surrounding the metallic Fe clusters. The decay length of these states has a minimum decay of 3.4 \AA at midgap and diverges at the valence- and conduction-band edges.

001,527
PB90-136490 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Oxygen Vacancies and Defect Electronic States on the SnO(sub 2)(110)-1x1 Surface.
Final rept.
D. F. Cox, T. B. Fryberger, and S. Semancik. 1988, 12p
Pub. in Physical Review B-Condensed Matter 38, n3 p2072-2083 1988.

Keywords: *Tin oxides, Vacancies(Crystal defects), Ultraviolet radiation, Electrical properties, Surfaces, Oxygen, Reprints, Electronic structure, Ion scattering, Photoemission, Photoelectron spectroscopy.

Ultraviolet photoemission (UPS) and ion scattering (ISS) have been used to study surface oxygen vacancies produced by heating a well-oxidized, nearly perfect (110) tin oxide surface. Observed defects states have been associated with the loss of bridging oxygen atoms below 800K, and the loss of in-plane oxygen above 800K. Although both defects lead to band gap emission, the electronic states connected to the in-plane vacancies extend to the Fermi level, and cause changes in the surface electrical properties of SnO₂.

001,528
PB90-136508 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Chemical Process Metrology Div.
Oxygen-Vacancy-Derived Defect Electronic States on the SnO(sub 2)(110) Surface.
Final rept.
D. F. Cox, T. B. Fryberger, and S. Semancik. 1988, 2p
Sponsored by Microelectronics Center of North Carolina, Research Triangle Park.
Pub. in Jnl. of Vacuum Science and Technology A-Vacuum Surfaces and Films 6, n3 p828-829 1988.

Keywords: *Tin oxides, Ultraviolet radiation, Vacancies(Crystal defects), Energy gap, Surfaces, Oxygen, Reprints, Photoelectron spectroscopy, Ion scattering, Electronic structure.

A characterization of oxygen vacancies on the (110)-1 x 1 surface of rutile-structured SnO₂ is investigated. Defect electronic states in the band gap are demonstrated to be associated with two different types of surface oxygen vacancies.

001,529
PB90-136623 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Finite Element Model of Stress Wave Topology in Unidirectional Graphite/Epoxy: Wave Velocities and Flux Deviations.
Final rept.
R. D. Kriz, and P. R. Heyliger. 1989, 8p
Pub. in Review of Progress in Quantitative Nondestructive Evaluation, v8A p141-148 1989.

Keywords: *Stress waves, *Topology, *Oriented fiber composites, *Velocity, Mathematical models, Wave

propagation, Plane waves, Nondestructive tests, Arrays, Laminates, Reprints, *Finite element method, *Graphite-epoxy composites.

The topological propagation of stress waves in off-axis unidirectional fiber-reinforced composites was modeled with finite elements. Solutions for the large required finite element grids are obtained in a reasonable computation time by using the large memory and vectorizable features of the Cyber 205. Waves are observed to propagate off of the fiber axis in a unidirectional graphite/epoxy plate. Wave speeds and Pointing vectors are predicted and compared with exact solutions to Christoffel's equations. The comparison is excellent for the cases of plane stress and plane strain. Most significant is observing the actual wave topologies for quasitransverse and quasilongitudinal waves. Hence, the geometric distribution of waves can be observed in composites. Potential applications are numerous: the study of wave interaction with damage in laminated composites and the design of NDE arrays which match with the predicted wave topologies are some topics that are now being studied.

001,530
PB90-136631 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Thermoelastic Coefficient and Its Pressure Derivative: Derivation from a Mie-Grueneisen Interatomic Potential.
Final rept.
H. M. Ledbetter, M. Lei, and R. R. Rao. 1989, 4p
Pub. in Physica B 159, p265-268 1989.

Keywords: *Thermoelastic theory, Elastic properties, Bulk modulus, Reprints, Interatomic potentials, Pressure dependence.

Using a Mie-Grueneisen interatomic potential, the authors derived a relationship for the thermoelastic coefficient K, the temperature change caused by stress, and for the thermoelastic-coefficient pressure derivative. The latter, related to third-order and fourth-order elastic constants, relates simply and approximately to both the bulk-modulus temperature derivative, and the bulk-modulus pressure derivative.

001,531
PB90-136664 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Relativistic BCS-OHR Model.
Final rept.
I. H. Lin, and R. B. Thompson. 1989, 8p
Pub. in Proceedings of International Conference on Fracture (7th), Houston, TX., March 20-24, 1989, p787-794.

Keywords: *Cracking(Fracturing), *Dislocations(Materials), *BCS theory, Fatigue(Materials), Crack resistance, Fracturing, Mechanical properties, Plastic properties, Steady state, Dynamics, Models.

The simple one-dimensional BCS-Ohr model of fracture can be generalized to relativistic steady state motion and can serve as very simple and analytic zero order approximation for the dynamic fracture and crack arrest problem.

001,532
PB90-136698 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Absorption Cross Section of As in Si.
Final rept.
J. Geist, M. G. Stapelbroek, and M. D. Petroff. 1989, 5p
Pub. in SPIE (Society of Photo-Optical Instrumentation Engineers)-Test and Evaluation of Infrared Detectors and Arrays 1108, p51-55 1989.

Keywords: *Arsenic, *Silicon, *Absorption cross sections, Epitaxy, Cryogenics, Reprints, Ionization cross sections, Photoionization, Infrared absorption.

Infrared absorption cross sections of As in Si near zero Kelvin have recently been measured in two different investigations. The average of the integrals of the cross section over photon wavenumber was 8.64×10 to the -13 th power/cm. This is nearly equal to the value predicted by the oscillator-strength sum rule. Between 500 and 1000/cm, the absorption cross sections reported here agree very well with 0.7 times the

currently accepted formula for the photoionization cross section of As in Si. Calibration errors in spreading resistance measurements on epitaxial layers seem to be the cause of the 0.7 multiplicative error in the photoionization formula. Above 1000/cm, 0.7 times the value from the formula predicts a larger photoionization cross section than the absorption cross sections reported here. This is apparently caused by the impact ionization of donor electrons from impurity atoms by energetic photoionized electrons.

001,533

PB90-149071

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Surface Science Div.

Photons, Rotons and Fractionally-Charged Vortices in the Quantum Hall Effect.

Final rept.

S. M. Girvin. 1988, 13p

Pub. in *Interfaces, Quantum Wells, and Superlattices*, p319-331 1988.

Keywords: *Hall effect, Electron gas, Superfluidity, Helium 4, Vortices, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, Bose condensation, Two dimensional, Rotons.

The fractional quantum Hall effect (FQHE) is a remarkable many-body phenomenon occurring in the two-dimensional electron gas (2DEG) at low temperatures in a high magnetic field. The experimental manifestations of the effect follow from the existence of an excitation gap and are quite similar to those of the integer case, but the gap arises for rather different reasons: The FQHE is intrinsically a many-body phenomenon associated with Coulomb correlations, while the integer effect is primarily a one-body effect associated with localization. The paper explores further the FQHE with emphasis on the nature of the collective excitation modes and the origin of the gap. It turns out that a remarkable amount of progress can be made by drawing on analogies with superfluidity in (⁴He) films.

001,534

PB90-149113

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Electromagnetic Technology Div.

Thermal Contraction of Fiberglass-Epoxy Sample Mandrels and Its Effect on Critical-Current Measurements.

Final rept.

L. F. Goodrich, S. L. Bray, and T. C. Stauffer. 1989, 3p

Sponsored by Department of Energy, Washington, DC. Pub. in *Proceedings of Japan-U.S. Workshop on High-Field Superconducting Materials and Standard Procedures for High-Field Superconducting Materials Testing* (6th), Boulder, CO., February 22-24, 1989, p91-93.

Keywords: *Superconductors, Standards, Strains, *Critical current, *Niobium stannides, *Mounting, Interlaboratory comparisons, Fiberglass reinforced composites, Temperature effects, VAMAS.

A systematic study of the effect of sample mounting techniques on the superconducting critical-current measurement was made in conjunction with the VAMAS (Versailles Agreement on Advanced Materials and Standards) interlaboratory comparison (round robin) measurements. A seemingly small change in mandrel geometry can result in a 40% change in the measured critical current of a Nb₃Sn sample at 12 T. This is a result of a change in the conductor pre-strain at 4 K caused by variation in thermal contraction between thick- and thin-walled fiberglass-epoxy composite (G-10) tubes. An approximate measure of the variations in thermal contraction (from room to liquid nitrogen temperature) indicates a 0.2% greater contraction for the thick-walled tube. This difference, combined with strain sensitivity measurements, is consistent with the observed decrease in critical current.

001,535

PB90-149121

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD, Reactor Radiation Div.

Suppression of Superconductivity by Antiferromagnetism in Tm(sub 2)Fe(sub 3)Si(sub 5).

Final rept.

J. A. Gotaas, H. F. Braun, P. Klavins, J. W. Lynn, and R. N. Shelton. 1987, 4p

Pub. in *Physical Review B-Condensed Matter* 36, n13

p7277-7280 1987.

Keywords: *Superconductors, *Antiferromagnetism, Thulium compounds, Iron inorganic compounds, Sili-

cides, Neutron diffraction, Phase diagrams, Reprints, High pressure.

Powder neutron diffraction experiments at pressures up to 8.2 kbar and temperatures down to 0.3 K have been performed on the antiferromagnetic ternary compound Tm₂Fe₃Si₅. For pressures between 2 and 21 kbar, this system becomes superconducting at (T_{sub c1})(T_{sub N}), with a subsequent reentrance to the normal conducting state at (T_{sub c2})(T_{sub N}). Measurements demonstrate that the antiferromagnetic structure is unchanged under pressure, with no evidence for a ferromagnetic component at any pressure that would compete with the superconducting phase. This is the first experimental observation of the quenching of superconductivity by a purely antiferromagnetic state.

001,536

PB90-149261

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Surface Science Div.

Off-Diagonal Long-Range Order in the Quantum Hall Effect.

Final rept.

S. M. Girvin. 1988, 14p

Pub. in *Interfaces, Quantum Wells, and Superlattices*, p333-346 1988.

Keywords: *Hall effect, Electron gas, Superfluidity, Phonons, Reprints, *Fractional Quantum Hall effect, *Quantum Hall effect, Order parameters, Symmetry breaking, Bose condensation, Collective excitations, Rotons.

It was shown in the author's previous lecture on collective excitations that it was quite useful to study analogies between the fractional quantum Hall effect (FQHE) and superfluidity and superconductivity in films. Superfluids and superconductors are characterized by a spontaneously broken gauge symmetry and an associated order parameter. The lecture investigated the question of whether or not there exists an order parameter which describes the FQHE state, possibly associated with some type of symmetry breaking.

001,537

PB90-149279

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD, Gas and Particulate Science Div.

Micro-Raman Spectroscopy of High-T(sub c) Superconductors in the Y-Ba-Cu-O System.

Final rept.

E. S. Etz, W. Wong-Ng, J. E. Blendell, and C. K.

Chiang. 1988, 6p

Pub. in *Microbeam Analysis*, p187-192 1988.

Keywords: *Raman spectroscopy, *Superconductors, Vibrational spectra, Microanalysis, Microstructure, Single crystals, Polycrystalline, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Barium yttrium cuprates, Microprobes.

Described is the application of micro-Raman spectroscopy to the microstructural characterization of superconducting materials in the Y-Ba-Cu-O system. Experimental detail is given of the measurement parameters employed in the Raman microprobe study of these materials. Three types of samples are investigated relative to microstructural homogeneity, composition, and crystal structure. These samples are polycrystalline ceramic powders, sintered ceramic pellets, and a specimen of single-crystal material. Of interest is the characterization of these samples relative to their fabrication and processing history and the resultant phase relationships. The micro-Raman spectra are examined on the basis of the reported vibrational data (Raman and infrared) for materials in this system of both tetragonal and orthorhombic symmetry. Conclusions are drawn relative to the heterogeneity of these polyphase materials.

001,538

PB90-149329

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD, Ceramics Div.

Bonding Structure of Silicon Oxide Films.

Final rept.

A. Feldman, Y. N. Sun, and E. N. Farabaugh. 1988,

3p

Pub. in *Jnl. of Applied Physics* 63, n6 p2149-2151, 15

Mar 88.

Keywords: *Silicon oxides, Silicon dioxide, Dielectric films, Oxygen, Reprints, *X ray photoelectron spectroscopy, Random mixture model, Random bond model, Clusters.

X-ray photoelectron spectroscopy measurements of the O 1s and Si 2p lines in films of the SiO_x system have been interpreted on the basis of the random network model. Fitting of the spectra to five lines corresponding to five silicon centered tetrahedral configurations yield the relative proportion of each tetrahedron in the film. The distributions agree neither with the random mixture model nor with the random bond model (RBM). The total oxygen in the films exceeds the amount of oxygen in the tetrahedral structures indicating the presence of molecular oxygen, water, peroxy bonding or other forms of oxygen not bonded to silicon. The general features of the distributions can be explained on the basis of silicon clusters, unincorporated oxygen, and the RBM.

001,539

PB90-149337

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD, Reactor Radiation Div.

Long Wavelength Spin-Wave Energies and Linewidths of the Amorphous Invar Alloy Fe(sub 100-x)B(sub x).

Final rept.

J. A. Fernandez-Baca, J. W. Lynn, J. J. Rhyne, and

G. E. Fish. 1987, 15p

Pub. in *Physical Review B* 36, n16 p8497-8511, 1 Dec

87.

Keywords: *Iron alloys, Boron containing alloys, Neutron scattering, Line width, Magnons, Invar, Reprints, *Spin waves, Heisenberg ferromagnets, Amorphous materials.

Neutron inelastic scattering experiments have been performed to investigate the long wavelength spin dynamics of the amorphous rapidly-quenched isotropic ferromagnet Fe(100-x)B(x) (for x = 14, 18). At both iron concentrations this system exhibits Invar behavior, where the thermal expansion is almost completely cancelled by a large positive magnetostriction. The spin-wave energies are found to be well described by a quadratic dispersion relation. The stiffness parameter D renormalizes with temperature as predicted by the two-magnon interaction theory of the Heisenberg ferromagnet, although the renormalization is more dramatic than expected for short-range interactions.

001,540

PB90-149386

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Electromagnetic Technology Div.

VAMAS (Versailles Project on Advanced Materials and Standards) Interlaboratory Comparisons of Critical Current versus Strain in Nb(sub 3)Sn.

Final rept.

J. W. Ekin. 1989, 5p

Pub. in *Proceedings of Japan-U.S. Workshop on High-Field Superconducting Materials and Standard Procedures for High-Field Superconducting Materials Testing* (6th), Boulder, CO., February 22-24, 1989, p94-98.

Keywords: *Superconductors, Magnetic fields, Strains, Reprints, *Niobium stannides, *Critical current, Interlaboratory comparisons, VAMAS.

A comparison is made of measurements of the effect of axial tensile strain on the critical current of multifilamentary Nb₃Sn superconductors by three different laboratories. Two of the laboratories used short sample testing apparatus wherein a straight section of conductor was cooled in a force-free state. One of the laboratories used a spring apparatus wherein a long sample was reacted in a coil shape and attached to a spring sample holder.

001,541

PB90-149394

Not available NTIS

National Inst. of Standards and Technology (NIST), Boulder, CO. Electromagnetic Technology Div.

Transverse Stress Effect on the Critical Current of Internal Tin and Bronze Process Nb(sub 3)Sn Superconductors.

Final rept.

J. W. Ekin, S. L. Bray, P. Danielson, D. Smathers, R. L. Sabatini, and M. Suenaga. 1989, 3p

Pub. in *Proceedings of Japan-U.S. Workshop on High-Field Superconducting Materials and Standard Procedures for High-Field Superconducting Materials Testing* (6th), Boulder, CO., February 22-24, 1989, p50-52.

Keywords: *Superconductors, Reprints, *Niobium stannides, *Critical current, Transverse stress.

The effect of transverse stress on the critical current density $J(c)$ has been shown to be significant in bronze process Nb₃Sn, with the onset of significant degradation occurring at about 50 MPa. In an applied field of 10 T, the magnitude of the effect is about seven times larger for transverse stress than for axial tensile stress. The authors have also measured the effect in an internal tin conductor with excess tin, which yields a more equiaxed Nb₃Sn grain morphology than for bronze process Nb₃Sn, where the grains tend to be more columnar. The effect of transverse stress on $J(c)$ was nearly identical for the two conductors, indicating that the transverse stress effect is probably not dependent on grain morphology.

001,542
PB90-149402 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Dependence of the Critical Current on Angle between Magnetic Field and Current in Y-, Bi-, and Tl-Based High-T(sub c) Superconductors.
Final rept.

J. W. Ekin, and T. M. Larson. 1989, 3p
Contract DE-AI01-84ER52113
Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of Japan-U.S. Workshop on High-Field Superconducting Materials and Standard Procedures for High-Field Superconducting Materials Testing (6th), Boulder, CO., February 22-24, 1989, p61-63.

Keywords: *Superconductors, Magnetic fields, Polycrystalline, Bismuth oxides, Reprints, *High temperature superconductors, *Critical current, Yttrium barium cuprates, Thallium oxides.

The change in $J(c)$ with angle between applied field and current depends on the magnetic field regime. There is essentially no change at low fields, where $J(c)$ is not determined by pinning but rather by self field effects. At intermediate fields in the plateau regime, the effect typically amounts to a 50 to 300% enhancement in $J(c)$ for the force-free case, comparable in magnitude to conventional superconductors, indicating a nearly isotropic well-connected network of percolation paths. At high fields, the field angle effect becomes negligible, indicating that the percolation paths in the high-field regime become more disconnected and highly convoluted with some section of each percolation path perpendicular to the applied field independent of the angle.

001,543
PB90-149444 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Magnetoelasticity and Structure of Er/Y Superlattices.
Final rept.

R. W. Erwin, J. J. Rhyne, J. Borchers, M. B. Salamon, R. Du, and C. P. Flynn. 1988, 3p
Pub. in Jnl. of Applied Physics 63, n8 pt2A p3461-3463, 15 Apr 88.

Keywords: Erbium alloys, Yttrium alloys, Single crystals, Magnetostriction, Neutron diffraction, Reprints, *Superlattices, Molecular beam epitaxy, Magnetic ordering, Spin waves.

Single crystal superlattices (Er(x)/Y(y)) have been grown by molecular-beam epitaxy techniques with the c-axis perpendicular to the growth plane. The magnetic structure has been determined by neutron diffraction, and demonstrates long range order of the c-axis Ising-like Er moments extending through the 'magnetically dead' Y layers as was found for the X-Y superlattices (Dy(x)/Y(y)).

001,544
PB90-149451 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Magnetic Structure of Dy-Y Superlattices.
Final rept.

R. W. Erwin, J. J. Rhyne, M. B. Salamon, J. Borchers, S. Sinha, R. Du, J. E. Cunningham, and C. P. Flynn. 1987, 18p
Pub. in Physical Review B 35, n13 p6808-6825 1987.

Keywords: Dysprosium alloys, Yttrium alloys, Metal films, Magnetostriction, Neutron diffraction, Reprints, *Superlattices, Molecular beam epitaxy, Magnetic ordering, Spin waves.

Superlattices of (Dy₁₅ Y₁₄)₆₄ and (Dy₉(Dy_{0.5}Y_{0.5})₈)₉₀ produced by molecular beam

epitaxy techniques are shown by neutron diffraction to order magnetically in a helix which is incommensurate with the bilayer thickness. The phase coherence of this ordering extends over several bilayers, and is especially striking in the sample where the layers of localized Dy spins are separated by 14 atomic planes of non-magnetic Y. The fact that the helix chirality propagates across several bilayers rules out a simple scalar RKKY coupling between the Dy planes on either side of a Y layer, but suggests instead that a helical spin density wave is induced in the Y conduction electrons. A simple model for the superlattice structure factor demonstrates that observed asymmetries in the magnetic diffraction peak intensities can be ascribed to the existence of different magnetic modulation wave-vectors in each layer type (Dy and Y).

001,545
PB90-149501 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Tunneling through a Spin-Polarizing Barrier: Boltzmann Equation Study.
Final rept.

M. J. DeWeert, and S. M. Girvin. 1988, 6p
Pub. in Physical Review B 37, n7 p3428-3433 1988.

Keywords: *Electron tunneling, Boltzmann equation, Distribution functions, Superconductors, Reprints, *Electron spin polarization, Magnetic insulators.

The authors investigated the nonequilibrium distribution functions for electrons in the electrodes of an M-I-M junction where the insulator is a ferromagnet with its domains aligned parallel to the interfaces. In this geometry, the tunneling barrier for spin-up electrons differs from that for spin-down electrons, so that the two spins tunnel at different rates. If the junction is biased so that the fermi levels on the right and left are shifted to $(\mu - 1/2eV)$ and $(\mu + 1/2eV)$, respectively, it is found that the electrons are spin polarized in the steady state. Electrons in the right electrode are polarized in the direction opposite those on the left. The spin polarization increases with voltage and tunneling conductance and decreases as the spin relaxation time falls. The authors also consider the possibility of the presence of the spin polarization in the quasiparticle branch of the current when the metals are superconducting, and suggest experiments to observe the effect.

001,546
PB90-149535 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Structure of Asymmetric Small-Angle Grain Boundaries.
Final rept.

D. P. DiVincenzo, and C. Rottman. 1988, 10p
Pub. in Physical Review B 37, n10 p5242-5251, 1 Apr 88.

Keywords: *Dislocations(Materials), *Grain boundaries, Reprints, *Crystal dislocations, Ising model, Devils staircase.

The authors studied the energetics and the structure of small-angle tilt grain boundaries (i.e., dislocation walls). By considering the elastic properties of groups of dislocations, it is shown that the structure of the Wulff plot is much richer than previously expected. Previous calculations found that the insertion of a single step costs a logarithmically divergent energy; it is shown that this step energy can be made finite if elastic screening is taken into account. Stepped structures lead to a whole series (i.e., a devil's staircase) of commensurate boundary orientations. Also, a first-order phase boundary is found. The authors speculate on the relation between these features and those of other models (e.g., the Ising model with long-range antiferromagnetic interactions) which exhibit a devil's staircase phase diagram.

001,547
PB90-150046 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Role of Multiple Scattering in XPS and Auger Electron Diffraction in Crystals.
Final rept.

W. F. Egelhoff. 1987, 4p
Pub. in Physical Review Letters 59, n5 p559-562, 3 Aug 87.

Keywords: *Electron diffraction, Auger electrons, X rays, Anisotropy, Nickel, Copper, Epitaxy, Reprints,

*Photoelectron spectroscopy, *Multiple scattering, Multilayers.

The angular anisotropies of x-ray photoelectron (XPS) and Auger peak intensities from Cu in epitaxial Ni-Cu-Ni(100) sandwich structures allow, for the first time, the breakdown of the observed diffraction from a crystal into the contribution from each layer of atoms. This data shows that the primary role of multiple scattering of the outgoing electron wave is to break up the coherence of the strong forward scattered beams which form upon the initial scattering events, i.e., scattering by nearest neighbor and next-nearest neighbor lattice atoms.

001,548
PB90-150111 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.
Processing: Property Relations for Ba(sub 2)YCu(sub 3)O(sub 7-x) High (T sub c) Superconductors.
Final rept.

J. E. Blendell, C. K. Chiang, D. C. Cranmer, S. W. Freiman, E. R. Fuller, E. Droscher-Krasicka, W. L. Johnson, H. M. Ledbetter, L. H. Bennett, L. J. Swartzendruber, R. B. Marinenko, R. L. Myklebust, D. S. Bright, and D. E. Newburg. 1987, 18p
Pub. in Advanced Ceramic Materials 2, n3B p512-529 1987.

Keywords: *Process variables, *Superconductors, *Ceramics, *Barium oxides, *Yttrium oxides, *Copper oxides, Mechanical properties, Magnetic properties, Powder(Mechanics), Pressing(Forming), Sintering, Annealing, Conductivity, Microstructure, Density(Mass/volume), Toughness, Modulus of elasticity, Transition temperature, Reprints, Temperature dependence.

Ba₂YCuO(7-x) ceramics were prepared by powder processing techniques, followed by pressing and sintering. Sintering was carried out at different temperatures in air or flowing O₂, followed by annealing. The subsequent superconducting transition temperature and the width of the transition as determined by both conductivity and A. C. spectroscopy was very sensitive to annealing temperature and atmosphere. The microstructure and density of the ceramics was also dependent on processing conditions. Compositional maps, fracture toughness and elastic modulus were obtained on the ceramics.

001,549
PB90-150202 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Two Simple Metal Vapor Deposition Sources for Downward Evaporation in Ultrahigh Vacuum.
Final rept.

D. A. Steigerwald, and W. F. Egelhoff. 1989, 2p
Pub. in Jnl. of Vacuum Science and Technology A 7, n5 p3123-3124 Sep/Oct 89.

Keywords: *Vapor deposition, *Vacuum deposition, Ultrahigh vacuum, Metal coatings, Performance, Design, Reprints, Costs.

The design and construction of two metal vapor deposition sources for a downward evaporation in ultra-high vacuum are described. The performance characteristics and estimated construction costs are discussed.

001,550
PB90-150228 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Physics Div.
Magnetic Microstructure of the (0001) Surface of hcp Cobalt.
Final rept.

J. Unguris, M. R. Scheinfein, R. J. Celotta, and D. T. Pierce. 1989, 3p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Applied Physics Letters 55, n24 p2553-2555, 11 Dec 89.

Keywords: *Cobalt, *Magnetic domains, Hexagonal close packed lattices, Microstructure, Surfaces, Reprints, Scanning electron microscopy, Electron spin polarization, Imaging techniques.

The magnetic domain structure of the (0001) surface of a hcp cobalt crystal was investigated using scanning electron microscopy with polarization analysis (SEMPA). This is the first observation by SEMPA of both out-of-plane and in-plane magnetization compo-

nents. The perpendicular magnetization imaged with SEMP showed a branched structure very similar to that previously observed by magneto-optic Kerr microscopy. In addition, a previously unobserved in-plane magnetic substructure was measured. The in-plane magnetization is divided into well-defined submicron domains that appear to reflect the sixfold symmetry of the crystal surface.

001,551

PB90-150236

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Physics Div.

Scanning Electron Microscopy with Polarization Analysis Studies of Ni-Fe Magnetic Memory Elements.

Final rept.

J. Unguris, M. R. Scheinfein, R. J. Celotta, and D. T. Pierce. 1989, 3p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Magnetics 25, n5 p4204-4206 Sep 89.

Keywords: Computer storage devices, Magnetic domains, Magnetic storage, Permalloys, Reprints, *Memory devices, Scanning electron microscopy, Electron spin polarization, Nonvolatile memories, Imaging techniques, Magnetic films.

The paper describes the use of Scanning Electron Microscopy with Polarization Analysis to quantitatively image the magnetic structure of permalloy magnetic memory elements. Various methods of determining the absolute magnitude and direction of the magnetization vector are described. The magnetic domain structures are observed as a function of ion milling time. During ion milling the surface composition is monitored by Auger analysis.

001,552

PB90-152471

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Magnetization of Imperfect Superconducting Grains.

Final rept.

R. L. Peterson. 1989, 4p

Pub. in Physical Review B 40, n4 p2678-2681, 1 Aug 89.

Keywords: *Superconductors, *Magnetization, Grain structure, Powder(Particles), Reprints, *High temperature superconductors, Bean model.

A critical-state theory of the magnetization of superconducting grains containing nonsuperconducting regions is presented which shows that the thickness of the sheath of supercurrents around these regions can be more important than the grain dimension in determining the magnetization. This may explain some apparently conflicting results on the magnetization of high-T(sub c) powders of different sizes.

001,553

PB90-153479

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Chemical Thermodynamics Div.

Histogram Specification as a Method of Density Modification.

Final rept.

R. W. Harrison. 1988, 4p

Pub. in Jnl. of Applied Crystallography 21, n6 p949-952 1988.

Keywords: Histograms, Proteins, Specifications, Reprints, *Fourier maps, Electron density, Image analysis.

A new method for improving the quality and extending the resolution of Fourier maps is described. The method is based on a histogram analysis of the electron density. The distribution of electron density values in the map is forced to have an 'ideal' distribution. The application of the method to improve the electron density map for the protein, Acinetobacter asparaginase, is included.

001,554

PB90-161985

PC A04/MF A01

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Technical Activities 1989, Surface Science Division.

C. J. Powell. Dec 89, 69p NISTIR-89/4224

See also report for 1988, PB89-161889.

Keywords: Surface chemistry, Thin films, Molecular structure, Synchrotron radiation, Standards, Interfaces, Bibliographies, *Surface science, Electron spectroscopy, National Institute of Standards and Technology.

The report summarizes technical activities of the NIST Surface Science Division during Fiscal Year 1989. These activities are in three principal areas: surface dynamical processes, thin films and interfaces, and surface spectroscopies and standards. A listing is given of publications, talks, professional committee participation, and professional interactions by the Division staff.

001,555

PB90-169285

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Resonant Photoemission Study of Superconducting Y-Ba-Cu-O.

Final rept.

R. L. Kurtz, D. Mueller, M. Osofsky, A. Shih, R. L. Stockbauer, L. E. Toth, and S. A. Wolf. 1987, 3p Pub. in Physical Review B-Condensed Matter 35, n16 p8818-8820 1987.

Keywords: Superconductors, Synchrotron radiation, Ultraviolet radiation, Valence bands, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Barium yttrium cuprates, Photoelectron spectroscopy, Photoemission, Electronic structure, Band theory, EV range 10-100, EV range 100-1000.

Ultraviolet photoelectron spectra of a 93 K superconducting compound, YBa₂Cu₃O₇ have been obtained using photon energies ranging from 25 to 180 eV. Resonant photoemission is used to identify the chemical origin of the features in the valence band electronic structure.

001,556

PB90-169301

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Polymers Div.

Electronic Properties, Superconductivity and Stability of the Ordered Alloys of the Ti-Rh, Zr-Rh and Hf-Rh Isoelectronic Systems.

Final rept.

R. Kuentzler, and R. M. Waterstrat. 1988, 7p

Sponsored by American Dental Association Health Foundation, Chicago, IL.

Pub. in Solid State Communications 68, n1 p85-91 Oct 88.

Keywords: *Rhodium intermetallics, *Titanium intermetallics, *Hafnium alloys, *Zirconium alloys, Rhodium alloys, Titanium alloys, Specific heat, Reprints, Magnetic susceptibility.

Experimental information on the electronic properties of the ordered Ti-Rh, Zr-Rh and Hf-Rh alloys has been obtained through low-temperature specific heat and magnetic susceptibility measurements. The relatively low density of states at the Fermi level for TiRh, ZrRh, HfRh, TiRh₃, ZrRh₃ and TiRh₃ is explained by a split-band regime which is typical of relatively stable ordered structures. Hf₂Rh (Ti₂Ni-type structure) is a superconductor with T(c) = 1.60 K and has a moderate gamma value.

001,557

PB90-169426

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Surface Forces and Fracture in Brittle Materials.

Final rept.

B. R. Lawn, and S. Lathabai. 1988, 10p

Sponsored by Office of Naval Research, Arlington, VA. Pub. in Materials Forum 11, p313-322 1988.

Keywords: *Surface energy, *Force, *Fracture properties, *Ceramics, *Brittle fracturing, Mica, Crack propagation, Kinetics, Interfaces, Diffusion, Chemical resistance, Hysteresis, Reprints.

The role of surface forces in the fracture of intrinsically brittle materials (ceramics) in chemical environments is examined. It is asserted that fundamental intersurface potential functions of the type directly measurable in the 'crossed cylinder' surface force apparatus of Israelachvili uniquely predetermine the crack mechanics, including healing and regrowth behavior. A critical element in the thesis is the presence of atomic-scale oscillations in the surface force function at small separations, corresponding to a short-range ordering influ-

ence of the confining solid structure on the intervening molecular species. It is contended that the oscillations should be manifest as metastable equilibrium states in fracture systems. Experimental data from cyclic crack growth tests on mica in moist atmospheres are used to support the contention. The data exhibit a certain hysteresis, in that the load to repropagate the cracks through a healed interface is lower than that initially required to propagate the cracks through the virgin material. For nonequilibrium configurations the data show strong kinetic characteristics, as represented in familiar crack velocity diagrams. A consideration of the near-tip crack profile indicates that the kinetics are controlled by activated motion (forward and backward) of the intrusive molecular species between interstitial sites at a severely constricted interface.

001,558

PB90-169855

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

2D and 3D Magnetic Behavior of Er in ErBa(sub 2)Cu(sub 3)O(sub 7).

Final rept.

J. W. Lynn, T. W. Clinton, W. H. Li, R. W. Erwin, J. Z. Liu, K. Vandervoort, and R. N. Shelton. 1989, 4p

Pub. in Physical Review Letters 63, n23 p2606-2609, 4 Dec 89.

Keywords: *Superconductors, Neutron scattering, Reprints, *Erbium barium cuprates, *Barium erbium cuprates, Antiferromagnetic materials, Magnetic superconductors, Magnetic ordering, Order parameters, Ising model.

Neutron scattering has been used to study the magnetic order of the Er ions in superconducting ErBa₂Cu₃O₇. Above the 3D Neel temperature (T(N) = 0.618 K) a rod of scattering characteristic of 2D behavior is unambiguously observed, showing that the magnetic interactions of the rare-earth ions are highly anisotropic; below T(N) the order parameter follows the exact Onsager solution for a 2D Ising antiferromagnet. At low T, two separate types of simple 3D antiferromagnetic structures are found, one characterized by a wave vector of (1/2, 0, 0), and the other by (1/2, 0, 1/2).

001,559

PB90-169863

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

X-ray Line Broadening Study on Shock-Modified Zirconia.

Final rept.

B. Morosin, R. A. Graham, Y. Zhang, J. M. Stewart,

and C. R. Hubbard. 1988, 9p

Pub. in Australian Jnl. of Physics 41, n2 p251-259 1988.

Keywords: *Zirconium oxides, X ray diffraction, Mechanical shock, Strains, Reprints, Line broadening, High pressure.

Zirconia (ZrO₂) powder compacts have been subjected to controlled, quantitative high pressure shock loading at peak pressures from 5-27 GPa and preserved for post-shock analysis. The overlapping, broadening x-ray diffraction peak profiles have been separated by least-squares fitting procedures. The separate lines have been analyzed in the usual manner to determine the residual lattice strain and the coherent crystallite size. Maximum modification effects are observed near 20 GPa with strain values near 0.003 and size values near 200 Å.

001,560

PB90-169996

PC A15/MF A02

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

NIST (National Institute of Standards and Technology) Reactor: Summary of Activities July 1988 through June 1989.

Technical note Jul 88-Jun 89.

C. O'Connor. Dec 89, 326p NIST/TN-1272

Also available from Supt. of Docs. See also PB89-168017.

Keywords: *Nuclear reactors, Crystal structure, Neutron diffraction, Neutron radiography, Nondestructive tests, Solid state physics, Nuclear physics, Isotopes, *National Institute for Standards and Technology, Activation analysis, Cold neutrons, Molecular dynamics.

PHYSICS

Solid State Physics

The report summarizes all those programs which use the NIST reactor. It covers the period for July 1988 through June 1989. The programs range from the use of neutron beams to study the structure and dynamics of materials through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, neutron radiography, and non-destructive evaluation.

001,561

PB90-170168

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Theoretical Models for High-Temperature Superconductivity.

Final rept.

R. C. Casella. 1988, 10p

Pub. in Nuovo Cimento 10 D, n12 p1439-1448 Dec 88.

Keywords: *Superconductors, Energy gap, Phonons, Reprints, *High temperature superconductors, *Band theory, Yttrium barium cuprates, Barium yttrium cuprates, Intermediate bosons.

A semi-phenomenological analysis is given of the effects of certain band structure features on the gap ratios $2\Delta/k_B T(e)$ for high- $T(e)$ superconductors, including multigap systems. In addition to phonons other intermediate bosons (IB) mediating the superconducting interaction are considered. Interesting results emerge when the IB energy exceeds the widths of possible narrow peaks in the density of states associated with sub-bands presumably belonging to substructures such as stacked Cu-O planes. Comparison with experiment is made. In particular, data obtained by Warren et al. via nuclear-spin relaxation on $Ba_2YCu_3O(7-\delta)$ can be interpreted within the present framework in terms of a model having an IB of energy approx = or > 1eV, which exceeds the predicted width (approx = or < 0.3eV) of a peak in the density of states containing the normal-state Fermi level. This suggests that the IB is not a phonon.

001,562

PB90-170242

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Donor-Shifted Phonon-Assisted Magneto-Optical Resonances in n-InSb.

Final rept.

C. L. Littler, W. Zawadzki, M. R. Loloee, X. N. Song,

and D. G. Seiler. 1989, 4p

Grant NSF-DMR86-17823

Sponsored by National Science Foundation, Washington, DC.

Pub. in Physical Review Letters 63, n26 p2845-2848, 25 Dec 89.

Keywords: *Indium antimonides, *Magneto-optics, Phonons, Impurities, Reprints.

The authors have observed and described new optical transitions between magnetodonor states in InSb, assisted by optic-phonon emission. The phonon-assisted transitions provide a unique opportunity to investigate high excited states of the magnetodonor system (up to principal quantum number $n=13$), which simulates the hydrogen atom in gigantic magnetic fields. High-resolution data reveal the presence of additional excited magnetodonor states related to lower Landau subbands unobserved until the present.

001,563

PB90-170275

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Nucleation and Growth of Cr on Stepped Surfaces with Facets: An FEEM (Field Electron Emission Microscopy) Study.

Final rept.

A. J. Melmed, and N. D. Shinn. 1987, 6p

Pub. in Jnl. of Physics Colloquium 48, nC-6 p33-38 Nov 87.

Keywords: *Chromium, *Crystal growth, Vapor deposited coatings, Electron microscopy, Thin films, Nucleation, Substrates, Tungsten, Rhenium, Reprints, Epitaxial growth.

The nucleation and epitaxial growth of Cr crystals resulting from vapor-deposition of Cr onto thermally annealed W and Re surfaces has been studied using field electron emission microscopy. The substrate surfaces consisted of low-index facets and terraces separated by atomic steps. Multiple nucleation, leading to polycrystal growth, could not be avoided on the Re sur-

faces. The Cr/W system was studied more extensively and was found to yield some surprising results. In the temperature range of about 500-1050 K, nucleation and growth of Cr crystals occurred only after 1-2 monolayers of Cr atoms had formed (the Stranski-Krastinov mode). However, at about 300 K on (011)W planes, two different growth modes were observed consistently, depending upon the vapor-deposition geometry; the Stranski-Krastinov or the Volmer-Weber mode.

001,564

PB90-170341

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Rare Earth Superlattices.

Final rept.

C. F. Majkrzak, D. Gibbs, P. Boni, A. I. Goldman, J.

Kwo, M. Hong, T. C. Hsich, R. M. Fleming, D. B.

McWhan, Y. Yafet, J. W. Cable, J. Bohr, H. Grimm,

and C. L. Chien. 1988, 6p

Pub. in Jnl. of Applied Physics 63, n8 p3447-3452 1988.

Keywords: *Rare earth elements, Neutron diffraction, Single crystals, Gadolinium, Dysprosium, Holmium, Yttrium, *Magnetic ordering, Superlattices, Molecular beam epitaxy.

The magnetic structures of several single-crystal, magnetic rare earth superlattice systems grown by molecular beam epitaxy are reviewed. In particular, the results of recent neutron diffraction investigations of long-range magnetic order in Gd-Y, Dy-Y, Gd-Dy, and Ho-Y periodic superlattices are presented. In the Gd-Y system, an antiphase domain structure develops for certain Y layer spacings, whereas modified helical moment configurations are found to occur in the other systems, some of which are commensurate with the chemical superlattice wavelength. References are made to theoretical interaction mechanisms recently proposed to account for the magnetic states of these novel materials.

001,565

PB90-170440

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Superconductivity in Bulk and Thin Films of La(sub 1.85)Sr(sub 0.15)CuO(sub 4-x) and Ba2YCu3O(sub 7-y).

Final rept.

K. Morjani, J. Bohandy, F. J. Adrian, B. F. Kim, R. D.

Shull, C. K. Chiang, L. J. Swartzendruber, and L. H.

Bennett. 1987, 3p

Pub. in Physical Review B: Condensed Matter 36, n7 p4036-4038 1987.

Keywords: *Superconductors, Electrical resistivity, Thin films, Reprints, *High temperature superconductors, *Superconducting films, *Lanthanum strontium cuprates, *Barium yttrium cuprates, *Yttrium barium cuprates, Magnetic susceptibility.

Bulk superconducting oxides with the composition $La(1.85)Sr(0.15)CuO(4-x)$ and $Ba_2YCu_3O(7-y)$ were fabricated and their superconducting properties measured using dc resistivity, complex ac susceptibility, and microwave absorption. The bulk materials were used to form thin films by a laser-aided deposition technique. The sensitive method of microwave absorption was used to establish that the thin films have superconducting properties similar to the bulk materials.

001,566

PB90-170523

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Development of Magnetic Anisotropies in Ultrathin Epitaxial Films of Fe(001) and Ni(001).

Final rept.

B. Heinrich, J. F. Cochran, A. S. Arrott, S. T. Purcell,

K. B. Urquhart, J. R. Dutcher, and W. F. Egelhoff.

1989, 18p

Pub. in Applied Physics A 49, p473-490 1989.

Keywords: *Magnetic anisotropy, Ferromagnetic resonance, Metal films, Thin films, Iron, Nickel, Copper, Silver, Substrates, Reprints, *Magnetic films, Molecular beam epitaxy, Brillouin effect, BCC lattices, FCC lattices.

Ultrathin films, bcc Fe(001) on Ag(001), fcc Fe(001) on Cu(001) and Fe/Ni(001) bilayers on Ag, were grown by molecular beam epitaxy. A wide range of surface science tools were employed to establish the quality of

epitaxial growth. Ferromagnetic resonance and Brillouin light scattering were used to extract the magnetic properties. Emphasis was placed on the study of magnetic anisotropies. Large uniaxial anisotropies with easy axis perpendicular to the film surface were observed in all ultrathin structures studied. These anisotropies were particularly strong in fcc Fe and bcc Fe films. In sufficiently thin samples the saturation magnetization was oriented perpendicularly to the film surface in the absence of an applied field. It has been demonstrated that in bcc Fe films the uniaxial perpendicular anisotropy originates at the film interfaces.

001,567

PB90-170549

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Summary, Omissions and Unanswered Questions.

Final rept.

S. M. Girvin. 1986, 19p

Pub. in Quantum Hall Effect, Chapter 10, p381-399

1987.

Keywords: *Hall effect, Ginzburg-Landau theory, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, Field theories.

A summary is presented of the questions discussed in the previous chapters concerning the integral and fractional quantum Hall effects. A list of remaining unsolved problems is presented, and some initial steps towards a Landau-Ginsburg theory of the fractional effect are taken.

001,568

PB90-170556

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Collective Excitations.

Final rept.

S. M. Girvin. 1987, 28p

Pub. in Quantum Hall Effect, Chapter 9, p353-380 1987.

Keywords: *Hall effect, Superfluidity, Vortices, Phonons, Reprints, *Fractional quantum Hall effect, *Quantum Hall effect, *Collective excitations, Rotons.

Neutral collective excitations in the fractional quantum Hall regime are investigated. Close similarities with the phenomena of superfluidity are found.

001,569

PB90-170804

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.

Specimen Biasing at Low Accelerating Voltages.

Final rept.

M. T. Postek. 1989, 5p

Pub. in Hitachi Instrument News 17, p12-16 Dec 89.

Keywords: *Electron microscopes, Field emission, Gallium arsenides, Backscattering, Secondary emission, Polymethyl methacrylate, Polyethylene, Bias, Reprints, *Scanning electron microscopy, Photoresists.

In a field emission scanning electron microscope such as the Hitachi S-800, biasing of the specimen may produce improved images at low beam energies (0.8 to 2.5 keV) especially when charging effects induced by the primary electron beam are present. Imaging in this mode is fundamentally backscattered electron derived. Examples of such improvement are given for uncoated photoresist on gallium arsenide, fractured polymethyl methacrylate, and polyethylene wrapper material. It can be concluded that specimen biasing may be a simpler and more convenient way to achieve some of the advantages afforded by the converted backscattered secondary electron (CBSE) technique for imaging, but without some of its fundamental disadvantages.

001,570

PB90-170986

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Semiclassical Scattering Corrections to the Quantum Hall Effect Conductivity and Resistivity Tensors.

Final rept.

M. E. Cage. 1989, 4p

Sponsored by Department of Defense, Washington, DC., Strategic Systems Programs Office (Navy), Ar-

lington, VA., and Sandia National Labs., Albuquerque, NM.
Pub. in Jnl. Phys.: Condens. Matter 1, p5531-5534 1989.

Keywords: *Hall effect, Electrical resistivity, Scattering, Tensors, Correction, Reprints, *Quantum Hall effect, Electrical conductivity, Relaxation.

Ando, Matsumoto and Uemura published an important paper in 1975 that greatly influenced the early experimental work on the quantum Hall effect. Their paper showed that, in both a semiclassical scattering model and in a self-consistent Born approximation, there is a correction to the quantum Hall conductivity component σ_{xy} of the conductivity tensor that is directly proportional to the diagonal conductivity component σ_{xx} . The present authors provide a detailed derivation of their results using the semiclassical scattering (relaxation-time approximation) model. They then present the surprising result that, in the semiclassical scattering model, there is no correction to the quantum Hall resistivity tensor component ρ_{xy} due to a finite value of ρ_{xx} .

001,571
PB90-171034 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Experimental Aspects and Metrological Applications.

Final rept.
M. E. Cage. 1987, 32p
Pub. in Quantum Hall Effect, Chapter 2, p37-68 1987.

Keywords: *Hall effect, *Metrology, Electric current, Electrical resistance, Bibliographies, Reprints, *Quantum Hall effect, Resistance standards, Two dimensional.

The quantum Hall effect provides an unparalleled opportunity to study and use the physical properties of macroscopic, two-dimensional electron or hole systems in the presence of strong magnetic fields. These studies are revealing surprising results that are of particular interest to the disciplines of condensed matter physics and electrical metrology. This chapter discusses some experimental observations and metrological applications of the integer Hall effect, and includes an extensive bibliography of representative literature in this field.

001,572
PB90-187576 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
Double-Step Behavior of Critical Current versus Magnetic Field in Y-, Bi- and Tl-Based Bulk High-T(sub c) Superconductors.
Final rept.
J. W. Ekin, T. M. Larson, A. M. Hermann, Z. Z. Sheng, K. Togano, and H. Kumakura. 1989, 8p
Grant N61533-88-F-1365
Sponsored by Department of the Navy, Washington, DC.
Pub. in Physica C 160, p489-496 1989.

Keywords: *Superconductors, Magnetic fields, Polycrystalline, Bismuth oxides, Reprints, *High temperature superconductors, *Critical current, Yttrium barium cuprates, Barium yttrium cuprates, Thallium oxides.

A double step characteristic is observed at 76 K in the transport critical current as a function of magnetic field (0 to the -4 power T to 10 T) in bulk sintered Y-, Bi- and Tl-based high-T(c) superconducting materials. The low-field, step-like drop in the critical current density $J(c)$ commences at magnetic fields B between about 0.3 and 2 mT. This is followed by a plateau region of relatively constant critical current extending from about 30 to 300 mT, and then a second drop at fields between about 0.3 and 10 T. These features occur for all three superconductor materials and are interpreted respectively as a self-field/weak-link regime, a remnant percolation path regime and a flux-flow/upper-critical-field regime. The sharpness of the transition of the voltage-current (V-I) characteristic, represented by the transition parameter n, has a similar double-step shape as a function of magnetic field directly corresponding to the features of the $J(c)$ (B) characteristic.

001,573
PB90-187600 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Fracture and Deformation Div.

Specific Heat of the High-T(sub c) Superconductor (Bi(sub 1.66)Pb(sub 0.34))Ca(sub 2)Sr(sub 2)Cu(sub 3)O(sub 10).

Final rept.
R. A. Fisher, S. Kim, Y. Wu, N. E. Phillips, H. M. Ledbetter, and K. Togano. 1989, 2p
Pub. in Physica C 162-164, p502-503 1989.

Keywords: *Superconductors, *Specific heat, Bismuth oxides, Lead oxides, Calcium oxides, Strontium oxides, Copper oxides, Reprints, *High temperature superconductors, Cuprates.

The specific heat (C) was measured for H=O and 7T in the ranges 0.4 to 20K and 65 to 125K. The coefficient of the low-temperature linear term in C was 0 plus or minus 0.5 mJ/(K squared) mole. On initial cooling, an anomaly in C was observed at T(c), but there were dramatic temperature hysteresis effects.

001,574
PB90-187774 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.
Effect of Annealing Conditions on Precipitate and Defect Evolution in Oxygen Implanted SOI Material.
Final rept.
S. J. Krause, S. Visitserntrakul, B. F. Cordts, and P. Roitman. 1989, 2p
Sponsored by Defense Nuclear Agency, Washington, DC.
Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) SOS/SOI Technology Conference, Stateline, NV., October 3-5, 1989, p81-82.

Keywords: *Annealing, *Precipitates, *Defects, *Oxygen, *Semiconductor materials, Silicon, Wafers, Nitrogen, Argon, Interfaces, Dislocations(Materials), Reprints, *Ion implantation, *Temperature dependence, Scanning electron microscopy, Transmission electron microscopy, SOI, Simox.

Silicon wafers were implanted with oxygen to a dose of 1.8 E 18/sq cm at 200 keV at a temperature of 620 C. The wafers were annealed at temperatures between 1250 and 1350 C for times between 1 and 6 hours in a nitrogen or argon ambient. The wafers were studied with SEM, TEM, and SIMS. For a given annealing ambient, there is a threshold temperature for the reduction and elimination of precipitates and associated lateral dislocations in the range of 1300 C to 1325 C. Nitrogen ambients result in nitrogen pileup at the oxide interfaces.

001,575
PB90-187824 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Fracture and Deformation Div.
Low-Temperature Elastic Constants of Polycrystalline La(sub 2)CuO(sub 4) and La(sub 1.85)Sr(sub 0.15)CuO(sub 4).
Final rept.
H. Ledbetter, S. A. Kim, C. E. Violet, and J. D. Thompson. 1989, 2p
Pub. in Physica C 162-164, p460-461 1989.

Keywords: Superconductors, Elastic properties, Ultrasonic tests, Cryogenics, Reprints, *Lanthanum strontium cuprates, *Lanthanum cuprates.

Using ultrasonic methods, the authors measured the 295-4-K elastic constants of superconductive La(1.85)Sr(0.15)CuO4 and nonsuperconductive La2CuO4. These materials show two elastic-constant similarities: nearly the same ambient-temperature elastic constants and an elastic-stiffness minimum in the 20-40-K region. Their principal difference is that La2CuO4 softens 3% during cooling, while La(1.85)Sr(0.15)CuO4 softens 30%. This reversible wide-temperature-range softening resembles a magnetic phase transition. Perhaps it relates to the large drop in spin-excitation intensity found by Shirane and coworkers using inelastic neutron scattering.

001,576
PB90-188236 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.
Neutron Scattering in Intermetallics.
Final rept.
J. J. Rhyne. 1987, 9p
Pub. in Jnl. of Magnetism and Magnetic Materials 70, n1-3 p88-96 1987.

Keywords: *Neutron scattering, *Intermetallics, Magnetic properties, Rare earth alloys, Crystal structure,

Iron containing alloys, Yttrium, Manganese, Cobalt, Aluminum, Magnons, Order-disorder transformations, Reprints, Amorphous state.

Inelastic and elastic neutron scattering as a probe of long range and disordered magnetism is discussed for example cases in rare earth intermetallic crystalline compounds and amorphous analogues. The determination of the sublattice site magnetizations is illustrated for RFe2 and Y6(MnxFe(1-x))23 compounds. The latter are shown to exhibit strong exchange disorder effects for intermediate compositions, as manifested by the development of short range antiferromagnetic clusters. The effect of randomization of the crystal field interaction in destroying long range order is illustrated in amorphous rare earth compounds and in rare earth compound hydrides. Results of inelastic scattering measurements which yield exchange and crystal field parameters are summarized for Laves phase Fe, Co, and Al compounds.

001,577
PB90-188269 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.
S-N-S Behavior of Grain Boundaries in Polycrystalline La(sub 1.85)Sr(sub 0.15)CuO(sub 4-y).
Final rept.
A. Roshko, J. S. Moodera, and Y. M. Chiang. 1989, 2p
Pub. in Physica C 162-164, p1625-1626 1989.

Keywords: *Superconductors, Grain boundaries, Polycrystalline, Reprints, *High temperature superconductors, *Lanthanum strontium cuprates, Temperature dependence, Critical current.

The field and temperature dependence of transport $J(c)$ in well characterized, polycrystalline La(1.85)Sr(0.15)CuO(4-y) has been investigated. The behavior at low fields, close to T(c), corresponds to that of S-N-S junctions.

001,578
PB90-188277 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Theory of Phase Transitions at Internal Interfaces.
Final rept.
C. Rottman. 1988, 14p
Pub. in Jnl. de Physique 49, nC-5 p313-326 1988.

Keywords: *Phase transformations, *Grain boundaries, Phase diagrams, Interfaces, Reprints.

A variety of phase transitions are possible at internal interfaces. The author systematically describes, from a pedagogical point of view, the various classes of phase transitions which are possible. Experiments which have been performed are mentioned at the appropriate places. Theories which predict these phase transitions and which explain the behavior associated with the transitions are emphasized. Possibilities for phase diagrams are suggested. Wetting and melting of internal interfaces are also discussed.

001,579
PB90-188426 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.
Initial Conditions Implied by t(1/2) Solidification of a Sphere with Capillarity and Interfacial Kinetics.
Final rept.
R. F. Sekerka, P. W. Voorhees, S. R. Coriell, and G. B. McFadden. 1988, 6p
Pub. in Jnl. of Crystal Growth 87, n4 p415-420 1988.

Keywords: *Solidification, *Crystal growth, *Capillarity, *Interfaces, *Kinetic theory, Nucleation, Reprints, Temperature dependence, Liquid-solid interfaces.

The initial conditions implied by square root of t growth of a spherical crystal solidifying from a pure, undercooled melt, including the effects of both capillarity and interface kinetics were explored. Findings are related to initial conditions that would be expected on the basis of classical nucleation theory. For crystal sizes near the nucleation radius, the temperature profiles show a cold region ahead of the advancing interface that is even more undercooled than the undercooled bath. The cold region acts as a local heat sink which compensates for the reduced growth speed that would otherwise result from capillarity and kinetics, leading to precisely the same square root t growth law that would have been obtained had both capillarity and kinetics

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been neglected. The reconciliation of the initial condition with nucleation theory remains unresolved.

001,580

PB90-188517

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Physics Div.

Dispersion of Evanescent Band Gap States in Fe Clusters on GaAs(110).

Final rept.

J. A. Stroscio, P. N. First, R. A. Dragoset, L. J. Whitman, D. T. Pierce, and R. J. Celotta. 1990, 5p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in Jnl. of Vacuum Science and Technology A 8, n1 p284-288 Jan/Feb 90.

Keywords: *Energy gap, Electron tunneling, Gallium arsenides, Substrates, Surfaces, Reprints, *Iron clusters, Scanning tunneling microscopy.

The authors report scanning tunneling microscopy results on the band gap states observed in tunneling to nanometer size metallic Fe clusters on GaAs(110) surfaces. In the vicinity of the Fe clusters, a continuum of gap states is found in tunneling spectra from regions of the bare semiconductor. The state density in the gap, emanating from the clusters, is found to decay exponentially with a decay length that is dependent on the energy in the band gap. The gap state decay length varies continuously from 3.4 Å at midgap to a divergence at the valence and conduction band edges, reflecting the characteristics of the generalized Bloch states in the semiconductor gap having complex wave vector.

001,581

PB90-190687

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Oxygen Concentration of Eu(sub 1)Ba(sub 2)Cu(sub 3)O(sub 7-x) in Vacuum: An Atom Probe Study II.

Final rept.

P. P. Camus, H. B. Elswijk, and A. J. Melmed. 1989, 4p
Pub. in Colloque de Physique C8, p477-480 Nov 89.

Keywords: *Superconductors, Concentration(Composition), Reprints, *High temperature superconductors, *Europium barium cuprates, *Barium europium cuprates, *Oxygen depletion, Atom probes.

Atom probe mass analysis using a wide acceptance angle instrument was used to measure the oxygen content and metallic stoichiometry of the near-surface region of the superconducting ceramic oxide $\text{Eu}_1\text{Ba}_2\text{Cu}_3\text{O}(7-x)$ (x approximately = 0.1) after exposure at 85K and room temperature in vacuum. An oxygen depleted layer formed by H₂ imaging must be removed before bulk concentrations are obtained. Room temperature holding in vacuum overnight (approximately 18h) then depletes the surface of oxygen to a depth of greater than 4 layers (1.2nm). However, after holding the specimen at 85K for up to 3h either with or without an applied field, no detectable loss of oxygen occurred. Therefore, for short time vacuum exposures at liquid nitrogen temperatures and below, no oxygen loss is expected; however, significant oxygen loss occurs for 18h vacuum exposures at room temperature.

001,582

PB90-190760

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Oxygen Concentration of Eu(sub 1)Ba(sub 2)Cu(sub 3)O(sub 7-x) in Vacuum: An Atom Probe Study.

Final rept.

H. B. Elswijk, A. J. Melmed, and P. P. Camus. 1989, 3p
Pub. in Applied Physics Letters 55, n25 p2667-2669, 18 Dec 89.

Keywords: *Superconductors, Concentration(Composition), Reprints, *High temperature superconductors, *Europium barium cuprates, *Barium europium cuprates, *Oxygen depletion, Atom probes.

Atom probe mass analysis, at 85 K, using a wide-angle instrument, was used to measure the oxygen content and metallic stoichiometry of the near-surface region of the superconducting ceramic oxide $\text{Eu}_1\text{Ba}_2\text{Cu}_3\text{O}(7-x)$ (x approximately = 0.1) after vacuum exposure at

room temperature. Routine specimen preparation, handling, and field-ion imaging produced a specimen which had already lost oxygen such that its measured surface oxygen content corresponded to $x = 0.73$ and the metallic stoichiometry of the surface was not the expected 1:2:3 but was enhanced in Ba and Eu. The specimen was subsequently exposed to vacuum for up to 80 h at room temperature and no additional loss of oxygen was detected. It was concluded that either a stoichiometric low-oxygen surface also would not have lost oxygen or the nonstoichiometric layer forms a barrier for subsequent oxygen loss.

001,583

PB90-190810

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

NBS (National Bureau of Standards) Crystal Data. NBS (National Bureau of Standards)*Search: A Program to Search the Database.

Final rept.

V. L. Himes, and A. D. Mighell. 1987, 11p
Pub. in Crystallographic Databases, p144-155 1987.

Keywords: *Crystallography, *Chemical compounds, *Chemical elements, Search structuring, Organic compounds, Organometallic compounds, Metals, Minerals, Intermetallics, Inorganic compounds, Reprints, *Data base management, Software tools.

The NBS Crystal Data Center maintains a database that contains evaluated crystallographic and chemical data on approximately 120,000 materials. The data fall into the following categories: organics, organometallics, metals, intermetallics, inorganics and minerals. NBS*Search (copyright 1987 by the U.S. Secretary of Commerce on behalf of the United States) has been written to provide search software that can be used with NBS CRYSTAL DATA (1987). The program is written in standard FORTRAN and is designed to be used in any analytical laboratory. The NBS*SEARCH software is multifunctional in design, and it is planned to incorporate additional search functions in forthcoming version of the program.

001,584

PB90-192303

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Spin Dynamics of Amorphous Magnets.

Final rept.

J. W. Lynn, and J. J. Rhyne. 1988, 41p
Pub. in Spin Waves and Magnetic Excitations, Chapter 4, p177-217 1988.

Keywords: Rare earth alloys, Neutron scattering, Magnons, Reprints, *Spin waves, Amorphous materials, Small angle scattering, Spin glass state, Magnetism.

The chapter reviews the subject of magnetic excitations in amorphous metallic alloys with principal emphasis on neutron scattering results. The effects of the amorphous topology on the magnetic excitations and how this is probed in the neutron experiments is explained with reference to current experimental results. The concepts of spin wave linewidth are reviewed and related to the physics of the reentrant spin glass and multicritical point systems in general. The effect of random anisotropy fields on the spin ordering and phase transition in rare earth amorphous alloys is reviewed and illustrated with results from small angle scattering studies.

001,585

PB90-192311

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Ordering of Nd in (Nd, Ce)(sub 2)CuO(sub 4).

Final rept.

J. W. Lynn, I. W. Sumarlin, S. Skanthakumar, W. H. Li, R. N. Shelton, J. L. Peng, Z. Fisk, and S. W. Cheong. 1990, 4p
Pub. in Physical Review B 41, n4 p2569-2572, 1 Feb 90.

Keywords: Antiferromagnetism, Copper oxides, Reprints, *Neodymium cuprates, *Neodymium cerium cuprates, *Magnetic ordering, Neodymium ions, Magnetic superconductors, Semiconductors.

Neutron-diffraction techniques have been used to study the magnetic ordering of the Nd ions in semiconducting Nd_2CuO_4 and superconducting $\text{Nd}_{1.85}\text{Ce}_{0.15}\text{CuO}_4$. For the Ce-doped system a sharp transition to long-range antiferromagnetic order

occurs at $T(N)$ approximately = 1.2 K, with a simple magnetic unit cell which is double the chemical unit cell along the a and b directions. The same magnetic structure is observed in the parent system Nd_2CuO_4 , in which the Cu spins are also ordered magnetically, but strong coupling between the Nd and Cu sublattices is indicated.

001,586

PB90-192352

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Instability of a Taylor-Couette Flow Interacting with a Crystal-Melt Interface.

Final rept.

G. B. McFadden, S. R. Coriell, M. E. Glicksman, and M. Selleck. 1989, 23p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in PCH PhysicoChemical Hydrodynamics 11, n4 p387-409 1989.

Keywords: *Crystal growth, *Solidification, Couette flow, Flow stability, Hydrodynamics, Reprints, *Taylor-Couette instability, Vortex flow, Taylor instability, Crystal-melt interface.

A linear stability analysis is presented for the axisymmetric Taylor Couette instability of the flow between infinite concentric rotating cylinders for the case that one of the bounding cylinders is a crystal-melt interface. Results are presented for various rotation ratios $\mu = \Omega(2)/\Omega(1)$ of the outer and inner cylinders in the narrow gap approximation. For the case of solid-body rotation of the liquid ($\mu = 1$), the linear stability of the system is unaffected by the crystal-melt interface. For rotation ratios $0 =$ or $< \mu < 1$ the Taylor-vortex mode is destabilized for large Prandtl numbers, and the critical Taylor number varies inversely with the Prandtl number. For large negative rotation ratios the instability is insensitive to the Prandtl number for the case of a crystalline outer cylinder. In the limiting case of small Prandtl number the results tend to the classical values for a rigid-walled system. The effect of varying the crystal width is also considered. An approximate solution valid for large Prandtl numbers is obtained analytically.

001,587

PB90-192451

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Quest for Universal Curves to Describe the Surface Sensitivity of Electron Spectroscopies.

Final rept.

C. J. Powell. 1988, 18p
Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 47, p197-214 Jul 88.

Keywords: Mean free path, Sensitivity, Reprints, *Surface analysis, *Electron spectroscopy, Attenuation length, Universal curves.

An overview is given of data for electron attenuation lengths (ALs) and inelastic mean free paths (IMFPs) in the energy range of interest for electron spectroscopy of surfaces with emphasis on the search for so-called universal curves. Reliable knowledge of ALs and IMFPs is important for determining the surface sensitivity of electron spectroscopies and for quantitative surface analysis by AES and XPS. Suitable formulas for ALs and IMFPs are needed as user guides but existing formulas are of limited accuracy due to problems in AL measurements and approximations in IMFP calculations. AL measurements and the various AL and IMFP formulas are critiqued. A new formula due to Tanuma et al. shows promise of being a useful guide to the energy- and material-dependences of IMFPs and may be a reasonable though less accurate guide for ALs.

001,588

PB90-192501

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Correlations in Amorphous Fe-Zr Alloys.

Final rept.

J. J. Rhyne, R. W. Erwin, J. A. Fernandez-Baca, and G. E. Fish. 1988, 3p
Pub. in Jnl. of Applied Physics 63, n8 p4080-4082 1988.

Keywords: *Iron alloys, *Zirconium containing alloys, Neutron scattering, Transition temperature, Correla-

tion, Reprints, Amorphous state, Exchange interactions, Magnetic ordering, Small angle scattering, Magnetism.

Results of high resolution small angle neutron scattering (SANS) studies on amorphous alloys of composition $\text{Fe}_x\text{Zr}(100-x)$ ($x = 90, 91, 92$) show that ferromagnetic correlations exist below $T(c)$, but that conventional long range order is destroyed by competing exchange interactions. The transition temperatures drop with increasing iron concentration ($T(c)$ approximately equal to 226 K for $\text{Fe}_{90}\text{Zr}_{10}$) down to $T(c)$ approximately equal to 175 K for $\text{Fe}_{92}\text{Zr}_8$). Data taken at very low Q ($0.008 < Q < 0.02/\text{\AA}$) provide evidence of relatively large (approximately 200 - approximately 400 \AA) static spin clusters which do not disorder at $T(c)$. Superposed is an ordering with a second shorter length scale which shows a cusp (not divergent) at the bulk $T(c)$. The data were fitted to a combination of a Lorentzian and a power of a Lorentzian, the latter of which represents scattering from clusters with a Maxwellian distribution of sizes.

001,589
PB90-192584 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Surface Science Div.

Field-Ion Energy Spectroscopy of Gold Overlayers on Silicon.

Final rept.
W. A. Schmidt, A. J. Melmed, M. F. Lovisa, M. Naschitzki, and J. H. Block. 1988, 9p
Pub. in Surface Science 194, n1-2 p127-135 Feb 88.

Keywords: *Gold coatings, *Silicon, Interfaces, Energy levels, Thin films, Valence bands, Reprints, *Electronic states, Field ion microscopy, Schottky barrier diodes.

Unoccupied localized states of the Au/Si(111) contact have been observed by means of field-ion energy spectroscopy. Gold overlayers of 3-5 ml thickness and greater were prepared and an intermixed Si-Au structure was formed at the interface. The spectroscopic result in the form of integral field-ion energy distributions confirmed the existence of empty electronic states beginning at the Fermi level. A pronounced hump in the distribution was evaluated and resulted in a high density of states at $(0.95 \pm 0.2)\text{eV}$ above the top of the valence band. For technical reasons, the spectroscopy was carried out with p-type Si. Using gold-covered n-type Si, Schottky barrier heights of the Au-n-Si(111) contact can be determined.

001,590
PB90-192626 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD, Reactor Radiation Div.

Effects of Crystal Anisotropy on Magnetization and Magnetic Order in Superconducting $\text{RBA}(\text{sub } 2)\text{Cu}(\text{sub } 3)\text{O}(\text{sub } 7-x)$.

Final rept.
R. N. Shelton, R. W. McCallum, M. A. Damento, K. A. Schneider, H. C. Ku, H. D. Yang, J. W. Lynn, W. H. Li, and Q. Li. 1987, 4p
Pub. in Physica B and C 148, n1-3 p285-288 1987.

Keywords: *Superconductors, Superconductivity, Anisotropy, Magnetization, Neutron diffraction, Single crystals, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Erbium barium cuprates, *Barium yttrium cuprates, *Barium erbium cuprates, Magnetic ordering, Critical current.

Two distinct experiments are used to study the influence of crystal anisotropy and superconductivity in $\text{YBa}_2\text{Cu}_3\text{O}_7$ and magnetic order in the superconducting state of $\text{ErBa}_2\text{Cu}_3\text{O}_7$. Magnetization data on a single crystal of $\text{YBa}_2\text{Cu}_3\text{O}_7$ reveal pronounced anisotropy. Analysis of the magnetization versus applied field hysteresis loops implies strong anisotropy of the critical current density. For $\text{ErBa}_2\text{Cu}_3\text{O}_7$, neutron diffraction measurements indicate that the Er moments order two dimensionally at low temperatures (about 0.5K), with chains of spins coupled ferromagnetically, while adjacent chains align antiparallel.

001,591
PB90-192717 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Surface Science Div.

Growth of Ultrathin Fe Films on Cu(100): Mechanisms, Morphology and Stability.

Final rept.
D. A. Steigerwald, and W. F. Egelhoff. 1988, 2p
Pub. in Jnl. of Vacuum Science and Technology A 6, n3 p1995-1996 May/June 88.

Keywords: *Iron, Metal films, Substrates, Copper, Separation, Stability, Reprints, *Epitaxial growth, X ray photoelectron spectroscopy.

The epitaxial growth of Fe on Cu(100) is found to proceed with the formation of Fe double-layers and surface segregation of Cu at 300K and above. These results are based on a study using XPS, XPS forward scattering and CO-titration.

001,592
PB90-192725 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD, Surface Science Div.

Observation of Intensity Oscillations in RHEED during the Epitaxial Growth of Cu and fcc Fe on Cu(100).

Final rept.
D. A. Steigerwald, and W. F. Egelhoff. 1987, 6p
Pub. in Surface Science 192, n2-3, pL887-L892 1987.

Keywords: *Copper, *Iron, Face centered cubic lattices, Surface properties, Metal films, Crystal growth, Substrates, Reprints, *Epitaxial growth, Reflection high energy electron diffraction, Molecular beam epitaxy.

Oscillations in the intensity of the specular beam in Reflection High Energy Electron Diffraction (RHEED) have been observed during the epitaxial growth of Cu on Cu(100) and face-centered cubic (fcc) Fe on fcc Fe. The oscillations are not observed for the growth of fcc Fe on Cu(100). Thus it is inferred that the homo-epitaxial growth of both metals is by a Frank-van der Merwe (layer-by-layer) mechanism, but that the hetero-epitaxial growth of fcc Fe on Cu(100) is accompanied by strong intermixing of the first Fe monolayer followed by gradual burying of the Cu. The burying is complete after approximately 5 ML at 255 K. In addition to facilitating the determination of the active growth mechanism, the experimental results allow for a simple, effective means for calibrating the incident metal flux from the MBE vapor sources.

001,593
PB90-192741 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD, Ceramics Div.

X-ray Photoelectron Spectroscopy of O 1s and Si 2p Lines in Films of $\text{SiO}(\text{sub } x)$ Formed by e-beam Evaporation.

Final rept.
Y. N. Sun, A. Feldman, and E. N. Farabaugh. 1988, 10p
Pub. in Thin Solid Films 157, n2 p351-360, 29 Feb 88.

Keywords: *Silicon oxides, *Silicon dioxide, Dielectric films, Thin films, Electron beams, Reprints, X ray photoelectron spectroscopy, Binding energy.

X-ray photoelectron spectroscopy (XPS) measurements were made of the line shapes and binding energies of the O 1s and Si 2p lines in films of the SiO_x system prepared by electron-beam (e-beam) evaporation. Stoichiometries were in the range $0 < x < 2$. Corrections for charging effects were obtained by measuring all line positions relative to the position of the Au 4f peak. The films contain principally two Si 2p peaks which change in amplitude and move to higher energies in a continuous manner as a function of x. The O 1s peak is a single line which shifts in a sublinear manner as a function of x. The results are consistent with the presence of silicon clusters, silicon-centered tetrahedra conforming to the random bond model (RBM) and forms of oxygen other than bridging oxygen such as peroxy bonding, molecular oxygen or OH.

001,594
PB90-193269 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Ceramics Div.

Lattice Statics Green's Function Method for Calculation of Atomistic Structure of Grain Boundary Interfaces in Solids. 2. Anharmonic Theory.

Final rept.
V. K. Tewary, and E. R. Fuller. 1989, 7p
Pub. in Jnl. of Materials Research 4, n2 p320-326 1989.

Keywords: *Crystal lattices, *Greens function, *Grain boundaries, Interfaces, Solids, Copper, Reprints, Anharmonic theory, Fcc lattices.

The lattice statics Green's function method for calculation of the atomistic structure of grain boundary interfaces in solids as described in Paper 1 is extended to

include anharmonic effects. It is shown that the 'anharmonic' response of a solid to 'anharmonic' forces can be represented in terms of the 'harmonic' response of the solid to an effective anharmonic force. The Green's function method then requires solving a finite order nonlinear matrix equation which is done by using standard numerical methods. For the purpose of illustration, the method is applied to calculate the atomistic structure of a Sigma 5 tilt boundary in fcc copper.

001,595
PB90-193277 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD, Ceramics Div.

Lattice Statics Green's Function Method for Calculation of Atomistic Structure of Grain Boundary Interfaces in Solids. 1. Harmonic Theory.

Final rept.
V. K. Tewary, E. R. Fuller, and R. M. Thomson. 1989, 11p
Pub. in Jnl. of Materials Research 4, n2 p309-319 1989.

Keywords: *Crystal lattices, *Greens function, *Grain boundaries, Interfaces, Solids, Harmonic analysis, Thermodynamic equilibrium, Reprints, Fcc lattices.

A lattice statics Green's function method is described for calculating the atomistic structure of a solid near a grain boundary interface. First, a reference state is defined which is 'near' the equilibrium state. The Green's function for the reference state is obtained in terms of the perfect lattice Green's function by mapping the lattice sites of the reference state to the perfect lattice sites and solving the Dyson's equation. This Green's function gives the response of the reference state which determines the atomic relaxations under the net forces which would be present in the reference state. The specific case of a Sigma 5 tilt boundary in a fcc lattice has been considered assuming the validity of the harmonic approximation.

001,596
PB90-193350 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD, Electricity Div.

Resource Letter QHE-1: The Integral and Fractional Quantum Hall Effects.

Final rept.
C. T. Van Degrift, M. E. Cage, and S. M. Girvin. 1990, 15p
Pub. in American Jnl. of Physics 58, n2 p109-123 Feb 90.

Keywords: *Hall effect, Reprints, *Integral quantum Hall effect, *Fractional quantum Hall effect, *Quantum Hall effect, Literature surveys, Resource letters.

The Resource Letter provides a guide to the literature on the integral and fractional quantum Hall effects. The letter E after an item indicates elementary level or material of general interest to persons becoming informed in the field. The letter I, for intermediate level, indicates material of somewhat more specialized nature; and the letter A indicates rather specialized or advanced material. An asterisk (*) indicates articles that are especially useful or interesting; a double asterisk (**) indicates those articles to be included in an accompanying reprint book.

001,597
PB90-205964 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO, Electromagnetic Technology Div.

Ohmic Contacts to High-T(sub c) Superconductors.

Final rept.
J. W. Ekin. 1990, 6p
Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) - Processing of Films for High (T sub c) Superconducting Electronics, v1187 p359-364 1990.

Keywords: *Superconductors, Transition temperature, Electrical resistivity, Gold, Silver, Indium, Surface resistivity, Area, Solders, Yttrium oxides, Barium oxides, Bismuth, Thallium, Strontium, Calcium, Ceramics, Reprints, *Cuprates, High temperature, Electric contacts.

The report summarizes and gives references describing the details of a method for reducing high T_c contact surface resistivities, $\rho_o(c)$, to the $10(\text{sup } -10)$ ohm sq cm range ($\rho_o(c) = RA$, where R is the contact resistance and A is the contact area). The reduction was obtained using both gold and silver contacts, and

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represents a decrease in contact resistivity by over eight orders of magnitude from that obtained using indium solder connections. Most of the results have been obtained so far for YBa₂Cu₃O(7- δ) (YBCO) but preliminary data for the Bi and Tl based compounds will also be summarized.

001,598

PB90-206681

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Ceramics Div.

Standard Reference Materials for X-ray Diffraction. Part 2. Calibration Using D-Spacing Standards.

Final rept.

W. Wong-Ng, and C. R. Hubbard. 1987, 7p

Pub. in Powder Diffraction, 2, n4 p242-248 1987.

Keywords: *X ray diffraction, *Standards, Powder(Particles), Reprints, *Standard reference materials, Sample preparation, Calibration.

External standard and internal standard calibrations are important procedures used to achieve high accuracy in x-ray diffraction studies. The theoretical basis as well as procedures of obtaining curves are given. Methods and examples of selecting Standard Reference Materials (SRMs) which are produced and issued by the National Bureau of Standards, and procedures of sample preparation with these standards are also described. Three examples are presented to indicate the value of using SRMs.

001,599

PB90-206889

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Temperature and Composition Dependence of the Energy Gap of Hg(sub 1-x)Cd(sub x)Te by Two-Photon Magneto Absorption Techniques.

Final rept.

D. G. Seiler, J. R. Lowney, C. L. Littler, and M. R.

Loloe. 1990, 8p

Pub. in Jnl. of Vacuum Science and Technology A, 8, n2 p1237-1244 Mar/Apr 90.

Keywords: *Energy gap, Infrared detectors, Magneto-optics, Reprints, *Mercury cadmium tellurides, Two photon absorption, Temperature dependence, Magnetoabsorption.

Accurate determinations of the energy gap $E(8)$ at liquid helium temperatures in alloys of $0.24 = \text{or} < x = \text{or} < 0.30$ have been made by two-photon magnetoabsorption techniques. They are shown to help verify the use of the Hansen-Schmit-Casselman (HSC) relation over the range $0 < x < 0.30$ at these temperatures. In contrast, the observed temperature dependence of $E(8)$ below 77 K is nonlinear and thus cannot be described accurately by the HSC relation. Analysis of $E(8)(T)$ data for three samples with $0.24 = \text{or} < x = \text{or} < 0.26$ has allowed the deduction of a new relationship for $E(8)(x,T)$ that more properly accounts for the nonlinear temperature dependence below 77 K and the linear behavior above 77 K, while still accurately describing the x dependence $E(8)(x,T)$ for $E(8)$ in eV and T in K. This relation should apply to alloys with $0.2 < x < 0.3$. The maximum change from the HSC relation in this range is 0.004eV for $x = 0.2$ at about 10 K.

001,600

PB90-207051

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Airy Pattern, Weak-Link Modelling of Critical Currents in High-T(sub c) Superconductors.

Final rept.

R. L. Peterson, and J. W. Ekin. 1989, 9p

Pub. in Physica C 157, p325-333 1989.

Keywords: *Superconductors, Josephson junctions, Magnetic fields, Granular materials, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Holmium barium cuprates, *Critical current.

The authors have measured the transport critical current density at very low magnetic fields in samples of superconducting bulk sintered Y1Ba2Cu3O(x), Y1Ba2Cu4O(x), and HoBa2Cu3O(x) obtained from several sources. The results are analyzed at low fields ($= \text{or} < 10$ mT) with a statistical model which assumes that the current is limited by Josephson weak links (SNS or SIS Josephson junctions or microbridges) whose locations are to be determined. Each weak link is assumed to be described by an Airy current-field pattern rather than a Fraunhofer pattern. The former has

a better theoretical foundation and is in better agreement with the data, varying as H to the (-3/2) power upon averaging. The fitting procedure yields the average cross sectional area of the weak links. By assuming the link thickness to be twice the London penetration depth at 77 K, it was found that the average linear dimensions of the links are in all cases comparable to the grain dimensions. The quantitative analysis also confirms the percolation concept, in which a subset of weakest links controls the transport current.

001,601

PB90-209594

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Applied and Computational Mathematics Div.

Numerical and Analytical Study of Nonlinear Bifurcations Associated with the Morphological Stability of Two-Dimensional Single Crystals.

L. N. Brush, R. F. Sekerka, and G. B. McFadden. Oct 89, 43p NISTIR-89/4193

Prepared in cooperation with Carnegie-Mellon Univ., Pittsburgh, PA.

Keywords: *Single crystals, *Crystal growth, *Mathematical models, Integral equations, Stability, Bifurcation(Mathematics), Nonlinear analysis, Numerical solution, Two dimensional.

The nonlinear stability of a two-dimensional single crystal of pure material in an under-cooled melt is studied both analytically and numerically. The quasi-steady state approximation is used for the thermal fields and the effects of different solid and liquid thermal conductivities, isotropic interfacial growth kinetics and isotropic surface tension are included. The bifurcation analysis is performed by calculating the instantaneous value of the fundamental component of the local normal growth speed for an interface perturbed by a single Fourier shape component. Numerically, the fundamental component of the interfacial growth speed is found by Fourier analysis of the solution to an integro-differential equation obeyed at the interface. Analytically, an expansion technique is used to derive a solvability condition defining each of these bifurcation points. The analytical and numerical results are in very close agreement. Almost all of the bifurcations are subcritical and the authors present their results by giving values of the Landau coefficient as a function of the different dimensionless parameters used in the model.

001,602

PB90-216847

PC A16/MF A02

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Semiconductor Measurement Technology: A Software Program for Aiding the Analysis of Ellipsometric Measurements, Simple Spectroscopic Models.

Special pub. (Final).

J. F. Marchiando. Apr 90, 364p NIST/SP-400/84

Also available from Supt. of Docs. See also PB89-235923.

Keywords: *Computer programs, *Spectroscopic analysis, *Polarimetry, *Dielectrics, Mathematical models, Computerized simulation, Differential equations, Sensitivity, Fortran, *Computer aided analysis, *Ellipsometry, User manuals(Computer programs), Iterative solutions.

MAIN2 is a software program for analyzing spectroscopic ellipsometric measurements. MAIN2 consists mainly of subroutines written in FORTRAN that are used to invert the standard reflection ellipsometry equations for simple systems. Here, a system is said to be simple if the solid material sample is characterized by models which assume at least the following: (1) materials are nonmagnetic; (2) samples exhibit depth-dependent optical properties, such as one with layered or laminar structure atop a substrate that behaves like a semi-infinite half-space; (3) layers are flat and of uniform thickness; and (4) the optical medium within each ambient/layer/substrate is isotropic, homogeneous, local, and linear. The ambient region refers to that region of space which lies external to the layer/substrate structure of the sample. Each layer is characterized by a thickness and a dielectric function. The dielectric function of a region, i.e., ambient, layer, or substrate, is represented by the Bruggeman effective medium approximation (EMA). Within the EMA, the effective medium of a region is characterized by an aggregate mixture of constituent media, and the dielectric function of each constituent medium is known a priori. The ellipsometric equations are formulated as a standard damped nonlinear least-squares problem

and then solved by an iterative method when possible. The program is sufficiently modular to allow one to modify some of the models used in the calculations.

001,603

PB90-217852

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Radiation Physics Div.

Soft X-ray Absorption and Emission Spectra of the YBa(sub 2)Cu(sub 3)O(sub 7-x) Superconductor.

Final rept.

K. L. Tsang, C. H. Zhang, T. A. Callcott, L. R.

Canfield, D. L. Ederer, J. E. Blendall, and C. W.

Clark. 1987, 6p

Pub. in Proceedings of Drexel International Conference on High Temperature Superconductivity, Philadelphia, PA., July 29-30, 1987, p225-230.

Keywords: *Superconductors, *X ray spectroscopy, Absorption spectra, Emission spectra, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Photoelectron spectroscopy, Soft x rays, Density of states.

The authors present total photoelectron yield spectra and electron-beam excited soft x-ray emission spectra for the YBa₂Cu₃O(7-x) superconductor. The 2+ valencies of Cu and Ba in the compound are confirmed by total photoelectron yield measurements. Emission spectra determine the p-type partial density of states (p-PDOS) localized on the Ba, Y, and O atomic sites. The p-PDOS are very small at the Fermi energy (epsilon-sub F) and exhibit peaks at 3.5 to 4 eV below (epsilon-sub F). K emission spectra of O confirm the interpretation that the structure observed in previous photoemission measurements is associated with the O 2p orbitals.

001,604

PB90-217944

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Progress Toward a Semiconductor Depth Profiling Standard.

Final rept.

D. S. Simons, P. Chi, R. G. Downing, J. R. Ehrstein,

and J. F. Knudsen. 1988, 4p

Pub. in Proceedings of International Conference on Secondary Ion Mass Spectrometry (6th), p433-436 1988.

Keywords: Monte Carlo method, Neutrons, Simulation, Standards, Reprints, *Secondary ion mass spectroscopy, *Depth profiles, Boron 10, Amorphous silicon, Ion implantation, Semiconductors.

An ion-implant of boron-10 in silicon to be used as a depth-profiling standard for secondary ion mass spectroscopy is described. Neutron depth profiling measurements can be used to measure the total implanted dose. Pre-amorphization by implantation of silicon is used to eliminate channeling artifacts that are present in single crystal material. The measured SIMS profile of (10)B implanted at 50 keV into amorphous silicon agrees well with the results of a Monte Carlo simulation based on 100,000 ion trajectories. Neutron depth profiling has inadequate depth resolution to follow the profile shape accurately in this case.

001,605

PB90-217993

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Photoemission Study of High T(sub c) Oxides.

Final rept.

D. Mueller, A. Shih, L. E. Toth, M. Osofsky, S. A.

Wolf, R. L. Kurtz, and R. L. Stockbauer. 1987, 9p

Pub. in Novel Superconductivity, p829-837 1987.

Keywords: *Superconductors, Synchrotron radiation, Ultraviolet radiation, Reprints, *High temperature superconductors, *Yttrium barium cuprates, *Photoelectron spectroscopy, Electronic structure, Density of states, Photoemission.

A number of ceramic compounds including YBa₂Cu₃O₇ have been reported to superconduct at temperatures in excess of 35K. A critical feature in the processing of these compounds required to obtain good superconductive properties appears to be a final annealing stage in an oxygen containing atmosphere to increase the oxygen content of the materials. Without the oxygen anneal step, the superconducting transition temperature drops and the drop in the temperature versus resistance curve becomes less defined. To

aid in the development of a better understanding of the electronic structure in this class of materials, the authors have examined changes in the electronic density of states for $\text{YBa}_2\text{Cu}_3\text{O}(x)$ with oxygen content via ultraviolet photoelectron spectroscopy. Samples with $x = 6.95, 6.5,$ and 6.05 were examined.

001,606

PB90-218041

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Modeling of Critical Currents in Granular High-T(sub c) Superconductors.

Final rept.

R. L. Peterson, and J. W. Ekin. 1989, 6p

Pub. in Proceedings of Workshop on Materials Science of High (T sub c) Superconductors, Gaithersburg, MD., October 11-13, 1988, p190-195 1989.

Keywords: *Superconductors, Josephson junctions, Magnetic fields, Granular materials, Mathematical models, Reprints, *High temperature superconductors, *Critical current, Yttrium barium cuprates.

The transport critical current density of several samples of bulk sintered high-T(c) superconductors was measured at very low magnetic fields and fitted to a model which assumes that the impediments to current at such fields are Josephson weak links. A sample of particular interest was $\text{YBa}_2\text{Cu}_3\text{O}(x)$ made from hydroxycarbonate precursors; the final bulk sintered sample was very fine-grained, having an average grain size of about 1.8 micrometers as determined by a linear intercept analysis. The fit to the model is excellent if the average linear dimension of the weak links is chosen to be 2.0 micrometers. The authors conclude that this sample as well as the others has Josephson weak links at its grain boundaries, and that any intragrain defects which may be responsible for flux pinning are not the primary weak links limiting the transport J(c) of bulk samples at very low magnetic fields.

001,607

PB90-218090

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Magneto-Optical Investigation of Impurity and Defect Levels in HgCdTe Alloys.

Final rept.

C. L. Littler, D. G. Seiler, and M. R. Loloee. 1990, 6p
Pub. in Jnl. of Vacuum Science and Technology A 8, n2 p1133-1138 Mar/Apr 90.

Keywords: *Mercury tellurides, *Cadmium tellurides, *Magneto-optics, Semiconductors, Spectra, Activation energy, Point defects, Impurities, Electron transitions, Reprints.

It has been observed and described magneto-optical transitions between impurity/defect levels and conduction band Landau levels for a variety of n-type HgCdTe samples with $0.2 < x < 0.3$. The activation energies of the levels fall into two categories: (1) 10-12 meV above the valence band edge, independent of Eg and (2) two close spaced levels at approximately 0.5 Eg. In addition, the spectra of several narrow gap (Eg less than or equal to 100 meV) samples exhibit shallower and deeper acceptor-like levels.

001,608

PB90-218249

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Precision Engineering Div.

Fields Scattered by a Dielectric Strip on a Dielectric Half-Space.

Final rept.

E. Marx. 1987, 4p

Pub. in Proceedings of AP-S Int. Symp. Digest: Antennas and Propagation, Blacksburg, VA., June 15-19, 1987, p1138-1141.

Keywords: *Electromagnetic scattering, *Dielectrics, Integral equations, Computerized simulation, Mathematical models, Electromagnetic fields, Field theory(Physics), Reprints.

The paper describes the theory of the determination of the field scattered by a dielectric strip over a half-space filled with a different dielectric. The solution is based on integral equations for surface fields defined at the interfaces. Sample outputs of a computer program are shown.

001,609

PB90-222738

PC A06/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Semiconductor Electronics Div.

Semiconductor Measurement Technology. EPROP: An Interactive FORTRAN Program for Computing Selected Electronic Properties of Gallium Arsenide and Silicon.

Special pub. (Final).

A. C. Seabaugh, J. J. Mathias, and M. I. Bell. May 90, 125p NIST/SP-400/85

Prepared in cooperation with Texas Instruments, Inc., Dallas.

Keywords: *Electrical properties, *Silicon, *Gallium arsenides, Semiconductors(Materials), Fermi surfaces, Computer programs, Tables(Data), *Computer applications, EPROP computer program.

A new computer program, EPROP (an acronym for Electronic PROPERTIES) is presented for use in interpreting measurements and experiments on gallium arsenide and silicon. EPROP computes a solution of the charge balance equation in thermodynamic equilibrium for up to six different impurities. The user supplies the density, energy level, and degeneracy for each impurity, and in response the program returns as many as 28 output parameters, such as the Fermi level, carrier density, and ionized impurity densities. These can be computed as functions of the temperature (or reciprocal temperature) or the density, energy, or degeneracy of any of the six possible impurities. Listings can also be obtained of various temperature-dependent parameters, such as the bandgap, densities of states, and effective masses. The interactive features of the program allow the user to send the output data to any combination of destinations: a terminal, a listing file, and/or up to four graphic output files, all at the user's direction. The user is also given freedom and ability to customize the data output to these destinations through menu-driven controls.

001,610

PB90-235326

(Order as PB90-235243, PC A06)

National Inst. of Standards and Technology, Gaithersburg, MD.

Observation and an Explanation of Breakdown of the Quantum Hall Effect.

Bi-monthly rept.

M. E. Cage, D. Y. Yu, and G. M. Reedtz. 29 Jan 90,

8p

Included in Jnl. of Research of the National Institute of Standards and Technology v95 n1 p93-100 Jan-Feb 90.

Keywords: *Hall effect, Quantum theory, Semiconductors(Materials), Gallium arsenides, Failure, Ceramics, Phonons, Electron Gas, Aluminum, Electrical faults, *Quantum Hall effect, Aluminum gallium arsenides, Heterostructures, QUILLS model.

A spatially localized breakdown of the nearly dissipationless quantum Hall effect into a set of discrete dissipative states in wide, high-quality GaAs/AlGaAs samples was observed. The phenomenon can be explained by an extension of the quasi-elastic inter-Landau level scattering model of Eaves and Sheard.

001,611

PB90-241258

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Nuclear Magnetic Resonance.

Final rept.

L. H. Bennett, and L. J. Swartzendruber. 1986, 10p

Pub. in Metals Handbook, v10 p277-286 1986.

Keywords: *Nuclear magnetic resonance, Radiofrequency spectroscopy, Ferromagnetic materials, Order disorder transformations, Reprints, Electronic structure, Pulse techniques.

A brief introduction is provided on the topic of nuclear magnetic resonance, answering the question 'What does the materials engineer have to know to enable him to interact with the characterization specialists' in this technique.

001,612

PB90-241274

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Analysis of SAS Data Dominated by Multiple Scattering.

Final rept.

N. F. Berk, and K. A. Hardman-Rhyme. 1988, 7p

Pub. in Jnl. of Applied Crystallography 21, p645-651 Dec 88.

Keywords: *Neutron scattering, *Neutron diffraction, Phase shift, Refraction, Reprints, *Small angle scattering, *Multiple scattering, Beam broadening.

Small angle scattering from powders, early-stage ceramics and other materials of technological interest often is dominated by multiple scattering. Such 'beam broadening' depends strongly on the wavelength of the incident radiation and in past has usually been associated with multiple refraction. Actually, wavelength-dependent intensities indicate incoherent multiple scattering in which the underlying single particle scattering may be in the diffractive, refractive or cross-over regime, depending on the value of the single particle scattering phase shift. In practice, the diffractive limit-identified theoretically with very small phase shifts--may be applicable even when the phase shift is not small. On one hand, the diffractive limit of single-particle scattering is a good approximation for phase shifts of order unity, while on the other, explicit effects of incoherent scattering render the beam broadening insensitive to the cross-over between diffractive and refractive scattering at larger phase shifts.

001,613

PB90-241308

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Metallurgy Div.

Magnetic-Field-Modulated Microwave-Absorption Detection in a Bi-Sr-Ca-Cu-O Superconductor.

Final rept.

J. Bohandy, F. J. Adrian, B. F. Kim, K. Moorjani, R. D. Shull, L. J. Swartzendruber, L. H. Bennett, and J. S. Wallace. 1988, 6p

Pub. in Jnl. Supercond. 1, n2 p191-196 Jun 88.

Keywords: *Superconductors, Transition temperature, Magnetic fields, Detection, Reprints, *High temperature superconductors, *Bismuth strontium calcium cuprates, Microwave absorption.

Superconducting transitions are observed at 110K, 100K, and 72K in a nominally $\text{BiSrCaCu}_2\text{O}(x)$ ceramic using the novel technique of magnetic-field-modulated microwave-absorption detection. These superconducting transition temperatures are found to be more sensitive to the application of an external magnetic field than in the $\text{YBa}_2\text{Cu}_3\text{O}_7$ ceramic.

001,614

PB90-241324

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.

Automated Extraction of Regular Spot Arrays from Electron Diffraction Images.

Final rept.

D. E. Bright, and E. B. Steel. 1988, 14p

Pub. in Jnl. of Microscopy 150, p167-180 Jun 88.

Keywords: *Electron diffraction, Polycrystalline, Automation, Reprints, *Image analysis, Computer applications, Particulates.

Electron diffraction patterns of polycrystalline substances are routinely obtained for small sample areas by using the transmission electron microscope in the selected area diffraction mode. The paper emphasizes one aspect of analyzing electron diffraction patterns - automatically selecting spots in the pattern and determining the corresponding basis vectors. A computer method is described that isolates the zone axis diffraction pattern in diffraction images by selecting the spots that belong to one or more regular arrays. The method gives the basis vectors for the arrays which can then be used to identify the particles by comparison with standard diffraction data. This method has been applied to both simple zone axis diffraction patterns and complex patterns displaying combinations of overlapping zone axis patterns and patterns from randomly oriented grains commonly observed in agglomerates of fine particulate. The method works over a wide variety of typical diffraction problems and appears to be a rugged method for identifying basis vectors for orientation or phase identification.

001,615

PB90-241357

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Scientific Computing Div.

PHYSICS

Solid State Physics

Similarity and Bifurcation in Unstable Viscoplastic Shear.

Final rept.

T. J. Burns. 1989, 16p

Pub. in SIAM Jnl. on Applied Mathematics 49, n1 p314-329 1989.

Keywords: *Shear properties, Perturbation, Reprints, *Viscoplasticity, Instability, Bifurcation(Mathematics).

The linear stability of perturbed simple shear in a strain-softening viscoplastic material is analyzed on a finite time interval. An asymptotic study is made of the influence of two small parameters, which give the orders of magnitude of inertial and viscous effects. It is shown that these two coefficients are connected by a similarity parameter. Also, a criterion is derived for the minimum strain rate where the instability behavior changes from being independent to being dependent on the wavenumber of the Fourier component of a small initial perturbation.

001,616

PB90-241365

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Quantized Dissipative States at Breakdown of the Quantum Hall Effect.

Final rept.

M. E. Cage, G. M. Reedtz, D. Y. Yu, and C. T. Van Degrift. 1990, 4p

Sponsored by Department of Defense, Washington, DC., and Sandia National Labs., Albuquerque, NM. Pub. in Semicond. Sci. Technol. 5, p351-354 1990.

Keywords: *Hall effect, Electron gas, Dissipation, Reprints, *Quantum Hall effect, Aluminum gallium arsenides, Two dimensional.

The authors report the breakdown of the nearly dissipationless quantum Hall effect into a set of distinct, quantized dissipative states in a wide, high-quality GaAs/AlGaAs sample. They found 35 dissipative states on one plateau and 9 on another plateau which have longitudinal voltage drops accurately quantized in units of $(h \text{ bar})/(\omega \text{ sub } c)/e$ to within their $\pm 0.6\%$ measurement uncertainty. This voltage quantization implies that the energy dissipation per carrier is quantized in units of the Landau level spacing $(h \text{ bar})/(\omega \text{ sub } c)$.

001,617

PB90-241407

Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Precision Engineering Div.

Modification of Hydrogen-Passivated Silicon by a Scanning Tunneling Microscope Operating in Air.

Final rept.

J. A. Dagata, J. Schneir, H. H. Harary, C. J. Evans, M. T. Postek, and J. Bennett. 1990, 3p

Pub. in Applied Physics Letters 56, n20 p2001-2003, 14 May 90.

Keywords: *Silicon, Reprints, *Scanning tunneling microscopy, *Surface reactions, Modification.

The chemical modification of hydrogen-passivated n-Si (111) surfaces by a scanning tunneling microscope (STM) operating in air is reported. The modified surface regions have been characterized by STM spectroscopy, scanning electron microscopy (SEM), time-of-flight secondary-ion mass spectrometry (TOF SIMS), and chemical etch/Nomarski microscopy. Comparison of STM images with SEM, TOF SIMS, and optical information indicates that the STM contrast mechanism of these features arises entirely from electronic structure effects rather than from topographical differences between the modified and unmodified substrate. No surface modification was observed in a nitrogen ambient. Direct writing of features with 100 nm resolution was demonstrated. The permanence of these features was verified by SEM imaging after three months storage in air. The results suggest that field-enhanced oxidation/diffusion occurs at the tip-substrate interface in the presence of oxygen.

001,618

PB90-241456

Not available NTIS

National Bureau of Standards (NEL), Boulder, CO. Electromagnetic Technology Div.

Critical Currents of High (T sub c) Superconductors: Pinning, Weak Links, Conduction, Anisotropy, and Contact Resistivities.

Final rept.

J. W. Ekin, R. L. Peterson, and S. L. Bray. 1989, 10p. Pub. in Proceedings of MRS (Materials Research Society) International Meeting on Advanced Materials 1988, Tokyo, Japan, v6 p135-144 1989.

Keywords: *Superconductors, Thallium inorganic compounds, Yttrium compounds, Transport properties, Electric contacts, Anisotropy, Reprints, *High temperature superconductors, *Critical current, Flux pinning, Weak links, Electrical conductivity.

The coherence length of high T(c) superconductors in the c-direction is much smaller than for conventional superconductors and the c-axis lattice spacing is several times larger. This intrinsic difference has significant consequences for transport properties. Crystallographic conduction anisotropy is a secondary limitation on critical current density J(c), but emerges as a prime determinant of transport J(c) in the absence of weak-link effects. The effect of conduction anisotropy on transport J(c) is described in terms of a current-transfer model. A summary is given of a method to achieve very low resistivity contacts with oxide superconductors. Low resistivity contacts have been fabricated with both yttrium and thallium based compounds.

001,619

PB90-244401

PC A03/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Computing and Applied Mathematics.

Effect of a Crystal-Melt Interface on Taylor-Vortex Flow with Buoyancy.

G. B. McFadden, B. T. Murray, S. R. Coriell, M. E. Glicksman, and M. E. Selleck. Jul 90, 19p NISTIR-4364

See also PB90-130261. Prepared in cooperation with Rensselaer Polytechnic Inst., Troy, NY. Dept. of Materials Engineering.

Keywords: *Crystal growth, Solidification, Buoyancy, *Crystal-melt interface, *Taylor-Couette flow, Flow stability.

During crystal growth from the liquid, a fundamental problem is to understand the interaction of the crystal-melt interface with fluid flow in the liquid. This problem combines the complexities of the Navier-Stokes equations for fluid flow in the liquid with the nonlinear behavior of the free boundary representing the crystal-melt interface. Some progress has been made by studying explicit flows that allow a base state corresponding to a one-dimensional crystal-melt interface with solute and/or temperature fields that depend only on the distance from the interface. This allows the strength of the interaction between the flow and the interface to be assessed by a linear stability analysis of the simple base state. The case of a Taylor-Couette flow interacting with a cylindrical crystalline interface is currently being investigated both experimentally and theoretically. The authors consider the changes in the linear stability of this system produced by density-driven convection generated by the interaction of the density gradients with the gravitational and centripetal acceleration.

001,620

PB90-254608

Not available NTIS

National Inst. of Standards and Technology (NEL), Boulder, CO. Electromagnetic Technology Div.

Proposed Study on the Effect of Sampling Bonding Techniques on the Measured Critical Current of Nb3Sn Superconductors.

Final rept.

L. F. Goodrich, and S. L. Bray. 1989, 11p. Pub. in Proceedings of Japan-U.S. Workshop on High-Field Superconducting Materials and Standard Procedures for High-Field Superconducting Materials Testing (6th), Boulder, CO., February 22-24, 1989, p99-108.

Keywords: Electrical measurement, Bonding, Reprints, *Niobium stannides, *Critical current, Interlaboratory comparisons.

The results of the recent VAMAS Nb3Sn critical-current round robin indicate that increased consistency in interlaboratory measurements might be achieved by a more detailed specification of the critical-current measurement technique. However, a competition exists between the benefit of a rigidly specified measurement technique, which insures measurement repro-

ducibility, and a less restrictive technique that would be practical for a greater number of laboratories. Ideally, the measurement technique should have the least number of restrictions that is consistent with measurement reproducibility. The proposal addresses only one aspect of the critical-current measurement technique, the sample-to-measurement-holder bonding method.

001,621

PB90-254772

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Magnetic Order and Spin Fluctuations in Oxide Superconductors.

Final rept.

J. W. Lynn. 1990, 6p

Pub. in Physica B 163, p69-74 1990.

Keywords: *Superconductors, Rare earth compounds, Barium oxides, Reprints, *High temperature superconductors, *Magnetic ordering, Lanthanum strontium cuprates, Neodymium cerium cuprates, Antiferromagnetic materials, Exchange interactions, Two dimensional.

A brief review is given of both the rare earth (R) and Cu magnetism in the RBa2Cu3O(6+x), RBa2Cu4O8, (La-Sr)2CuO4 and (Nd-Ce)2CuO4 systems. The Cu magnetism is dominated by the strong in-plane exchange interactions, which give rise to two-dimensional magnetic behavior in both the antiferromagnetically ordered insulating phase as well as in the superconducting state. The rare earth ions, on the other hand, order at low temperatures irrespective of the presence or absence of superconductivity. In the 1-2-3 and 2-4-8 materials, 2-d behavior is observed, while in the (Nd-Ce)2CuO4 system there is a substantial magnetic interaction between the Nd and Cu sublattices.

001,622

PB90-254780

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Two-Dimensional Magnetic Order of Er in ErBa2Cu3O7.

Final rept.

J. W. Lynn, T. W. Clinton, W. H. Li, R. W. Erwin, J. Z. Liu, R. N. Shelton, and P. Klavins. 1990, 3p

Pub. in Jnl. of Applied Physics 67, n9 p4533-4535, 1 May 90.

Keywords: *Superconductors, Neutron diffraction, Reprints, *Erbium barium cuprates, *Magnetic ordering, *High temperature superconductors, Antiferromagnetic materials, Onsager relations, Ising model, Order parameters, Two dimensional.

Neutron diffraction has been used to study the magnetic order of the Er ions in superconducting ErBa2Cu3O7. Above the three-dimensional (3D) Neel temperature $T(N) = 0.618 \text{ K}$ a rod of scattering characteristic of two-dimensional (2D) behavior is unambiguously observed, showing that the magnetic interactions of the rare earth ions are highly anisotropic, while there are no significant correlations observed between the sheets of Er spins. The system orders two dimensionally, and as a necessary consequence 3D order also sets in at the same temperature. The order parameter is found to obey the exact Onsager solution for a $S = 1/2$, 2D Ising antiferromagnet. At low T, two separate types of simple 3D antiferromagnetic structures are found, one characterized by a wave vector of $(1/2, 0, 0)$, and the other by $(1/2, 0, 1/2)$.

001,623

PB90-254889

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Metallurgy Div.

Fe Mossbauer Effect in Y(sub x)Pr(sub 1-x)Ba2(Cu,0.98Fe,0.02)3O7.

Final rept.

M. Rubinstein, L. J. Swartzendruber, L. H. Bennett, J. J. Ritter, and U. Atzmony. 1990, 3p

Pub. in Jnl. of Applied Physics 67, n9 p5029-5031, 1 May 90.

Keywords: *Superconductors, Mossbauer effect, Hyperfine structure, Reprints, *Yttrium praseodymium barium ferrate cuprates, *High temperature superconductors, Magnetic susceptibility, Magnetic ordering, Iron 57.

(57)Fe Mossbauer effect and magnetic-susceptibility measurements were performed on $Y(0.2)Pr(0.8)Ba_2(Cu(0.98)Fe(0.02))_3O(7-\delta)$ and $Y(0.8)Pr(0.2)Ba_2(Cu(0.98)Fe(0.02))_3O(7-\delta)$, where

delta approx = 0. The insulating 80% Pr compound showed susceptibility anomalies and a large hyperfine field distribution at low temperatures in addition to a hyperfine field spectrum for Fe on the Cu(2) sites. The superconducting 20% Pr compound displayed none of these effects at any temperature. After examining the alternatives, it is postulated that magnetic ordering of the Pr ions and an enhanced rare-earth transition-metal interaction due to f-electron admixture is responsible for these observations.

001,624
PB90-254913 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.
**Magnetic Properties of Pr in Non-Superconducting
PrBa2Cu3O7.**
Final rept.

S. Skanthakumar, W. H. Li, J. W. Lynn, A. Kebede, J. E. Crow, and T. Mihalisin. 1990, 3p
Pub. in *Physica B* 163, p239-241 1990.

Keywords: Neutron scattering, Inelastic scattering, Specific heat, Reprints, *Praseodymium barium cuprates, *Magnetic ordering, Antiferromagnetic materials.

The magnetic order and spin fluctuations of Pr in non-superconducting PrBa2Cu3O7 have been studied by specific heat, susceptibility and neutron scattering measurements. The neutron data show that the basic ordering consists of a simple antiferromagnetic arrangement, with an ordering temperature of about 17 K, while the specific heat data reveal a large value of the electronic specific heat coefficient gamma, comparable to heavy fermion like materials. The observed magnetic inelastic scattering shows a broad quasi-elastic response as a function of energy, similar to mixed valent-like systems. These results suggest that there is substantial f-electron character at the Fermi level in this material.

001,625
PB90-254921 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.
Magnetic Phase Transitions in Nd2CuO4.
Final rept.
S. Skanthakumar, H. Zhang, T. W. Clinton, I. W. Sumarlin, W. H. Li, J. W. Lynn, Z. Fisk, and S. W. Cheong. 1990, 3p
Pub. in *Jnl. of Applied Physics* 67, n9 p4530-4532, 1 May 90.

Keywords: Neutron scattering, X ray diffraction, Single crystals, Tetragonal lattices, Phase transformations, Reprints, *Neodymium cuprates, *Magnetic ordering, Polarized beams, Antiferromagnetic materials.

Polarized and unpolarized neutron scattering techniques along with x-ray diffraction have been used to study the magnetic and structural properties of a single crystal of Nd2CuO4. Long-range magnetic order of the Cu moments develops at T(N) = 245 K, with a simple antiferromagnetic configuration of spins as found in La2NiO4, while the spin directions may be either collinear or noncollinear. Additional abrupt transitions are observed at 75 and 30 K, in which spin reorientations take place. Bragg peaks associated with the crystal structure are found at the same positions as the magnetic Bragg peaks, and indicate that a small distortion of the basic tetragonal structure has occurred above 300 K. At low temperatures the Nd moments also order antiferromagnetically (T(N) = 1.5 K), while an additional transition of a continuous nature is observed at 150 mK.

001,626
PB90-254970 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.
Two- and Three-Dimensional Magnetic Order of the Rare-Earth Ions in RBa2Cu4O8.
Final rept.
H. Zhang, J. W. Lynn, W. H. Li, T. W. Clinton, and D. E. Morris. 1990, 8p
Pub. in *Physical Review B* 41, n16, p11 229-11 236, 1 Jun 90.

Keywords: Neutron scattering, Magnetic anisotropy, Reprints, *Erbium barium cuprates, *Dysprosium barium cuprates, *Magnetic ordering, Antiferromagnetic materials, Two dimensional, Three dimensional.

Neutron scattering has been used to investigate the magnetic ordering of the rare-earth ions in the

ErBa2Cu4O8 and DyBa2Cu4O8 materials. For the Er system a simple three-dimensional (3D) antiferromagnetic structure is observed, in which the magnetic unit cell is twice the chemical unit cell along the a axis, with a Neel temperature T(N) about = 0.49 K. In the vicinity of the Neel temperature, however, scattering characteristic of two-dimensional behavior, indicative of the strong anisotropy of the magnetic interactions, is observed. The magnetic anisotropy arises naturally from the crystal structure, as the c-axis spacing of the magnetic ions is about 3 times the a-b spacing. 2D behavior is also observed in the Dy material near its Neel temperature of about 0.9 K. However, the scattering in the Dy system does not cross over to the expected 3D Bragg peaks at low temperatures, but rather the 2D line shape persists to the lowest temperatures measured.

001,627
PB90-256835 (Order as PB90-256793, PC A08)
National Inst. of Standards and Technology, Gaithersburg, MD.

Phase Equilibria and Crystal Chemistry in Portions of the System SrO-CaO-Bi2O3-CuO, Part 2 - The System SrO-Bi2O3-CuO.
R. S. Roth, C. J. Rawn, B. P. Burton, and F. Beech. 1990, 45p
Included in *Jnl. of Research of the National Institute of Standards and Technology*, v95 n3 p291-335 May-Jun 90.

Keywords: *Strontium oxides, *Bismuth oxides, *Copper oxides, X-ray diffraction, Single crystals, Crystal structure, *Crystal chemistry, *Strontium bismuth cuprates, High temperature superconductors, Phase equilibrium.

New data are presented on the phase equilibria and crystal chemistry of the binary systems SrO-Bi2O3 and SrO-CuO and the ternary system SrO-Bi2O3-CuO. Symmetry data and unit cell dimensions based on single crystal and powder x-ray diffraction measurement are reported for all the binary SrO-Bi2O3 phases, including a new phase identified as Sr6Bi2O9. The ternary system contains at least four ternary phases which can be formed in air at about 900 C. These are identified as Sr2Bi2CuO6, Sr8Bi4Cu5O(19 + x) Sr3Bi2Cu2O8 and a solid solution (the Raveau phase) which, for equilibrium conditions at about 900 C, corresponds approximately to the formula Sr(1.8-x)Bi(22+x)Cu(1 + or - x/2)Oz(0.0 = or < about 0.15). Superconductivity in the phase apparently occurs only in compositions that correspond to negative values of x. Compositions that lie outside the equilibrium Raveau-phase field often form nearly homogeneous Raveau-phase products. Typically this occurs after relatively brief heat treatments, or in crystallization of a quenched melt.

001,628
PB90-261330 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Precision Engineering Div.
Low-Profile High-Efficiency Microchannel-Plate Detector System for Scanning Electron Microscopy Applications.
Final rept.
M. T. Postek, W. J. Keery, and N. V. Frederick. 1990, 11p
Pub. in *Review of Scientific Instruments* 61, n6 p1648-1657 Jun 90.

Keywords: Backscattering, Efficiency, Line width, Reprints, *Scanning electron microscopes, *Microchannel electron multipliers, Secondary electrons.

A new design high-efficiency microchannel-plate detector and amplification system is described for use in the scanning electron microscope. This complete detector system consists of four basic units: the microchannel-plate detector; the video amplifier; the high-voltage power supply; and the control unit. The microchannel-plate detector system is efficient at both high and low accelerating voltages, and is capable of both secondary electron and backscattered electron detection modes. The size of the actual detector is approximately 3.5 mm in thickness and 25.4 mm in diameter. Thus, use of the detector system permits using almost all the sample chamber to accommodate large specimens with only the loss of the 3.5 mm of working distance. Another feature is that the system also employs a unique video amplifier where there are no active elements at high voltage. The microchannel-plate detector system enables the investigation of secondary electron induced contrast mechanisms and backscat-

tered electron detection at extremely low accelerating voltages even those below 1.0 keV.

001,629
PB90-261413 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.
Antiferromagnetic Ordering in Superconducting and Oxygen-Deficient Nonsuperconducting RBa2Cu3O(7-delta) Compounds (R = Nd and Sm).
Final rept.
K. N. Yang, J. M. Ferreira, B. W. Lee, M. B. Maple, W. H. Li, J. Lynn, and R. W. Erwin. 1989, 11p
Pub. in *Physical Review B* 40, n16 p10 963-10 972, 1 Dec 89.

Keywords: *Superconductors, Specific heat, Comparison, Reprints, *High temperature superconductors, *Neodymium barium cuprates, *Samarium barium cuprates, *Antiferromagnetic materials, *Magnetic ordering.

Low-temperature (0.5-4 K) specific-heat measurements have been made on oxygen-deficient (delta approx = 0.5) nonsuperconducting RBa2Cu3O(7-delta) (R = Nd and Sm) compounds and compared to measurements previously performed on their high-critical-temperature T(c) approx = 92 K superconducting counterparts (delta approx = 0.1). It is shown that the specific-heat anomaly due to magnetic ordering of the Nd(3+) and Sm(3+) ions in the T(c) approx = 92 K superconducting RBa2Cu3O(7-delta) (R = Nd and Sm) compounds can be well described by a two-dimensional anisotropic antiferromagnetic Ising model with exchange-interaction parameters E(1) and E(2) in the a-b plane; the respective values of the Neel temperature T(N) and the ratio E(1)/E(2) are 0.5 K and 50 for Nd and 0.61 K and 11 for Sm.

001,630
PB90-265281 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Computing and Applied Mathematics.
Effect of Gravity Modulation on Solutal Convection During Directional Solidification.
B. T. Murray, S. R. Coriell, and G. B. McFadden. Aug 90, 31p NISTIR-90/4389

Keywords: *Convection, Reduced gravity, Modulation, *Directional solidification, Binary alloys, Gravitational effects, Space processing, Floquet theory, Flow stability, Semiconductors.

During directional solidification of a binary alloy at constant velocity, thermosolutal convection may occur due to the temperature and solute gradients associated with the solidification process. For vertical growth in an ideal furnace (lacking horizontal gradients), a quiescent state is possible. For a range of processing conditions, the thermal Rayleigh number is sufficiently small that the stabilizing role of the thermal field during growth vertically upwards may be neglected, and only solutal convection need be considered. The effect of a time-periodic vertical gravitational acceleration (or equivalently vibration) on the onset of solutal convection is calculated based on linear stability using Floquet theory. It was found that a stable base state can be destabilized due to modulation, while an unstable state can be stabilized. The flow and solute disturbance fields show both synchronous and subharmonic temporal response to the driving sinusoidal modulation.

001,631
PB90-271131 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Ceramics Div.
Relationship of Electrical, Magnetic, and Mechanical Properties to Processing in High-Temperature Superconductors.
Final rept.
J. E. Blendell, C. K. Chiang, D. C. Cranmer, S. W. Freiman, E. R. Fuller, E. Drescher-Krasicka, W. L. Johnson, H. M. Ledbetter, L. H. Bennett, L. J. Swartzendruber, R. B. Marinenko, R. L. Myklebust, D. S. Bright, and D. E. Newbury. 1987, 21p
Pub. in *ACS (American Chemical Society) Symposium Series Chem. High-Temp. Supercond.*, v351 p240-260 1987.

Keywords: *Superconductors, Transition temperature, Microstructure, Fracture strength, Toughness, Processing, Fabrication, Reprints, *High temperature su-

Solid State Physics

perconductors, *Yttrium barium cuprates, Electrical conductivity, Magnetic susceptibility, Elasticity.

A number of properties of superconducting ceramics have been measured and related to their microstructure and processing sequence. The $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ ceramics were prepared by powder processing techniques, followed by dry pressing and sintering in both air and flowing oxygen at various temperatures. The sintered bodies were annealed at various temperatures and environments. Superconducting properties, such as the transition temperature and the width of the transition, were measured by both electrical conductivity and AC magnetic susceptibility; both of these properties show a strong sensitivity to annealing temperature and atmosphere. The microstructure and density were also strongly dependent on processing conditions. Mechanical properties, such as elastic modulus, hardness, and fracture toughness, which will be important for the reliable use of these materials in large scale structures, were also determined.

001,632
PB90-271214 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Applied and Computational Mathematics Div.

Directional Solidification of a Planar Interface in the Presence of a Time-Dependent Electric Current.

Final rept.
L. N. Brush, S. R. Coriell, and G. B. McFadden.
1990, 18p
Pub. in Jnl. of Crystal Growth 102, p725-742 1990.

Keywords: *Crystal growth, Indium antimonides, Bismuth, Gallium alloys, Bismuth alloys, Tin alloys, Peltier effect, Thermoelectricity, Reprints, *Crystal-melt interface, *Directional solidification, Germanium alloys, Binary alloys, Electromigration, Joule heating, Time dependence.

The authors develop a numerical method to study the motion of a planar crystal-melt interface during the directional solidification of a binary alloy in the presence of a time-dependent electric current. The model includes the Thomson effect, the Peltier effect, Joule heating and electromigration of solute in the coupled set of equations governing heat flow in the crystal and melt, and solute diffusion in the melt. For a variety of time-dependent currents, the temperature fields and the interface velocity are calculated as functions of time for indium antimonide and bismuth, and for the binary alloys, germanium-gallium and tin-bismuth. For the alloys, the authors also calculate the solid composition as a function of position, and thus make quantitative predictions of the effect of an electrical pulse on the solute distribution in the solidified material. In addition, for a sinusoidal current of small amplitude, the authors have compared the numerical solutions with approximate analytical solutions valid to first order in the current amplitude. By using this numerical approach, the specific mechanisms which play dominant roles in interface demarcation by current pulsing can be identified.

001,633
PB90-271438 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Synchrotron Radiation Studies of the Electronic Structures of High-T(sub c) Superconductors.
Final rept.
R. L. Kurtz. 1988, 14p
Pub. in AIP (American Institute of Physics) Conference Proceedings, n165 p222-234 1988.

Keywords: *Superconductors, Synchrotron radiation, Valence bands, Reprints, *High temperature superconductors, *Electronic structure, Lanthanum barium strontium cuprates, Yttrium barium cuprates, Photoemission.

Experimental measurements of the electronic structure of the high-T(c) superconductors $\text{La}_{2-x}(\text{Sr},\text{Ba})_x\text{CuO}_4$ and $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ are reviewed and discussed in the context of determining the strengths of the interactions within the valence bands. It is concluded that the Cu 3d - O 2p valence bands are highly hybridized and there are strong electron-electron correlations. It is shown that the $\text{Cu}(3+)$ configuration (3d⁸) is energetically unfavorable and the systems are best thought of as having an approximate valence of $\text{Cu}(2+)$. The influence of surface stoichiometry on the electronic structure is discussed, and preliminary molecular adsorption studies are reported.

001,634
PB90-271453 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Laser Probing of III-V Semiconductor Growth on Si(100).
Final rept.
S. R. Leone. 1990, 8p
Contract AFOSR84-0272
Sponsored by Air Force Weapons Lab., Kirtland AFB, NM.

Pub. in Proceedings of SPIE (Society of Photo-Optical Instrumentation Engineers) Laser Photoionization and Desorption Surface Analysis Techniques, v1208 p11-17 1990.

Keywords: *Crystal growth, Semiconductor devices, Gallium arsenides, Monitoring, Substrates, Silicon, Arsenic, Phosphorus, Reprints, *Molecular beam epitaxy, Laser induced fluorescence.

Investigations of III-V semiconductor growth by laser probing of the gas phase constituents represents a potential new technique for monitoring and improving molecular beam epitaxy. Laser-induced fluorescence (LIF) detection methods have now been devised to measure directly the number density of Ga and In atoms and As₂ dimer species during the deposition and growth. The studies are applied to the early stages of growth of III-V materials on Si(100). Additional techniques may be employed in the future to detect species such as As₄, P₄, and other minor dopants in various molecular forms. Laser detection is used here to make measurements on scattering and sticking coefficients, the rates and energetics of desorbing species, and state-resolved accommodation. Important islanding behavior is detected by measurements of the kinetics for certain constituents in the presence of others. These techniques will be of value in devising practical in situ optical diagnostics for molecular beam epitaxy of III-V semiconductor devices.

001,635
PB90-271552 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Applied and Computational Mathematics Div.
Interface Instabilities during Laser Melting of Thin Films.
Final rept.
G. B. McFadden, S. R. Coriell, L. N. Brush, and K. A. Jackson. 1990, 7p
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Applied Mechanics Reviews 43, n5 pt2 pS70-S75 May 90.

Keywords: Crystal growth, Dendritic crystals, Solidification, Reprints, *Liquid-solid interfaces, *Silicon films, Laser heating, Instability, Boundary integral method.

Thin silicon films on a cooled substrate are often found to develop two-phase lamellar structures upon radiative heating. Jackson and Kurtz developed a two-dimensional model for the process in which the heated film consists of alternating parallel bands of liquid and solid phases separated by straight solid-liquid interfaces. To understand the cellular or dendritic structures that sometimes are observed in these interfaces, they also performed a linearized morphological stability analysis and obtained the conditions for the growth or decay of infinitesimal perturbations to the interface. In the work the authors extend that analysis to finite amplitudes by developing a boundary integral representation of the thermal field, and obtain numerical solutions for nonplanar solid-liquid interfaces.

001,636
PB91-101089 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Mathematical Analysis Div.
Numerical and Analytical Study of Nonlinear Bifurcations Associated with the Morphological Stability of Two-Dimensional Single Crystals.
Final rept.
L. N. Brush, R. F. Sekerka, and G. B. McFadden.
1990, 21p
See also PB90-209594. Sponsored by National Science Foundation, Washington, DC., and National Aeronautics and Space Administration, Washington, DC.
Pub. in Jnl. of Crystal Growth v100, p89-108 1990.

Keywords: *Single crystals, *Crystal growth, Melts, Numerical analysis, Stability criteria, Fourier analysis,

Mathematical models, Reprints, *Bifurcation(Mathematics), Morphology, Liquid-solid interfaces, Landau factor.

The nonlinear instability of a two-dimensional single crystal of pure material growing from an undercooled melt is studied both analytically and numerically. The quasi-steady state approximation is used for the thermal fields and the effects of different solid and liquid thermal conductivities and isotropic surface tension are included. A bifurcation analysis is performed by calculating the instantaneous value of the fundamental component of the local normal growth speed for an interface perturbed by a single Fourier shape component. The base state is time dependent, and two bifurcation criteria are studied, the relative stability criterion according to which the time derivative of the ratio of the perturbation amplitude to the radius of the underlying circle vanishes, and the absolute stability criterion according to which the time derivative of the perturbation amplitude vanishes. Numerically, the fundamental component of the interfacial growth speed is found by Fourier analysis of the solution to an integro-differential equation (obeyed at the interface) which gives the instantaneous value of the local normal growth speed. Analytically, a weakly nonlinear expansion technique is used to derive a solvability condition at each bifurcation. Analytical and numerical results are in very close agreement, and therefore mutually corroborative. Landau coefficients are presented as a function of the various dimensionless parameters used in the model. Almost all of the bifurcations are subcritical.

001,637
PB91-101105 Not available NTIS
National Bureau of Standards (IMSE), Gaithersburg, MD.
Quasi-Periodic Crystals: A Revolution in Crystallography.
Final rept.
J. W. Cahn, and D. Gratias. 1987, 11p
Pub. in Advancing Materials Research, p151-160 1987.

Keywords: Electron diffraction, Crystal structure, Reprints, *Quasicrystals, Icosahedral phase.

This is a much-condensed version of a talk given at the National Academy of Sciences on the occasion of the 25th anniversary of the Materials Science Interdisciplinary Laboratories. The talk emphasized the interdisciplinary background of the current research on quasicrystals.

001,638
PB91-101386 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
Electronic Structure of High-T(sub c) Superconductors Studied Using Photoelectron Spectroscopy.
Final rept.
R. L. Kurtz, S. W. Robey, R. L. Stockbauer, D. Mueller, A. Shih, L. Toth, A. K. Singh, and M. Osafsky. 1989, 6p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in Vacuum 39, n7/8 p611-615 1989.

Keywords: *Superconductors, Synchrotron radiation, Valence bands, Reprints, *High temperature superconductors, *Electronic structure, Photoelectron spectroscopy, Lanthanum strontium cuprates, Yttrium barium cuprates, Bismuth strontium calcium cuprates, Thallium calcium barium cuprates.

Fundamental information about the structure of the valence band and the chemical valence states of the various constituents of the La-Sr-Cu, Y-Ba-Cu, Bi-Sr-Cu and Ti-Ca-Ba-Cu oxides have been obtained using photoelectron spectroscopy. These results show that the one-electron theories do not adequately describe the electronic structure of these superconductors. The atomic origins of the features observed in the valence bands have been investigated by studying photoemission resonances and changes in excitation cross-sections with photon energy. Results to date suggest that these materials have varying densities of states at the Fermi level, valence bands composed of O 2p and Cu 3d states, and display no significant changes in the band structure associated with the superconducting behavior when the temperature is lowered below T(c). In addition, the complex surface chemistry of these oxides makes it essential to study the surface stoichiometry and the interaction of simple molecules. O₂ and CO are found to interact only weakly with the sur-

faces of the materials studied to date, while the H₂O and CO₂ react strongly, forming hydroxides and carbonates.

001,639

PB91-101394 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Hyperthermal (0.1-4 eV) F Atom Beam Source Suitable for Surface Etching Investigations.

Final rept.

R. J. Levis, C. J. Waltman, L. M. Cousins, R. G. Copeland, and S. R. Leone. 1990, 6p
Grants NSF-CHE84-08403, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in *Jnl. of Vacuum Science and Technology A* 8, n4 p3118-3122 Jul/Aug 90.

Keywords: *Atomic beams, *Etching, Thin films, Cryogenics, Reprints, *Fluorine atoms, Xenon fluorides, Laser radiation, Semiconductors, Vaporization, EV range 01-10.

Using laser vaporization of cryogenic films of XeF₂, a beam of F atoms is produced with most probable kinetic energy variable from 0.3 to 1.1eV. Fluorine atoms are observed with energies up to 4.3eV. Also present in the beam are F₂, Xe, XeF, XeF₂, and impurity H and HF. The beams are produced by vaporizing thin films of XeF₂ with 266 nm photons of a quadrupled Nd:YAG laser. The kinetic energy of the F atoms can be increased monotonically by decreasing the repetition rate of the vaporization laser from 1 to 0.1 Hz while the deposition rate of XeF₂ is constant. The relative velocities of the heavier species are always less than that of the F atoms, but their most probable energies are greater than the energy of the F beam. This result suggests that a hydrodynamic flow of the lighter species propels the heavier F₂, Xe, XeF, and XeF₂ particles to higher velocities. Evidence is presented that complete desorption of the XeF₂ film occurs within the vaporization area during each laser pulse, from which a desorption yield can be estimated. Such a source may be suitable for novel studies of anisotropic etching of semiconductor substrates with energetic reactive species.

001,640

PB91-101436 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Mathematical Analysis Div.

Hydrodynamic and Free Boundary Instabilities during Crystal Growth: The Effect of a Plane Stagnation Flow.

Final rept.

G. B. McFadden, S. R. Coriell, and J. I. D. Alexander. 1988, 25p

Sponsored by National Aeronautics and Space Administration, Washington, DC.

Pub. in *Communications on Pure and Applied Mathematics*, vXLI p683-706 1988.

Keywords: *Crystal growth, Reprints, Crystal-melt interface, Flow stability, Stagnation flow, Free boundaries, Thermosolutal convection.

During freezing of a liquid containing solute, buoyancy-driven convection can occur due to thermal and concentration gradients. The crystal-melt interface is a free boundary and is subject to interfacial instabilities. During vertical directional solidification of a binary alloy, a quiescent flow state with a planar crystal-melt interface is possible, but may be unstable to convective and interfacial perturbations. The authors consider the effect of an imposed plane stagnation flow that impinges normal to the interface on the conditions for the onset of instability. For perturbations with wave vector perpendicular to the plane of the stagnation flow, the equations reduce to ordinary differential equations with variable coefficients which are solved numerically. For this class of perturbations and for fixed solute concentration in the crystal, the imposed stagnation flow stabilizes the system.

001,641

PB91-101576 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.

Phase Improvement in the Structure Interpretation of Fragment TR2C from Bull Testis Calmodulin Using Combined Entropy Maximization and Solvent Flattening.

Final rept.

L. Sjolín, L. A. Svensson, E. Prince, and S. Sundell.

1990, 7p

Pub. in *Acta Cryst. B* 46, p209-215 1990.

Keywords: *Crystal structure, *Animal products, *Phase transformations, *Proteins, Cattle, Entropy, Scattering, Fourier analysis, Reprints, *Calmodulin, *Troponin C.

Fragment TR2C (residues 78-148) of bull testis calmodulin (Mr = 8260 daltons) crystallizes in space group P4(sub 3)2(sub 1)2 with a = 52.4(1) and c = 130.0(1)Å, with two complete molecules in the asymmetric unit. After unsuccessful attempts to find a satisfactory starting set of phases using single-isomorphous-replacement and single-anomalous-scattering methods, a set of phases was found from one solution obtained by standard molecular-replacement methods, using the structure of troponin C as the starting model. The second independent molecule was found from Fourier maps based on maximum-entropy calculations and the startset of phases from the molecular-replacement calculations. The present structure has been refined at 3.6 Å resolution with 1420 independent reflections to R = 0.257.

001,642

PB91-101618 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Semiconductor Electronics Div.

Polarization X-ray Absorption Near-Edge Structure Study of Pr₂-xCe_xCuO₄ Single Crystals: The Nature of Ce Doping.

Final rept.

Z. Tan, J. I. Budnick, C. E. Bouldin, J. C. Woicik, S.

W. Cheong, A. S. Cooper, G. P. Espinosa, and Z.

Fisk. 1990, 4p

Contract DE-AS05-80ER10742

Sponsored by Department of Energy, Washington, DC.
Pub. in *Physical Review B* 42, n1 p1037-1040, 1 Jul 90.

Keywords: *Superconductors, X ray absorption, Single crystals, Polarization, Reprints, *High temperature superconductors, *Praseodymium cerium cuprates, Doped materials, Band theory.

A polarization Cu K-edge x-ray absorption near-edge structure study has been carried out on Pr(2-x)Ce(x)CuO₄ single crystals. The spectra for x-ray polarization vector E nearly parallel to the crystal c axis suggest that electrons contributed by Ce doping are initially localized at the Cu site. The spectra for E perpendicular to the c axis exhibit an almost rigid edge shift to lower energies upon Ce doping. This suggests that the unoccupied in-plane Cu 4p states shift to lower energies. Therefore, the Ce doping donates electrons to the Cu site and also shifts the unoccupied 4p band. The authors propose that the upper unoccupied band consisting of predominantly Cu 3d states shifts downward and eventually joins the initially localized states near the Fermi level and thus, forms the conduction band in the n-type superconductor.

001,643

PB91-107185 PC A03/MF A01
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Semiconductor Electronics Div.

SPARCOL: A Front End for the MAIN2 Program.

R. L. Mattis. Oct 90, 25p NISTIR-4426

Keywords: *Polarimetry, *Spectroscopic analysis, *Semiconductors(Materials), Models, Layers, Reflectance, Ellipsometers, Data processing, *Computer applications, SPARCOL computer program, Interactive systems, File maintenance.

SPARCOL is an interactive program which serves as a front-end to the MAIN2 and MAIN2R computer programs. SPARCOL stands for Spectroscopic ellipsometry And Reflectance for Characterization Of Layers. It consists of a Fortran-77 program and a VMS DCL command procedure. SPARCOL is used to prepare the X.DAT and X.INN files required by MAIN2 and MAIN2R, and to give these files user-defined names. Although these two files can be created using a text editor, the user may find it helpful to prepare them using SPARCOL. The MAIN2 program is used for processing ellipsometric data. The MAIN2R program is very similar to MAIN2 but has been modified to process reflectance data.

001,644

PB91-107557 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Applied and Computational Mathematics Div.

Micromagnetic Calculations of 180 deg Surface Domain Wall Magnetization Profiles with Comparison to Measurements.

J. L. Blue, and M. R. Scheinfein. Sep 90, 12p

NISTIR-4427

Keywords: Mathematical models, Ferromagnetism, Magnetization, Permalloys, *Domain walls, *Surface magnetism, Micromagnetics, Scanning electron microscopy, Landau-Lifshitz-Gilbert equation.

The authors compare measurements of magnetization profiles across 180 deg surface domain walls in a permalloy ferromagnet with calculations from micromagnetic models. The models were solved both by relaxation and by a time-evolution calculation. The measurements were made using scanning electron microscopy with polarization analysis (SEMPA). The authors obtain good agreement without postulating any surface anisotropy effect. This is the first successful comparison between experiment and a time-evolution calculation.

001,645

PB91-112045 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Gas and Particulate Science Div.

Factors That Affect Reproducibility in SIMS Analysis of Semiconductors.

Final rept.

P. H. Chi, and D. S. Simons. 1990, 4p

Pub. in *Proceedings of Secondary Ion Mass Spectrometry Conference (SIMS VII)*, Monterey, CA., September 3-8, 1989, p127-130 1990.

Keywords: *Semiconductor doping, Concentration(Composition), Reproducibility, Impurities, Precision, Reprints, *Relative sensitivity factor, Doped materials.

The relative sensitivity factor (RSF), a parameter used to determine the concentration of dopants and impurities in semiconductors, can change significantly for repeated measurements of a single reference sample, although the instrument operating conditions are apparently kept unchanged. This spread in RSF values can result in a rather large imprecision for concentration determinations in unknown samples. The authors have made a systematic investigation of several factors that may affect the reproducibility of RSF measurements: sample holder factors (flatness of mask, type of window, crater position), spectrometer factors (energy band pass, peak shape), and element analyzed.

001,646

PB91-112136 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Surface Science Div.

X-ray Photoelectron and Auger Electron Forward Scattering: A New Tool for Surface Crystallography.

Final rept.

W. F. Egelhoff. 1990, 23p

Pub. in *Critical Reviews in Solid State and Materials Sciences* 16, p213-235 1990.

Keywords: *Surfaces, Scattering, Crystal structure, Auger electrons, Photoelectrons, Adsorption, Epitaxy, Interfaces, Reviews, Reprints.

A critical review is given of a new technique, developed during the past several years, for surface crystallography. The technique is based on the observation that X-ray photoelectrons and Auger electrons with kinetic energies of a few hundred electron volts and above exhibit enhanced intensities along internuclear axes, or bond directions, connecting the emitting atom with its nearest and next-nearest neighbor atoms. This effect is an excellent diagnostic of whether or not an atom is in the top layer, and if not, it is an excellent diagnostic of the local structural environment around the emitting atom. As a new probe of short-range order, this technique finds important applications in areas such as the orientation of adsorbed molecules, epitaxial growth morphology, surface segregation, interdiffusion at interfaces, core-level binding-energy shifts, and electron escape depths.

001,647

PB91-112144

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

X-ray Photoelectron and Auger Electron Forward-Scattering Studies of Lattice Expansions and Contractions in Epitaxial Films.

Final rept.

W. F. Egelhoff, I. Jacob, J. M. Rudd, J. F. Cochran, and B. Heinrich. 1990, 6p
Pub. in *Jnl. of Vacuum Science and Technology A* 8, n3 p1582-1586 May/June 90.

Keywords: *Lattice parameters, Auger electrons, Photoelectrons, Metal films, Manganese, Copper, Epitaxy, Expansion, Contraction, Reprints.

X-ray photoelectrons and Auger electrons emitted by atoms in a lattice undergo forward scattering by neighboring atoms during their propagation through the lattice. This forward scattering produces enhancements in the emission intensity along nearest-neighbor directions. In the present work, the directions of these enhancements are used to infer lattice expansions and contractions in epitaxial films. Epitaxial films of Mn grown on Cu(100) expand outwards and on Ag(100) contract inwards, as compared to a simple extension of the face-centered-cubic substrate lattice. Thus, in both cases, the Mn lattice is body-centered-tetragonal.

001,648

PB91-112177

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div. **Surface, Interface, and Thin-Film Magnetism.**

Final rept.

L. M. Falicov, D. T. Pierce, S. D. Bader, R. Gronsky, and K. B. Hathaway. 1990, 42p
Pub. in *Jnl. of Materials Research* 5, n6 p1299-1340 June 90.

Keywords: Thin films, Interfaces, Reviews, Reprints, *Magnetism, Electron spin polarization, Surface magnetism, Epitaxial growth, Magnetic films, State of the art.

A comprehensive review and state of the art in the field of surface, interface, and thin-film magnetism is presented. New growth techniques which produce atomically engineered novel materials, special characterization techniques to measure magnetic properties of low-dimensional systems, and computational advances which allow large complex calculations have together stimulated the current activity in this field and opened new opportunities for research. The current status and issues in the area of material growth techniques and physical properties, characterization methods, and theoretical methods and ideas are reviewed. A fundamental understanding of surface, interface, and thin-film magnetism is of importance to many applications in magnetics technology, which is also surveyed. Questions of fundamental and technological interest that offer opportunities for exciting future research are identified.

001,649

PB91-112284

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Large Surface Anisotropies in Ultrathin Films of bcc and fcc Fe(001).

Final rept.

B. Heinrich, D. A. Steigerwald, K. B. Urquhart, S. T. Purcell, and W. F. Egelhoff. 1988, 6p
Pub. in *Jnl. of Applied Physics* 63, n8 p3863-3868 1988.

Keywords: *Iron, Magnetic anisotropy, Thin films, Metal films, Epitaxy, Whiskers(Single crystals), Reprints, *Magnetism, Superlattices, Multilayers, BCC lattices, FCC lattices.

Large uniaxial anisotropies associated with interfaces are observed for ultrathin films (3-28 ML) of bcc Fe(001) grown epitaxially on Ag(001) single crystal substrates and for epitaxial sandwiches of fcc Fe(001) grown with 3 layers of Fe using Cu as substrate and coverlayers. Adequate treatment of spin-orbit coupling in magnetic theories remains a challenge. Comparisons of ultrathin films of bcc Fe(001) on Ag(001) with differing coverlayers of Ag or Au show subtle differences in magnetic behavior as studied by ferromagnetic resonance (FMR) and Brillouin light scattering (BLS). Comparison of the properties of films grown on perfect iron whisker surfaces with results for mosaic

single crystal substrates show that, while the former are much to be preferred for growth studies, the latter are really adequate for magnetic studies.

001,650

PB91-112375

Not available NTIS

National Inst. of Standards and Technology (MSEL), Gaithersburg, MD. Reactor Radiation Div.

Crystal Structure, Atomic Ordering and Charge Localization in Pb₂Sr₂Y(sub 1-x)Ca_xCu₃O₈(sub 8 + delta) (x=0, delta=1.47).

Final rept.

M. Marezio, A. Santoro, J. J. Capponi, E. A. Hewat, and R. J. Cava. 1990, 12p
Pub. in *Physica C* 169, p401-412 1990.

Keywords: *Crystal structure, *Superconductors, Electron diffraction, Neutron diffraction, X ray diffraction, Reprints, *Lead strontium yttrium cuprates, *High temperature superconductors.

Neutron, X-ray and electron diffraction measurements have been carried out on Pb₂Sr₂Y(1-x)Ca_xCu₃O₈(8 + delta) samples. The oxygen incorporated in the structure during the oxidation is located on the (Cu) planes sandwiched between the two (PbO) layers. Pb₂Sr₂YCu₃O₈ becomes superconducting at about 80 K when some of the trivalent Y cations are replaced by divalent Ca. In this case the extra positive charges oxidize the Cu(2+) cations in the CuO₂ planes instead of Pb(2+) to 4+ and Cu(1+) to 2+, as does the incorporation of oxygen. This different behavior can be explained as a concentration effect which changes the oxidation/reduction potentials.

001,651

PB91-112565

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Experimental Program on High (T sub c) Oxide Superconductors at the Naval Research Laboratory.

Final rept.

M. Osofsky, L. Toth, S. Lawrence, S. Qadri, A. Shih, D. Mueller, R. Hein, W. Fuller, F. Rachford, E. Skelton, T. Elam, D. Gubser, S. Wolf, J. Gottas, J. Rhyne, R. Kurtz, and R. Stockbauer. 1987, 3p
Pub. in *Proceedings MRS Spring Meeting High Temperature Superconductors*, Anaheim, CA., April 23-24, 1987, p173-175.

Keywords: *Superconductors, Research projects, Reprints, *High temperature superconductors, Yttrium barium cuprates, Naval Research Laboratory.

Since the middle of December 1986, the Naval Research Laboratory (and its collaborators) has had a program to study the new class of very high superconducting transition temperature copper oxides based on the perovskite structure. They have studied both the 40K superconductors based on the K₂NiF₄ structure consisting of La₂-zMxCuO₄ where M=Ba, Sr, and Ca, and the 95K superconductor based on the YBa₂Cu₃O₇ structure. The bulk samples were prepared using conventional powder ceramic processing technique from powders of the metallic oxides or carbonates and calcined in air at temperatures ranging from 950-1000 C. The samples were cold pressed into pellets and sintered in air and annealed in oxygen. Film samples are being prepared by sputtering, electron beam evaporation and chemical vapor deposition.

001,652

PB91-112573

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Precision Engineering Div.

Low-Profile Microchannel-Plate Electron Detector System for SEM.

Final rept.

M. T. Postek, W. J. Keery, and N. V. Frederick. 1990, 2p
Pub. in *Proceedings of International Congress for Electron Microscopy* (12th), Seattle, WA., August 12-18, 1990, p378-379.

Keywords: *Electron microscopy, Electron scattering, Backscattering, Line width, Reprints, *Scanning electron microscopy, *Microchannel electron multipliers, Secondary electrons.

The microchannel-plate system described here provides an alternative to the E/T detection system and it is adaptable to any SEM. Based on the initial concept, complete MCP systems are now commercially available for most any instrument. The MCP system provides an ability to study signal and contrast forming mechanisms that have been unable to be viewed ear-

er, due to detector limitations, and opens up new research opportunities for the scanning electron microscope. The paper presents the results of work done with the system at both high and low accelerating voltage.

001,653

PB91-112649

Not available NTIS

National Bureau of Standards (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Anomalous Vibrations of Hydrogen Isotopes in beta-Phase Vanadium Hydride.

Final rept.

J. J. Rush, N. F. Berk, A. Magerl, J. M. Rowe, and J. L. Provo. 1988, 3p
Pub. in *Physical Review B* 37, n13 p7901-7903, 1 May 88.

Keywords: *Vibrational spectra, Deuterium compounds, Tritium compounds, Neutron scattering, Intensity, Abnormalities, Reprints, *Vanadium hydrides.

Hydrogen-isotope vibration spectra have been measured between 34 and 240 meV for beta-phase V₂H, V₂D, and V₂T by inelastic neutron scattering. The observed low-energy vibrational transitions reveal a strongly anharmonic potential in the ab plane which is both isotope and temperature dependent. The results cannot be explained by models recently proposed for the potential in V₂H. The unusual overlap of the low-energy isotope vibrations with the band modes suggests that any theoretical representation must take into account the complex interactions between these modes and the acoustic lattice vibrations.

001,654

PB91-112664

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.

180 deg Surface Domain Wall Magnetization Profiles: Comparisons between Scanning Electron Microscopy with Polarization Analysis Measurements, Magneto-Optic Kerr Microscopy Measurements and Micromagnetic Models.

Final rept.

M. R. Scheinfein, P. J. Ryan, J. Unguris, D. T. Pierce, and R. J. Celotta. 1990, 3p
Sponsored by Office of Naval Research, Arlington, VA. Pub. in *Applied Physics Letters* 57, n17 p1817-1819, 22 Oct 90.

Keywords: Kerr magneto-optical effect, Nickel rich permalloy, Magnetic anisotropy, Magnetostatics, Surfaces, Reprints, *Domain walls, Scanning electron microscopy, Electron spin polarization.

The authors compare measurements of magnetization profiles across a 180 deg surface domain wall in a 0.24-micrometer-thick Permalloy (Ni₈₁Fe₁₉), obtained with scanning electron microscopy with polarization analysis (SEMPA) and longitudinal magneto-optic (MO) Kerr microscopy with the predictions of a bulk micromagnetic theory. Both measurement techniques yield wall profiles in accordance with the predictions of micromagnetic theory. The authors conclude that for micromagnetic structure with relevant length scales on the order of tens of nanometers, SEMPA and MO Kerr microscopy yield equivalent quantitative micromagnetic information within the transverse spatial resolution limits of each technique. Near-surface effects such as enhanced surface moments, weakened surface exchange, and surface anisotropy are not important in determining the surface domain wall profiles that were observed.

001,655

PB91-112672

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.

Scanning Electron Microscopy with Polarization Analysis (SEMPA).

Final rept.

M. R. Scheinfein, J. Unguris, M. H. Kelley, D. T. Pierce, and R. J. Celotta. 1990, 26p
See also PB90-150236. Sponsored by Office of Naval Research, Arlington, VA.
Pub. in *Review of Scientific Instruments* 61, n10 p2501-2526 Oct 90.

Keywords: Magnetic recording, Magnetization, Polarization, Reviews, Reprints, *Surface magnetism, Scanning electron microscopy, Domain walls, Electron spin polarization, Sherman functions, SEMPA system.

The high spatial resolution imaging of magnetic microstructure has important ramifications for both fundamental studies of magnetism and the technology surrounding the magnetic recording industry. One technique for imaging surface magnetic microstructure on the 10-nm-length scale is scanning electron microscopy with polarization analysis (SEMPA). In the review article the authors review the important instrumental components characterizing the SEMPA system. Characteristics of the electron probe forming optics, electron spin-polarization analyzers with associated transport optics, and signal processing electronics are described. Emphasis on the fundamental design requirements are stressed. Data acquisition, storage, and processing, as it applies specifically to SEMPA, are reviewed. Instrumental artifacts specific to SEMPA are outlined, and techniques for their correction are given. Examples of magnetic images at high spatial resolution are shown.

001,656
PB91-118174 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Short Range Order in Submonolayer Ni on GaAs(110) by XPS Forward Scattering.
Final rept.
W. F. Egelhoff, D. A. Steigerwald, J. E. Rowe, and T. D. Bussing. 1988, 4p
Pub. in *Jnl. of Vacuum Science and Technology* 6, n3 p1495-1498 1988.

Keywords: *Monomolecular films, Gallium arsenides, Substrates, Nickel, Reprints, X ray photoelectron spectroscopy.

Angle-resolved x-ray photoelectron spectroscopy (XPS) has been used to examine the structural arrangement of atoms in submonolayer coverages of Ni on GaAs(110). Insights into the short-range order around a lattice atom are possible because the outgoing photoelectron diffracts off overlying lattice atoms. This diffraction contains a strong component of forward scattering that yields enhanced intensities along axes connecting the emitting atom to its overlying nearest and next-nearest neighbors. The authors have found that these enhanced intensities are observed in the Ni 2p core level for 0.1ML Ni on GaAs(110) after annealing to 300 C but are much weaker before annealing. The angles at which these enhanced intensities appear suggest that upon annealing the Ni atoms replace Ga and As atoms in the third layer from the surface and perhaps in the second layer. Replacement may also occur in the top layer but this would produce no forward scattering signature. Thus the authors' structural results are consistent with this being a reactive interface.

001,657
PB91-118604 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.
X-ray Photoelectron Spectroscopy/Ar(1+) Ion Profile Study of Thin Oxide Layers on InP.
Final rept.
S. Thurgate, and N. E. Erickson. 1990, 7p
Pub. in *Jnl. of Vacuum Science and Technology* A 8, n5 p3669-3675 Sep/Oct 90.

Keywords: *Indium phosphides, Reprints, *Oxide layers, X ray photoelectron spectroscopy, Ion bombardment, Argon ions, Surface reactions, KeV range 01-10.

The effect of incremental ion bombardment on the surface layers of an aqua regia etched InP sample was studied by monitoring the components of the In 3d (5/2) and O 1s x-ray photoelectron spectroscopy (XPS) lines as the sample was bombarded with low energy (1 keV) Ar (1+) ions. The analysis of the XPS lines showed that the InP substrate was damaged at very low ion doses, and finally decomposed by the ion beam. When the ion 'cleaned' sample was exposed to oxygen, a different oxide system was produced which consisted largely of In₂O₃ and InPO₄ (or In(PO₃)_x). This model of the oxidized surface of InP is consistent with other measurements and the authors conclude that ion milling together with XPS and careful curve fitting can be used to find the nature of the thin oxides on InP.

001,658
PB91-133785 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.

Magnetic-Field-Modulated Written Bits in TbFeCo Thin Films: Transmission Electron Microscopy Lorentz and Scanning Electron Microscopy with Polarization Analysis Studies.

Final rept.
M. Aeschlimann, M. Scheinfein, J. Unguris, F. J. A. M. Greidanus, and S. Klahn. 1990, 9p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in *Jnl. of Applied Physics* 68, n9 p4710-4718, 1 Nov 90.

Keywords: *Thermomagnetic effects, Polarization(Spin alignment), Magnetic recording, Cobalt alloys, Iron alloys, Terbium alloys, Magnetic domains, Metal films, Thin films, Reprints, Transmission electron microscopy, Scanning electron microscopy, Surface magnetism, Magnetic films.

Domains written thermomagnetically in TbFeCo thin films are studied with Lorentz transmission electron microscopy (TEM) and scanning electron microscopy with polarization analysis (SEMPA). Four different rare-earth/transition-metal compositions Tb(x)Fe(y)Co(1-x-y) are examined. It was found that the magnetic contrast in the SEMPA measurements is proportional to the magnetization of the transition-metal (TM) subnetwork which is antiferromagnetically coupled to the rare-earth (RE) subnetwork. This allows high-contrast SEMPA images to be acquired even when the system is magnetically compensated. The surface magnetization can be explained by assuming that the surface of the TbFeCo alloy consists of an outermost thin oxide layer followed by an Fe-rich subsurface layer. The importance of the demagnetizing field on the switching and domain nucleation process for thermomagnetically written bits is examined.

001,659
PB91-133959 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.
Magnetic Properties of Sandwiches and Superlattices of fcc Fe(001) Grown on Cu(001) Substrates.
Final rept.
J. R. Dutcher, W. F. Egelhoff, J. F. Cochran, D. A. Steigerwald, and B. Heinrich. 1988, 3p
Pub. in *Jnl. of Applied Physics* 63, n8 p3464-3466 1988.

Keywords: *Iron, Magnetic anisotropy, Ferromagnetic resonance, Light scattering, Substrates, Copper, Reprints, Brillouin effect, Superlattices, Magnetism.

The magnetic properties of Cu/Fe epitaxial sandwiches and superlattices have been measured using Brillouin light scattering and ferromagnetic resonance. All of the samples are perpendicularly magnetized at room temperature, due to the presence of large uniaxial anisotropies with an easy axis perpendicular to the sample surface. Inclusion of a second order uniaxial anisotropy term is particularly important for one of the superlattice samples.

001,660
PB91-134064 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Electromagnetic Technology Div.
Thermal Contraction of Fiberglass-Epoxy Sample Holders Used for Nb₃Sn Critical-Current Measurements.
Final rept.
L. F. Goodrich, S. L. Bray, and T. C. Stauffer. 1990, 8p
See also PB90-149113. Sponsored by Department of Energy, Washington, DC. Office of Fusion Energy.
Pub. in *Advances in Cryogenic Engineering* Materials, v36 p117-124 1990.

Keywords: *Superconductors, *Holders, Electrical measurement, Contraction, Reprints, *Niobium stannides, *Critical current, Fiberglass reinforced composites, Temperature dependence.

It is typical for Nb₃Sn-Cu superconductor specimens to be wound into coils on tubular specimen holders is different that that of the specimen, axial strain may be applied to the specimen upon cooling from room to liquid-helium temperature. This strain can affect the measured critical current. The thermal contraction was measured for three different Nb₃Sn-Cu superconductors. Also, the thermal contraction was measured for several different specimen holders, all of which were made from fiberglass-epoxy composites. The results of these measurements show that the thermal contraction of tube stock is strongly dependent on the ratio of its wall thickness to its radius, while the con-

traction of tubes machined from plate stock is relatively independent of these dimensions. Critical-current measurements of Nb₃Sn-Cu specimens mounted on these various holders show that the presence of differential thermal contraction between the specimen and its holder can significantly affect the measured critical current.

001,661
PB91-134247 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Monocrystal-Polycrystal Elastic-Constant Models.
Final rept.
H. Ledbetter. 1990, 14p
See also PB85-207983.
Pub. in *Dynamic Elastic Modulus Measurements in Materials*, ASTM STP 1045, p135-148 1990.

Keywords: *Crystals, *Elastic properties, *Ultrasonic tests, Polycrystals, Single crystals, Mathematical models, Bulk modulus, Shear modulus, Stiffness, Simple cubic lattices, Copper, Reprints.

Considering only cubic symmetry (three independent monocrystal elastic-stiffness coefficients, C_{ij}), various models for converting the C_{ij} to the effective macroscopic quasiisotropic and homogeneous elastic constants, the bulk modulus, and the shear modulus. To test the models, a typical metal copper, was considered which possesses a moderate Zener elastic-anisotropy ratio, 3.19, and which was measured by pulse-echo dynamic (MHz) methods. The Hershey-Kroner-Eshelby and equivalent models work best. Using the H-K-E model, the effective polycrystalline elastic constants of twenty-five cubic elements were calculated.

001,662
PB91-134932 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.
Scanning-Tunneling-Microscopy Study of InSb(110).
Final rept.
L. J. Whitman, J. A. Stroscio, R. A. Dragoset, and R. J. Celotta. 1990, 4p
Sponsored by Office of Naval Research, Arlington, VA.
Pub. in *Physical Review B* 42, n11 p7288-7291, 15 Oct 90.

Keywords: *Indium antimonides, Surface properties, Reprints, *Scanning tunneling microscopy, Band theory, Semiconductors.

The (110) cleavage surface of InSb has been studied with scanning tunneling microscopy. A variety of surface defects has been observed, including those that appear to be simple vacancies and Schottky defects. Atomic-resolution images have been obtained of both the occupied- and unoccupied-state densities concentrated on the Sb anion and In cation, respectively. By simultaneously imaging both the occupied- and unoccupied-state densities, the relative positions of the In and Sb dangling bonds within the unit cell have been determined. As expected, the In state density is shifted with respect to the Sb state density by approximately one-half of a unit cell along the (bracket) (1,-1,0) (bracket) direction. Along the (bracket) (001) (bracket) direction, the In state density is displaced by approximately one-third of a unit cell, in good agreement with surface electronic structure and surface-buckling calculations. Measurements of the tunnel current versus voltage reveal conductance within the band gap associated with dopant-induced occupation of the conduction band.

Structural Mechanics

001,663
PB90-155359 PC A05/MF A01
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.
Institute for Materials Science and Engineering, Fracture and Deformation Division: Technical Activities 1989.
H. I. McHenry. Dec 89, 84p NISTIR-89/4149
See also report for 1988, PB89-148399.

Keywords: *Service life, *Reliability, *Materials tests, *Research management, Nondestructive tests, Com-

Structural Mechanics

posite materials, Cryogenics, Ceramics, Superconductors, Metals, Welding, *Fracture mechanics, *Deformation.

The report describes the 1989 fiscal year programs of the Materials Reliability Division of the Institute for Materials Science and Engineering. It summarizes the principal accomplishments in three general research areas: materials performance, properties, and processing. The Fracture Mechanics, Fracture Physics, Nondestructive Evaluation, and Composite Materials groups work together to detect damage in metals and composite materials and to assess the significance of the damage with respect to service performance. The Cryogenic Materials and Physical Properties groups investigate the behavior of materials at low temperature and measure and model the physical properties of advanced materials, including composites, ceramics and the new high-critical-temperature superconductors. The Welding and Thermomechanical Processing groups investigate the nonequilibrium metallurgical changes that occur during processing and affect the quality, microstructure, properties and performance of metals. The report lists the division's professional staff, their research areas, publications, leadership in professional societies, and collaboration in research programs with industries and universities.

001,664

PB90-169400 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg,
MD. Robot Systems Div.

Finite Element Procedures for Large Strain Elastic-Plastic Theories.

Final rept.

J. D. Lee. 1988, 12p

Pub. in *Computers and Structures* 28, n3 p395-406
1988.

Keywords: *Finite element analysis, Lagrangian functions, Strains, Reprints, Virtual work, Elasticity, Plasticity.

In a unified approach, the virtual work equations in rate form and in incremental forms are derived rigorously for elastic-plastic continuum subjected to large strains. The finite element procedures for the analyses of elastic-plastic solid based on Lee's theory and Green-Naghdi's theory are presented. Also, it is shown that transformations can be performed among the Eulerian, the Total-Lagrangian, and the Updated-Lagrangian formulations, and among different forms of constitutive relations without any approximation.

001,665

PB91-101154 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO.
Fracture and Deformation Div.

Rayleigh Wave Propagation in Deformed Orthotropic Materials, 1987.

Final rept.

P. P. Delsanto, and A. V. Clark. 1987, 9p

See also PB87-132049.

Pub. in *Jnl. of the Acoustical Society of America* 81, n4
p952-960 Apr 87.

Keywords: *Rayleigh waves, Stress measurement, Elastic properties, Perturbation theory, Ultrasonic radiation, Phase velocity, Orthotropism, Surfaces, Plates, Reprints, Inverse problems.

A perturbation method is described for the investigation of the propagation of Rayleigh waves on the surface of a homogeneous anisotropic initially deformed material plate. The authors' perturbation formalism is quite general and can also be applied when other small effects, like slight temperature changes or external magnetic fields, affect the Rayleigh wave propagation velocity. The special cases of slight orthotropy and initial deformations are analyzed in detail. For these cases the authors derive the Rayleigh wave phase velocity as a function of the propagation direction, the elastic constants, and the initial stresses. The linearity of the authors' formulas suggests that Rayleigh waves can be conveniently used as an experimental technique for the solution of the inverse problem of determining the elastic constants and/or the initial stresses in a material.

001,666

PB91-101170 Not available NTIS
National Bureau of Standards (IMSE), Boulder, CO.
Fracture and Deformation Div.

Wide Plate Crack Arrest Testing: Evolution of Experimental Procedures.

Final rept.

R. deWit, and R. J. Fields. 1985, 7p

See also PB88-139134. Sponsored by Department of
Energy, Washington, DC.

Pub. in *Proceedings of SEM (Society for Experimental
Mechanics) Fall Conference on Experimental Mechan-
ics: Transducer Technology for Physical Measure-
ments, Grenelefe, FL., November 17-20, 1985*, p69-
75.

Keywords: *Crack propagation, *Tension tests, *Metal plates, Cracking(Fracturing), Test facilities, Dynamic tests, Stresses, Tensile properties, Strain gages, Tensile stress, Reprints.

Since September 1984, four wide plate crack arrest tests have been carried out on the 26 MN tensile capacity testing machine at the National Bureau of Standards near Washington, D.C. Each test has been different with respect to conditions of testing, specimen configuration, and instrumentation used to monitor the dynamic response of the specimen during the crack run and arrest event. The progressive changes in test procedure to be discussed represent attempts to obtain the desired crack run and arrest behavior and to improve the quality of the data collected. In particular, efforts to cause the initiation of crack propagation at lower stress intensity factors will be discussed. Also, the optimization of strain gage location and the final choice of recording instrumentation will be reported in detail. Two techniques for measuring crack velocity will be compared.

001,667

PB91-101212 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Applied and Computational Mathe-
matics Div.

Finite Element Code Downsized for Personal Computers.

Final rept.

J. T. Fong. 1989, 3p

Pub. in *SIAM (Society for Industrial and Applied Mathe-
matics) News* 22, n2 p18-20 Mar 89.

Keywords: *Stress analysis, *Structural analysis, Thermal stresses, Heat transfer, Performance evaluation, Reprints, ANSYS 4.3 computer program, Personal computers, Computer software, Workstations, *Finite element method.

The paper is an experience report on a PC version of a general-purpose finite-element-analysis (FEA) code named ANSYS 4.3. The report is intended for three types of potential users: A Novice User who has a general idea of FEA but has never applied it to a problem on PC or otherwise; A Professional User who has applied a general-purpose FEA code on a non-PC computer, but has never tried a down-sized version of the code on a PC; and An Ultimate User who has written FEA codes for small-to-medium size problems in academic research or industrial consulting and is now thinking of tackling larger problems with more complicated geometry and material property inhomogeneities. It focuses on four technical criteria: The Start Up Effort; The PC Performance; The PC to Workstation Connection; and The Documentation.

General

001,668

AD-A137 146/7 PC A02/MF A01
Naval Research Lab., Washington, DC.

Beam Current Density Monitor for Intense Electron Beams.

Memorandum rept.

R. B. Fiorito, M. Raleigh, and S. M. Seltzer. 28 Dec

83, 21p Rept no. NRL-MR-5241

Keywords: *Electron probes, *Monitors, *Electron beams, Current density, Mapping, Intensity, High energy, Mechanical properties, Electrical properties, Response, Temperature, Experimental data.

The authors describe a new type of electric probe for mapping the radial current density profile of high-energy, high current electron beams. The idea of developing an electrically sensitive probe for these conditions was originally suggested to one of the authors during a year's visit to the Lawrence Livermore Nation-

al Laboratory. The resulting probe is intended for use on the Experimental Test Accelerator (ETA) and the Advanced Test Accelerator at that laboratory. This report discusses in detail: the mechanical design, the electrical response, and temperature effects, as they pertain to the electric probe, and describe the first experimental results obtained using this probe on ETA.

001,669

AD-A212 415/4 PC A03/MF A01
National Inst. of Standards and Technology, Boulder,
CO.

Liquid and Solid Ion Plasmas.

D. J. Wineland, and J. J. Bollinger. 10 Sep 89, 11p

Contract N00014-89-F-00020

Keywords: Angular momentum, Cooling, Distribution functions, Electromagnetic fields, Images, Ions, Lasers, Liquids, Plasmas(Physics), Solids, Spatial distribution, Spectroscopy, Velocity, Thermal properties, Laser spectroscopy, Penning traps, Laser cooling, *Ion traps.

Atomic ions which are stored in electromagnetic fields are an example of nonneutral plasmas. Laser techniques allow control of plasma angular momentum and provide plasma cooling to temperatures much less than 1K. Using imaging techniques, plasma spatial information is achieved. Laser spectroscopy techniques allow measurement of plasma velocity distribution functions. Liquid and solid behavior of ion plasmas is studied. Keywords: Liquid plasmas; Solid plasmas; Plasma distribution functions; Penning trap; Laser cooling. (jhd)

001,670

DE89004815 PC A02
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Div.

Development of a sup 3 He/Xe Gas Scintillation Counter to Measure the sup 3 He(n,p)T Cross Section in the Intermediate Energy Range.

J. W. Behrens, O. A. Wasson, A. D. Carlson, and H.

Ma. 1988, 4p CONF-880546-44

Contract AI01-86ER40275

International Conference on Nuclear Data for Science
and Technology, Mito, Japan, 30 May 1988.

Paper copy only, copy does not permit microfiche pro-
duction.

Keywords: *Helium 3 target, *Scintillation counters, Cross sections, Design, Energy resolution, Neutron reactions, ERDA/440103, ERDA/651220, NTISDE.

A sup 3 He/Xe gas scintillation counter has been developed for measuring the neutron energy range from thermal to 3 MeV. Great effort was concentrated on improving the detector design to optimize light production and collection to improve the energy resolution which is primarily controlled by photon statistics. The detectors were tested using a sup 238 Pu alpha-particle source, a thermal neutron beam from the NBS reactor, and the white-neutron spectrum from the NBS linac. The detector measures an energy resolution of 17% (FWHM) for the sup 3 He(n,p)T reaction at 2.0 MeV which is sufficient for cross section measurement. 12 refs., 8 figs. (ERA citation 14:009024)

001,671

DE89004817 PC A02
National Bureau of Standards, Gaithersburg, MD.

Measurements of the sup 235 U(N,F) Standard Cross Section at the National Bureau of Standards.

R. G. Johnson, A. D. Carlson, O. A. Wasson, K. C.

Duvall, and J. W. Behrens. 1988, 4p CONF-880546-

42

Contracts AI01-86ER40275, W-7405-ENG-36
International conference on nuclear data for science
and technology, Mito, Japan, 30 May 1988.

Paper copy only, copy does not permit microfiche pro-
duction.

Keywords: *Uranium 235 Target, Cross Sections, Energy Dependence, Fission, Neutron Reactions, Nuclear Data Collections, US NBS, ERDA/652020, *Fission cross sections, *Standards.

The primary mission of the Neutron Interactions and Dosimetry Group at the National Bureau of Standards (NBS) is the measurement of the standard neutron cross sections. The group has had a long-term program for the measurement of one of the most important of these cross sections—the neutron-induced fission cross section of sup 235 U. Since the ENDF/B-VI evaluation has been recently released, it is appropriate

to review the measurements of the sup 235 U(n,f) cross section which have been made at the NBS using accelerator-based neutron sources. In the 0.1--20 MeV region where this cross section is a standard, six separate measurements of the differential cross section, using a variety of techniques have been made. Both the NBS 150-MeV Electron Linac and the 3-MV Positive Ion Accelerator have been used as neutron sources. Two of the measurements are relative to the H(n,p) cross section while the remainder are absolute. These measurements will be reviewed and compared to ENDF/B-VI. The current status of this program and possible future improvements will be discussed. 11 refs., 3 figs., 1 tab. (ERA citation 14:009990)

001,672
DE89004819 PC A02
National Bureau of Standards, Gaithersburg, MD.
Measurement of the Sup 235 U(N,F) Reaction from Thermal to 1 KeV.

R. A. Schrack. 1988, 4p CONF-880546-41
Contract AI01-86ER40275
International conference on nuclear data for science and technology, Mito, Japan, 30 May 1988.
Paper copy only, copy does not permit microfiche production.

Keywords: *Uranium 235 Target, Boron 10, Comparative Evaluations, Cross Sections, Electronic Circuits, Fission, Ionization Chambers, Neutron Reactions, Time-of-Flight Method, ERDA/652020, *Fission cross sections.

The neutron induced fission cross section for sup 235 U has been measured from .02 to 1000 electron volts at the NBS electron LINAC facility. This cross section, especially the integrals from 7.8 to 11 eV and from 100 to 1000 eV, is incorporating both the sup 235 U foils and the sup 10 B foils used to monitor the neutron beam was built. The geometry of the chamber and the data taking system are designed to give the effect of a common environment and flight path so as to reduce or eliminate background and energy assignment problems. The shape measurements were normalized at thermal. Results are compared to other recent measurements and ENDF/B-V. 5 refs., 9 figs., 3 tabs. (ERA citation 14:009989)

001,673
DE89016082 PC A02/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

Performance of the High Power RF System for the NIST (National Institute of Standards and Technology) - Los Alamos Racetrack Microtron.

R. I. Cutler, and L. Young. 1988, 3p CONF-881049-74
Contracts AI01-87ER40332, W-7405-ENG-36
14. linear accelerator conference (LINAC-14), 3-7 Oct 1988.

Portions of this document are illegible in microfiche products.

Keywords: *RF Systems, *Racetrack Microtrons, Calibration, Control Systems, Electron Beams, Performance, ERDA/430303.

The high power RF system of the NIST-LANL RTM has been tested at nominal full power levels and has accelerated electron beams successfully. RF stability and calibration measurements have been made using the accelerated electron beam. These measurements have been used to calculate the effective shunt impedance of the side-coupled accelerator structure. RF stability measurements were also performed using power meters and phase detectors. 7 refs., 4 figs.

001,674
DE89016083 PC A02/MF A01
National Inst. of Standards and Technology, Gaithersburg, MD.

NIST (National Institute of Standards and Technology) - Los Alamos Racetrack Microtron Status.

M. A. Wilson, R. L. Ayres, R. I. Cutler, P. H. Debenham, and E. R. Lindstrom. 1988, 5p CONF-881049-75
Contracts AI01-87ER40332, W-7405-ENG-36
14. linear accelerator conference (LINAC-14), 3-7 Oct 1988.

Portions of this document are illegible in microfiche products.

Keywords: *Racetrack Microtrons, Beam Emittance, Beam Transport, Design, Electron Beams, Klystrons, Performance, RF Systems, ERDA/430200, ERDA/430100.

The NIST-Los Alamos Racetrack Microtron (RTM) is designed to deliver a low-emittance electron beam of up to 0.5 mA cw over an energy range of 17 MeV to 185 MeV. Fed by a 5 MeV injector, the RTM contains two 180 degree end magnets that recirculate the beam up to 15 times through a 12 MeV RF linac. The linac, which operates in a standing-wave mode at 2380 MHz, has been tested to nearly full RF power. At present, the injector has undergone beam tests, and the beam transport system is complete through the 12 MeV linac. A temporary beam line has been installed at the exit of one end magnet to measure the beam energy, energy spread, and emittance after one pass through the accelerator. Preliminary results indicate that the accelerated beam energy spread and emittance are within design goals. 4 refs., 7 figs.

001,675
DE90008800 PC A02/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electricity Div.

New determination of the fine-structure constant. Final report.
1989, 4p DOE/ER/40282-T1
Contract AI01-86ER40282
Sponsored by Department of Energy, Washington, DC. Portions of this document are illegible in microfiche products.

Keywords: *Quantum Electrodynamics, Accuracy, Calibration, Comparative Evaluations, Current Density, Impurities, Josephson Effect, Lasers, Magnetic Fields, Measuring Methods, Real Time Systems, Sampling, Stability, Structural Models, Technology Assessment, Variations, EDB/657002, *Fine structure constant, *Fundamental constants.

This report, submitted by the Electricity Division of NIST, is to summarize the work performed under contract DE-AI01-86ER40282 and represents a new experimental determination of the fine-structure constant (alpha), to the accuracy of 3.7 parts in 10(sup 8) (0.037 parts per million or ppm). The success of this experiment enabled the unequivocal testing of quantum electrodynamic theory (QED) to the same level of accuracy through the comparison of experimental and theoretical values of QED dependent quantities. These are the anomalous magnetic moment of the electron, a(sub e), the hyperfine splittings in muonium and positronium, and various Lamb shifts in hydrogen and helium. In view of the importance of quantum electrodynamics to our understanding of atomic, molecular, and particle physics, such critical comparisons have immense potential for confirming QED.

001,676
PB90-135963 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Quadratic Zeeman Effect in Moderately Strong Magnetic Fields.
Final rept.
S. L. Coffey, A. Deprit, B. Miller, and C. A. Williams.
1987, 15p
Pub. in Annals of the New York Academy of Sciences 497, p22-36 May 87.

Keywords: *Zeeman effect, Molecular spectroscopy, Celestial mechanics, Orbits, Reprints, Bifurcation(Mathematics), Chaos.

A compound reduction, first by the Delaunay group and then by the group of rotations about the direction of the magnetic field, establishes that the phase space consists of a two-parameter bundle of two-dimensional spheres. On each sphere, the north pole which represents a class of circular orbits is an equilibrium in the phase flow; it is stable as long as the projection H of the angular momentum along the magnetic field is greater than L/5, L being the second integral resulting from the elimination of the mean anomaly. At the critical value H = L/5, there occurs a Hopf bifurcation: the circular orbits become unstable while there appear two families of stable equilibria representing elliptic orbits whose semi-major axis is perpendicular to the line of nodes. Chaos is likely to set off along the homoclinic orbits asymptotic to the unstable equilibria.

001,677
PB90-136342 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Characteristics of an Optically Pumped Cs Frequency Standard at the NRLM (National Research Laboratory of Metrology).

Final rept.
S. Ohshima, Y. Nakadan, T. Ikegami, Y. Koga, R. Drullinger, and L. Hollberg. 1989, 4p
Pub. in IEEE (Institute of Electrical and Electronics Engineers) Transactions on Instrumentation and Measurement 38, n2 p533-536 Apr 89.

Keywords: *Cesium frequency standards, *Frequency standards, *Standards, Optical pumping, Frequency stability, Reprints.

Some characteristics are reported of an optically pumped Cs frequency standard developed at the National Research Laboratory of Metrology (NRLM). The short term frequency stability was estimated to be 1.1 x 10 to the -12th power/(square root of tau) when the optical feedback technique for laser diode stabilization was used. Frequency shifts due to microwave power and pumping conditions were measured and their characteristics are described.

001,678
PB90-136359 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Fundamental Tests of the Isotropy of Space Using Fast-Beam Laser Spectroscopy.
Final rept.

O. Poulsen, N. Bierre, E. Riis, S. A. Lee, and J. L. Hall. 1989, 23p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of Conference on Atomic Physics II, Paris, France, July 1988, p589-611 1989.

Keywords: *Special relativity, Isotropy, Tests, Laser spectroscopy, Light speed.

A brief review is given of experimental attempts to test the foundations of special relativity. The need for dynamical test theories to analyze such experiments is noted, and a new experiment sensitive to the one-way speed of light and the anisotropy of space is presented. The experiment is analyzed, using the test theory of Mansouri and Sexl.

001,679
PB90-136409 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Systematics of X-ray Transition Energies for High-Z Atoms.
Final rept.
R. D. Deslattes, E. G. Kessler, Y. K. Kim, and P. Indelicato. 1987, 5p
Pub. in Jnl. of Physics Colloquium 1, nC9 p591-595 1987.

Keywords: *Electron transitions, *X-rays, Atomic energy levels, Reprints, Forbidden transitions.

Experimental and theoretical x-ray transition energies are precisely estimated and compared for 40 < Z < 100. All allowed and forbidden intervals for the n=1 to n=2, 3 levels are determined. The experimental values are derived from absolute wavelength measurements of K (alpha) and K (beta) transitions and from L series x-ray measurements. The theoretical values are obtained using a multiconfiguration Dirac-Fock code with some modifications in the Lamb shift calculations. Comparison between experiment and theory for Z < 85 now provides a more coherent qualitative picture.

001,680
PB90-136417 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Fluorescent and Scattered Spectra: Near-Threshold Excitation of Atoms, Molecules, and Solids.
Final rept.
R. D. Deslattes. 1987, 12p
Pub. in Jnl. of Physics Colloquium 1, nC9 p579-590 1987.

Keywords: *Spectroscopy, Synchrotron radiation, X-ray spectra, Fluorescence, Raman spectra, Excitation, Scattering, Reprints, NSLS.

The beamline at the NSLS (Brookhaven) was designed for a class of doubly differential experiments in

PHYSICS

General

which spectra produced in response to tunable monochromatic photon excitation could be analyzed with high spectroscopic resolution. An important motivation is associated with satellite diagnostics, the contribution of double (and multiple) vacancy excitation to absorption profiles and the production of satellite-free spectra. While these phenomena are primarily associated with thresholds for double vacancy production, other interesting processes occur in the single vacancy threshold region. Included are new results on resonant elastic and inelastic (RAMAN) processes. At high resolution and with one, two or more sub-threshold resonances, Raman spectra display a particularly rich phenomenology.

001,681
PB90-136870 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Distance Measurements in Space: Gravitational Physics Tests and a Proposed Laser Gravitational Wave Antenna.

Final rept.
P. L. Bender. 1989, 22p
Contract NAGW-822

Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Conference on Atomic Physics II, Paris, France, July 1988, p567-588 1989.

Keywords: Distance measuring equipment, Gravitation, Reviews, Tests, *Gravitational wave antennas, *Gravitational waves, Laser range finders, Laser applications.

A number of new or very much improved tests of gravitational theory based on accurate distance measurements now appear to be possible using space techniques. The present status of solar system tests is reviewed, including planetary radar data, Mars Viking lander range measurements, and lunar laser ranging results. Additional possible future tests based on range measurements to a suggested Small Mercury Relativity Orbiter also are described. Then, present and possible future gravitational wave detection experiments in space at frequencies below 1 Hz are discussed. One option is a Laser Gravitational-wave Observatory in Space, with sufficient sensitivity to observe the signals from large numbers of galactic binaries of different types.

001,682
PB90-136888 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Ionizing Radiation Physics Div.

ETRAN-Experimental Benchmarks.
Final rept.
M. J. Berger. 1988, 37p
Pub. in Ettore Majorana International Science Series: Physical Sciences 38, p183-219 1988.

Keywords: Bremsstrahlung, Monte Carlo method, Transport properties, Electrons, Photons, Predictions, Comparison, Reprints, *ETRAN computer code.

Predictions from the electron-photon Monte Carlo code ETRAN are compared with results from 46 experiments with simple irradiation and target geometries. The comparisons pertain to transmission and reflection coefficients, energy spectra and angular distributions of transmitted and reflected electrons, the distribution with depth of deposited charge, spatial distributions of deposited energy, response functions for NaI and Si detectors, and the production of bremsstrahlung in thick targets.

001,683
PB90-136912 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Gas and Particulate Science Div.

Object Finder Based on Multiple Thresholds, Connectivity, and Internal Structure.
Final rept.
D. S. Bright. 1987, 2p
Pub. in Microbeam Analysis, p290-291 1987.

Keywords: Algorithms, Splitting, Ion microscopes, Electron diffraction, Reprints, *Image processing, *Feature extraction, Digital data.
An algorithm is presented to locate objects in digital images. The algorithm is not sensitive to object shape or size, but rather to intensities relative to a local surround and lack of internal structures that themselves could be considered objects. Although computationally expensive, the blob splitting algorithm is robust and

is used routinely in our laboratory for such tasks as locating particles or spots in ion microscope or electron diffraction images where there is a large background where the objects are of various sizes and shapes and have fuzzy edges or where the objects are not clearly separated.

001,684
PB90-136938 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Precision Engineering Div.

National Institute of Standards and Technology Molecular Measuring Machine: A Long-Range Scanning Tunneling Microscope for Dimensional Metrology.
Final rept.
E. C. Teague. 1989, 3p
Pub. in Microbeam Analysis, p545-547 1989.

Keywords: *Dimensional measurement, *Metrology, Surface roughness, Length, Precision, Design, Reprints, *Scanning tunneling microscopy, Nanotechnology.
A summary of the major design concepts for the National Institute of Standards and Technology Molecular Measuring Machine is given. Also included is a brief description of the mechanical design of the core structure, isolation system, and metrology reference system.

001,685
PB90-149105 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Physics Div.

Correction to 'Calorimetric Measurement of the Carbon Kerma Factor for 14.6-MeV Neutrons' by J. C. McDonald.
Final rept.
L. J. Goodman. 1988, 2p
Pub. in Radiation Research 113, n2 p396-397 1988.

Keywords: *Carbon, *Neutrons, Gamma rays, Computation, Correction, Reprints, *Kerma, MeV range 10-100, Calorimetry.
The report corrected has a serious calculation error in the compensation for the gamma-ray kerma of the mixed radiation field used to make the measurements. The error is explained and the value of the carbon kerma factor for 14.6-MeV neutrons is recalculated from the experimental data. Comparison of this value to those determined by others suggests that the calorimetric technique described has a significant error.

001,686
PB90-149139 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Electricity Div.

Observation of Associative Ionization of Ultracold Laser-Trapped Sodium Atoms.
Final rept.
P. L. Gould, P. D. Lett, P. S. Julienne, W. D. Phillips,
H. R. Thorsheim, and J. Weiner. 1988, 4p
Pub. in Physical Review Letters 60, n9 p788-791 1988.

Keywords: Cryogenics, Reprints, *Sodium atoms, Associative ionization, Laser cooling, Laser trapping.
The authors have observed associative ionization of laser cooled and trapped sodium atoms. The measured rate coefficient for the process at a temperature of 0.75 (+ or - .25) mK is 1.1×10^{-11} to the -11 power (+ or - 0.3) cc/sec, which implies a cross section of 8.6×10^{-10} to the -14 power/sq cm. This is three orders of magnitude larger than the cross section measured in previous experiments at higher temperatures.

001,687
PB90-150103 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Physics Div.

ETRAN: Experimental Benchmarks.
Final rept.
M. J. Berger. 1988, 37p
Pub. in Monte Carlo Transport of Electrons and Photons, Chapter 8, p183-219 1988.

Keywords: *Bremsstrahlung, Monte Carlo method, Comparison, Transmission, Reflection, Photons, Predictions, *Electron transport, ETRAN computer code, Benchmarks.
Predictions from the electron-photon Monte Carlo code ETRAN are compared with results from 46 experiments with simple irradiation and target geometries.

The comparisons pertain to transmission and reflection coefficients, energy spectra and angular distributions of transmitted and reflected electrons, the distribution with depth of deposited charge, spatial distributions of deposited energy, response functions for NaI and Si detectors, and the production of bremsstrahlung in thick targets.

001,688
PB90-150269 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Atomic and Plasma Radiation Div.

Atomic Transition-Probability Measurements for Prominent Spectral Lines of Neutral Nitrogen.
Final rept.
Q. Zhu, J. M. Bridges, T. Hahn, and W. L. Wiese.
1989, 6p
Pub. in Physical Review A 40, n7 p3721-3726, 1 Oct 89.

Keywords: *Spectral lines, Transition probabilities, Electric areas, Reprints, *Nitrogen atoms.
Relative transition probabilities of 29 lines belonging to the 3s-3p, 3s-4p, 3p-3s(double prime), and 2s2p(4) - 2s(2)sp(2)4p transition arrays of N I have been measured in emission with a wall-stabilized arc and were normalized to an absolute scale utilizing two recent lifetime results. The experiment was undertaken to help resolve some long-standing discrepancies in the nitrogen data. The results are usually slightly larger than two earlier emission measurements but are in closer agreement with recent calculations. The total uncertainties of individual transition-probability values are estimated not to exceed a range from plus or minus 12% to plus or minus 15%, the larger uncertainties occurring for the very weak lines.

001,689
PB90-152778 Not available NTIS
National Bureau of Standards (NEL), Boulder, CO.
Thermophysics Div.

Interim Thermodynamic Property Formulation for Air.
Final rept.
R. T. Jacobsen, R. B. Stewart, S. G. Penoncello, and
R. D. McCarty. 1987, 16p
Pub. in Fluid Phase Equilibria 37, p169-184 Oct 87.

Keywords: *Air, *Thermodynamic properties, Density, Equations of state, Thermodynamics, Pressure, Temperature, Dew point, Liquid saturation, Boiling points, Bubbles, Reprints.
A new interim formulation for the thermodynamic properties of air which includes estimated properties for the liquid is reported. Separate equations for the calculation of bubble point and dew point properties are included. The need for further measurements of liquid air properties and of properties on and near the dew point curve and bubble point curve to provide the basis for a new accurate correlation is summarized. Vapor properties are believed to be sufficiently accurate for design and analysis work, except near the dew point curve, but no substantiated claim for the accuracy of the calculated liquid properties can be made.

001,690
PB90-152810 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Center for Radiation Research.

Active Target Production of Muons for Muon Catalyzed Fusion.
Final rept.
M. Jandel, M. Danos, and J. Rafelski. 1988, 4p
Pub. in Physical Review C-Nuclear Physics 37, n1 p403-406 1988.

Keywords: *Muons, Reprints, *Muon-catalyzed fusion, Particle production, Deuterium target, Tritium target, Fusion reactors.
Using a Monte Carlo method, the authors study the energy efficiency of muon production by a high energy beam of deuterons (i.e., protons and neutrons). They present detailed results for infinite deuterium-tritium targets in dependence on target density and beam energy. The key role of secondary (shower) production of muons is demonstrated. The authors qualitatively explore constraints on the design of muon catalyzed fusion power reactors.

001,691
PB90-152851 Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.

Transport Properties of Fluids of Cryogenic Interest.

Final rept.
W. M. Haynes, D. E. Diller, and H. M. Roder. 1987, 13p
Pub. in *Cryogenics* 27, n7 p348-360 1987.

Keywords: *Thermal conductivity, *Viscosity, Liquefied gases, Liquid helium, Liquid hydrogen, Liquid nitrogen, Liquid oxygen, Mixtures, Reprints, *Cryogenic fluids.

The paper consists of a status report for viscosity and thermal conductivity data and correlations for pure fluids and fluid mixtures encountered in cryogenic process technology. Recommended correlations or tables of values are identified for each fluid. Specific data needs for future work are reported. Also presented are brief descriptions of the experimental techniques for viscosity and thermal conductivity measurements, along with estimates of the experimental uncertainties.

001,692
PB90-155870 PC A03/MF A01

National Inst. of Standards and Technology (NEL), Boulder, CO. Chemical Engineering Science Div.
Apparatus for Measuring High-Flux Heat Transfer in Radiatively Heated Compact Exchangers.
D. A. Olson. Oct 89, 37p NISTIR-89/3926
Contract NASA-L7400C

Sponsored by National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.

Keywords: *Heat flux, *Heat transfer, *Heat exchangers, *Thermal measurements, *Test facilities, Convection, Friction factor, Furnaces, Heat flux meters, Helium, Thermal measuring instruments, National Aerospace Plane.

Described is an apparatus which can deliver uniform heat flux densities of up to 80 W/sq cm over an area 7.8 cm by 15.2 cm for use in measuring the heat transfer and pressure drop in thin (6 mm or less), compact heat exchangers. Helium gas at flow rates of 0 to 40 kg/h and pressures to 6.9 MPa (1000 psi) is the working fluid. The instrumentation used in the apparatus and the methods for analyzing the data is described. The apparatus will be used initially to test the performance of prototype cooling jackets for the engine struts of the National Aerospace Plane (NASP).

001,693
PB90-163627 PC A07/MF A01

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Electronics and Electrical Engineering.
Electromechanical Properties of Superconductors for High-Energy Physics Applications. Part 2.
J. W. Ekin, L. F. Goodrich, S. L. Bray, N. F. Bergren, and R. B. Goldfarb. Nov 89, 148p NISTIR-89/3912
Also available from Supt. of Docs. See also PB87-165585. Sponsored by Department of Energy, Washington, DC. Div. of High Energy Physics.

Keywords: *Superconducting magnets, Electromechanics, Tensile stress, Bending stress, Steels, Magnetization, *Superconducting cables, *High energy physics, Superconducting super collider, Niobium titanium, Critical current.

The report presents data on superconductor performance under mechanical load. The data are needed for setting mechanical design constraints and measuring the electromechanical performance of NbTi superconductors for DOE high-energy physics magnet applications. Highlights of the report include the following: The first measurements of the effect of axial tensile stress, applied at room temperature, on the critical current of NbTi superconductor strands have been measured. A study of the critical-current variations along NbTi strands extracted from a Rutherford cable has been made. A systematic study of the effects of bending strain on the critical current of NbTi conductors has been performed. Many high-energy-physics accelerators use high-permeability steel for the return flux path of the superconducting magnets. Measurements of the permeability, saturation magnetization, and intrinsic coercivity of several high-permeability steel alloys were made.

001,694
PB90-163924

(Order as PB90-163874, PC A04)

National Inst. of Standards and Technology, Gaithersburg, MD.

Measuring the Root-Mean-Square Value of a Finite Record Length Periodic Waveform.

E. C. Teague. 1989, 5p
Included in *Jnl. of Research of the National Institute of Standards and Technology*, v94 n6 p367-371 1989.

Keywords: *Waveforms, *Surface roughness, Measurement, Profiles, Random error, Root mean square value, Uncertainty.

The paper presents a discussion of the uncertainty in measuring the root-mean-square, rms, value of a periodic waveform which results from the use of a finite record length. The analysis was motivated by seeking to understand the source of a random uncertainty component which was present in some measurements of the absolute arithmetic average, R_{sub} a deviation from a mean line of profiles of precision roughness specimens. The profiles of these specimens had an approximately triangular waveform with two wavelengths and amplitudes. For the longer wavelength specimens the random phasing of the waveform with respect to the recording interval proved to be a major source of uncertainty in the measurements.

001,695
PB90-169244 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Prompt Gamma as a Fluence Rate Monitor in Neutron Beam Experiments.

Final rept.
G. P. Lamaze, D. M. Gilliam, and A. P. Williams. 1988, 9p
Sponsored by Department of Energy, Washington, DC., and Institut Max von Laue - Paul Langevin, Grenoble (France).
Pub. in *Jnl. of Radioanalytical and Nuclear Chemistry* 123, n2 p551-559 1988.

Keywords: *Neutron beams, Neutron reactions, Neutrons, Reprints, *Neutron fluence, Boron 10 target, Gamma detection, Lithium 7, Lifetime.

The $(10)\text{B}(\alpha,n)$ reaction is a commonly used reaction for measuring neutron fluence rates and is considered a 'standard' reaction below 100 keV neutron energy. This reaction has a large, well-known thermal cross section and its departure from $1/v$ behavior is about 3 parts in 10000. The principal alpha branch is to the first excited state of $(7)\text{Li}$ which then decays by emission of a 478 keV gamma ray. The alpha particles can be measured with surface barrier detectors or both recoil particles can be measured with a gas proportional counter. Energy loss of the emitted alpha particles restricts the former to thin samples and wall- and end-effects reduce the accuracy of the latter. However, the measurement of the gamma branch can be made with boron samples that totally absorb thermal neutrons. This allows greater sensitivity and eliminates the uncertainty of target thickness. The absolute efficiency of the gamma(γ) detector can be measured by an alpha-gamma coincidence technique or with a calibrated $(7)\text{Be}$ source. Preliminary investigations of this method are presented with a discussion of the problems that must be overcome. Application of this method to a new measurement of the neutron lifetime are discussed.

001,696
PB90-169335 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
Multilayer-Coated Mirrors as Power Filters in Synchrotron Radiation Beamlines.

Final rept.
J. B. Kortright, P. Plag, R. C. C. Perera, P. L. Cowan, D. W. Lindle, and B. Karlin. 1988, 5p
Pub. in *Nuclear Instruments and Methods in Physics Research* 266, n1-3 p452-456 1988.

Keywords: *Mirrors, Monochromators, Synchrotron radiation, Reprints, *NSLS, *Beam optics, KeV range 1-10, EV range 100-1000, Multilayers.

Multilayer-coated mirrors, rather than conventional total reflection mirrors, have been proposed as a means to reduce power incident on the first optical element of high resolution monochromators. The authors have investigated this application of multilayers specifically for the 800-400 eV range for the X24-A bending magnet beamline at the National Synchrotron Light Source. Various aspects of this application are discussed, including power and thermal considerations, beamline layout considerations and constraints, and choice of multilayer materials and substrate. Results of a preliminary characterization of a mirror coated with a

SiC/V multilayer and installed in the beamline are also discussed.

001,697
PB90-169418 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Length and Mass Div.
Laser Length Metrology.

Final rept.
H. P. Layer. 1987, 6p
Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p63-1-63-6 1987.

Keywords: *Dimensional measurement, *Metrology, *Length, Standards, Accuracy, Reprints, Laser applications, Meter.

The accuracy of length measurements is determined by the relationship between the measurement procedures and instruments and the standard of length. This relationship includes the definition and realization of the meter, the transfer of the standard to the working instrument, and the correction for the index of refraction of air.

001,698
PB90-169467 Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.
Stability of a Current-Carrying Hollow Liquid-Metal Cylinder.

Final rept.
R. A. MacDonald. 1989, 7p
Pub. in *Jnl. of Applied Physics* 66, n11 p5302-5308, 1 Dec 89.

Keywords: Electric current, Reduced gravity, Dispersion relations, Liquid metals, Stability, *Liquid metal cylinders, High temperature.

An investigation of the factors that influence the stability of a conducting hollow liquid-metal cylinder in a microgravity environment is carried out for the particular configuration in which a fraction of the current in the cylinder is returned down a central conducting rod. The analysis assumes that axial symmetry is maintained, that at any instant the cylinder is at a uniform temperature, and that the liquid metal is incompressible and inviscid. Vibrations in which the inner and outer boundaries of the cylinder move in phase are found to be always stable. The out-of-phase modes are unstable for long wavelengths, but these unstable modes can be excluded by a suitable choice of the length and thickness of the cylinder. The relationship of this analysis to the recent results of Chow and Harvanek on electromagnetic capillary instabilities in a hollow liquid-metal cylinder is discussed.

001,699
PB90-170051 Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
Multiple-Scattering Angular Deflections and Energy-Loss Straggling.

Final rept.
M. J. Berger, and R. Wang. 1988, 36p
Sponsored by Department of Energy, Washington, DC. Pub. in *Monte Carlo Transport of Electrons and Photons*, Chapter 2, p21-56 1988.

Keywords: *Electron scattering, Scattering cross sections, Inelastic scattering, Elastic scattering, Monte Carlo method, Water, Reprints, *Electron transport, Energy losses.

The paper deals with Monte Carlo models of electron transport in which, for the sake of economy, the simulation of all successive Coulomb collisions is replaced by the sampling of multiple-scattering angular deflections and energy losses in successive short track segments. The authors review some of the required input cross sections, as well as the applicable multiple-scattering theories. Among the topics discussed are: the calculation of elastic scattering cross sections with screened Coulomb potentials (Thomas-Fermi, Hartree-Fock and solid-state); comparisons of the multiple-scattering distribution of Moliere with that of Goudsmit and Saunderson; contribution of inelastic scattering to multiple-scattering deflections; development of an energy-loss cross-section database for water; use of this database in a Monte Carlo calculation of energy-loss straggling, and comparisons with straggling distributions from the Landau theory.

001,700
PB90-170473 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
ASTM (American Society for Testing and Materials) Dosimetry Activities: A Progress Report.
 Final rept.
 J. C. Humphreys, H. Farrar, and B. P. Fairand. 1988, 4p
 Pub. in Radiation Physics and Chemistry - International Jnl. of Radiation Applications and Instrumentation 31, n4-6 p1C p409-412 1988.

Keywords: *Dosimetry, *Standards, Ionizing radiation, Food processing, Reprints, *Gamma dosimetry, *Electron dosimetry, Radiation hardening, Electronic equipment.

Radiation Dosimetry standards are under development in ASTM on the selection of dosimetry systems for use in the operation of gamma ray or electron beam food processing facilities, on the dosimetry in gamma ray facilities used for radiation hardness testing of electronic devices, and on the use of dosimetry systems for general applications such as the Fricke and ceric-cerous sulfate dosimeters.

001,701
PB90-170499 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.
NBS (National Bureau of Standards) Ionizing-Radiation Measurement Services.
 Final rept.
 D. D. Hoppes. 1987, 11p
 Pub. in 'Innovation: Key to the Future,' NCSL Workshop and Symposium Technical Presentations, Denver, CO., July 12-16, 1987, p70-1-70-11.

Keywords: *Dosimetry, Ionizing radiation, Alpha particles, Neutrons, Radioactivity, Reprints, *Calibration, Electron dosimetry, Gamma dosimetry, X-ray dosimetry, Radioisotopes, National Institute of Standards and Technology.

Calibrations offered within the Ionizing Radiation Division of the NBS Center for Radiation Research involve dosimetry of x rays, gamma rays, and electrons; dosimetry for high dose applications; measurement of neutron sources and dosimeters; and activity measurements of radionuclides. Each of these services has evolved from the establishment and maintenance of national standards, usually with a strong and continuing link to measurements made in other nations. Reports now being published describe in detail the bases, techniques, and uncertainties of each type of calibrations service. Even when demand does not warrant a calibration service, or while such a service is being developed, special tests are a way of propagating the national standards. Where formal measurement-assurance programs or accreditations do not exist, special cooperations or Research Associate arrangements offer a way of confirming the measuring ability of commercial firms or other government agencies. Existing examples from the Radioactivity Group will be discussed.

001,702
PB90-170721 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Gas and Particulate Science Div.
Test of a Bremsstrahlung Equation for Energy-Dispersive X-ray Spectrometers.
 Final rept.
 J. A. Small, D. E. Newbury, and R. L. Myklebust. 1987, 2p
 Pub. in Microbeam Analysis, p20-21 1987.

Keywords: *X ray spectrometers, *Bremsstrahlung, Mathematical models, Reprints, Si semiconductor detectors.

Recently the authors published an empirical model describing the generation of bremsstrahlung x-radiation as a function of the atomic number of the target, z, x-ray energy, E_v , and electron energy, E_o . This model was developed for pure-element targets excited by 10-40 keV electrons. It was based on the fitting of a high quality data set where great care was taken to insure that the detector was operating properly and that the spectra were free from obvious artifacts. The objective of this paper is to determine the applicability of the model to other detector systems. The results of the comparison to a second detector system indicate that the model can be used to accurately predict brems-

strahlung intensities from a second experimental setup.

001,703
PB90-170747 Not available NTIS
 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Length and Mass Div.
Rydberg Constant and Fundamental Atomic Physics.
 Final rept.
 P. Zhao, W. Lichten, and Z. X. Zhou. 1989, 11p
 Grant NSF-PHY84-19105
 Sponsored by National Science Foundation, Washington, DC.
 Pub. in Physical Review A 39, n6 p2888-2898, 15 Mar 89.

Keywords: *Fundamental constants, *Dimensional measurement, Atomic physics, Hydrogen, Spectra, Length, Standards, Reprints, *Rydberg constant, Meter.

A detailed report on the current status of measurements of the Rydberg constant is given. The authors' recently reported value of $R(\text{sub infinity}) = 109737.31573(3)/\text{cm}$ has been confirmed by three other laboratories within experimental error. An additional check on the iodine cell, the heart of the authors' wavelength and frequency reference, confirms a negligible pressure shift. The possible role of the Tydberg constant in fundamental atomic physics lies in tests of quantum electrodynamics and in improvement of the realization of the meter. The authors propose that the hydrogen spectrum be used to realize the meter in the optical domain, as an alternative to the current frequency chains. For the realization to be useful, improvement of the current precision of the Rydberg constant by a factor of 2 or more is required.

001,704
PB90-170812 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div.
Cooling, Stopping, and Trapping Atoms.
 Final rept.
 W. D. Phillips, P. L. Gould, and P. D. Lett. 1988, 7p
 Sponsored by Office of Naval Research, Arlington, VA.
 Pub. in Science 239, n4842 p877-883, 19 Feb 88.

Keywords: Atomic beams, Atomic spectroscopy, Reviews, Reprints, *Beam cooling, *Atom traps, Laser cooling, Laser trapping, Magnetic traps.

The authors review laser cooling and deceleration of atomic beams, magnetic and laser trapping of neutral atoms, and a number of recent advances in the use of radiative forces to manipulate atoms.

001,705
PB90-170994 Not available NTIS
 National Bureau of Standards (NEL), Gaithersburg, MD. Thermophysics Div.
Fast Radiation Thermometry.
 Final rept.
 A. Cezairliyan, J. F. Babelot, J. Magill, and R. W. Ohse. 1988, 24p
 Pub. in Theory and Practice of Radiation Thermometry, Chapter 8, p529-552 1988.

Keywords: *Temperature measurement, Photoelectric cells, Photographic techniques, Thermal radiation, Resistance heating, Reprints, Laser heating.

The chapter covers the development of temperature methods having high time resolution.

001,706
PB90-171083 Not available NTIS
 National Bureau of Standards (NML), Gaithersburg, MD. Temperature and Pressure Div.
Excitation of the Isobaric Analog State of (165)Ho by Pion Single Charge Exchange.
 Final rept.
 J. N. Knudson, H. W. Baer, A. G. Bergmann, J. D. Bowman, J. R. Comfort, H. Crannell, W. J. Fickinger, R. A. Gianelli, S. S. Hanna, P. A. Heusi, S. Hoihraten, F. Irom, R. A. Loveman, H. Marshak, D. Pocanic, B. G. Ritchie, S. H. Rokni, D. Rothenberger, C. J. Sefor, and D. I. Sober. 1987, 6p
 Pub. in Physical Review C-Nuclear Physics 35, n4 p1382-1387 1987.

Keywords: Differential cross sections, Reprints, *Holmium 165, Pion plus reactions, Charge exchange reactions, Isobaric nuclei, Deformed nuclei.

Forward-angle differential cross sections for the $(165)\text{Ho}(\pi^+, \pi^0)(165)\text{Er}(\text{IAS})$ reaction have been measured at $T(\pi) = 98.0, 163.2$ and 228.3 MeV in the angular range $2 \text{ degree} \leq \theta < \theta_0 < 14 \text{ degree}$. The shapes of the angular distributions at 98.0 and 163.2 MeV are compared to predictions arising from the strong absorption model of pion single-charge exchange scattering. Extrapolated 0 degree cross sections are compared with trends previously established with mostly spherical and near-spherical nuclei. The measurement demonstrates the possibility of using the (π^+, π^0) reaction for studying neutron density deformations in oriented $(165)\text{Ho}$.

001,707
PB90-171091 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Prospects for Using Laser-Prepared Atomic Fountains for Optical Frequency Standards Applications.
 Final rept.
 J. L. Hall, M. Zhu, and P. Buch. 1989, 12p
 Grant NSF-PHY86-04504
 Sponsored by National Science Foundation, Washington, DC.
 Pub. in Jnl. of the Optical Society of America B 6, n11 p2194-2205 Nov 89.

Keywords: *Frequency standards, *Atomic clocks, Reprints, *Atomic fountains, Laser cooling, High resolution.

The authors consider the problems and techniques of high-resolution microwave and optical spectroscopy of atoms on free-flight gravitational orbits in an atomic fountain. They consider choice of species and tabulate some relevant characteristics of several attractive atomic systems, including possible clock transitions and their estimated radiative linewidths. They illustrate one possible scheme for approaching Zacharias' dream of an atomic fountain and discuss a powerful two-stage laser cooling technique to reduce unwanted velocity spread. They present the status of measurements on slow atoms and on stabilized laser sources for the atomic-clock applications in both rf and optical domains.

001,708
PB90-171109 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Bremsstrahlung Radiation Emitted in Fast-Electron-H Atom Collisions.
 Final rept.
 A. Dubois, and A. Maquet. 1989, 10p
 Pub. in Physical Review A 40, n8 p4288-4297, 15 Oct 89.

Keywords: *Bremsstrahlung, Cross sections, Reprints, *Electron-atom collisions, *Hydrogen atoms, Born approximation.

A previous calculation for free-free transitions is generalized so as to treat one-photon (spontaneous) bremsstrahlung emitted in the course of collisions of relatively fast electrons with atomic hydrogen. While the electron-atom collision is described within the first Born approximation, the role of the atomic spectrum is taken into account exactly via the use of a compact representation of the Coulomb Green's function. The authors discuss the main features of the cross sections and address some physically relevant issues such as the importance of the screening by the atomic electron, the role of the atomic structure, and limiting cases such as the soft-photon and the small-momentum transfer limits. They also discuss the differences observed between the cross sections for spontaneous bremsstrahlung and stimulated free-free transitions.

001,709
PB90-171125 Not available NTIS
 National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.
Approximate Scattering Wave Functions for Few-Particle Continua.
 Final rept.
 J. S. Briggs. 1990, 3p
 Pub. in Physical Review A 41, n1 p539-541, 1 Jan 90.

Keywords: *Wave functions, Ionization, Scattering, Identities, Reprints, Electron-atom collisions, Hydrogen atoms, Electron impact.

An operator identity which allows the wave operator for N particles interacting pairwise to be expanded as products of operators in which fewer than N particles interact is given. This identity is used to derive approximate scattering wave functions for N -particle continua that avoid certain difficulties associated with Faddeev-type expansions. For example, a derivation is given of a scattering wave function used successfully recently to describe the three-particle continuum occurring in the electron impact ionization of the hydrogen atom.

001,710
PB90-187758 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Center for Chemical Engineering.
**Two-Phase Heat Transfer in the Vicinity of a Lower
Consolute Point.**

Final rept.
M. C. Jones. 1989, 18p
Pub. in *Supercritical Fluid Science and Technology*,
ACS (American Chemical Society) Symposium Series
406, Chapter 25, p396-413 1989.

Keywords: *Heat transfer, *Two phase flow, *Condensing, Heat transfer coefficient, Mixtures, Supercritical flow, Carbon dioxide, Experimental data, Thermodynamic equilibrium, Reprints, Binary mixtures, Supercritical state, Vapor condensation.

Experimental measurements of heat transfer coefficients are reported for three binary mixtures near their lower consolute points. Two of these, respectively n -pentane and n -decane in solution with supercritical CO_2 , involve vapor-liquid equilibrium whereas the third, triethylamine-water, involves liquid-liquid equilibrium. Anomalously high heat transfer coefficients were found for the supercritical mixtures at compositions which condense on heating (retrograde condensation). These are attributed to thermocapillarity, and criteria are proposed for the values of dimensionless parameters which would indicate its presence. For cases considered, numerical values support this explanation. Additional support is provided by photographic evidence.

001,711
PB90-187766 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Molecular Spectroscopy Div.
Collisions of Ultracold Trapped Atoms.

Final rept.
P. S. Julienne, and F. H. Mies. 1989, 13p
Sponsored by Air Force Office of Scientific Research,
Bolling AFB, DC.
Pub. in *Jnl. of the Optical Society of America B* 6, n11
p2257-2269 Nov 89.

Keywords: Metastable state, Helium, Ionization, Reprints, *Atomic collisions, Atom traps, Laser cooling, Ultracold atoms, Penning effect.

Collisions of ultracold atoms can now be investigated in the laboratory at temperatures below 0.001 K. Such collisions are qualitatively different in many ways from collisions at normal energies, where $T \gg 1$ K, because of the long time and distance scales associated with such collisions. Spontaneous emission can strongly modify collision dynamics of excited-state species produced by near-resonant optical excitation if the temperature is less than the characteristic temperature $T(S)$, where the collision time is comparable with the spontaneous-emission lifetime. The authors also estimate the temperature $T(Q)$ that is characteristic of the onset of quantum threshold behavior, where the WKB approximation fails to apply as the de Broglie wavelength becomes large. It was found that $T(Q)$ is generally larger than $T(D)$, the Doppler cooling limit, except for collisions controlled by long-range potentials varying as $1/R$ cubed. $T(Q)$ may be larger or smaller than $T(S)$. Expressions for estimating the magnitude of rate coefficients in the $T \rightarrow 0$ limit are given.

001,712
PB90-187873 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Capture of Inner-Shell Electrons in the Strong-Potential Born (SPB) Approximation.

Final rept.
H. Marxer, and J. S. Briggs. 1989, 2p
Pub. in *Z. Phys. D - Atoms, Molecules and Clusters* 13,
p75-76 1989.

Keywords: *Electron capture, Reprints, Strong potential Born approximation, Electron-proton interactions, K shell.

For the first time the capture of inner-shell electrons by protons is calculated by the SPB method without further approximation and using Hartree-Slater wavefunctions. The resulting cross-section has roughly the correct shape, but is much too large. The problem is traced to a loss of normalization caused by the SPB approximation. A suitably renormalized SPB gives close agreement with experiment.

001,713
PB90-187881 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Radiation Physics Div.
Search for a Joint Spin-Orbit and Exchange Asymmetry in Elastic Electron Scattering from Spin-Polarized Sodium.

Final rept.
J. J. McClelland, S. J. Buckman, M. H. Kelley, and R. J. Celotta. 1990, 4p

Sponsored by Department of Energy, Washington, DC.

Pub. in *Jnl. of Physics B: At. Mol. Opt. Phys.* 23, L21-L-24 1990.

Keywords: *Electron scattering, Polarization(Spin alignment), Elastic scattering, Spin orbit interactions, Asymmetry, Reprints, Sodium atoms.

Measurements of the asymmetry in the scattering of unpolarized electrons from optically pumped spin-polarized sodium atoms have been carried out at incident electron energies of 20, 54.4 and 70 eV and for a range of scattering angles between 20 deg and 140 deg. This asymmetry, which was first proposed by Farago as a means of measuring spin-orbit effects in the presence of a dominant spin-exchange interaction, is less than 1% at all energies and scattering angles studied.

001,714
PB90-188459 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Velocity Distributions from the Fourier Transforms of Ramsey Line Shapes.

Final rept.
J. H. Shirley. 1989, 6p
Pub. in *Proceedings of Annual Symposium on Frequency Control* (43rd), Denver, CO., May 31-June 2, 1989, p162-167.

Keywords: Frequency standards, Atomic beams, Fourier transformation, Accuracy, Reprints, *Ramsey line shapes, Velocity distribution.

A computerized method for finding velocity distributions from the Fourier transforms of Ramsey line shapes has been developed. Since atoms in certain velocity groups (those returning to their initial state) do not contribute to the lineshape, a single lineshape transform gives an incomplete picture of the velocity distribution. To bypass this problem, the author uses Ramsey lineshape data taken at different excitation powers so that these velocity groups will contribute. A weighted average of data from three powers gives satisfactory results.

001,715
PB90-188616 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
Progress at NIST (National Institute of Standards and Technology) Towards Absolute Frequency Standards Using Stored Ions.

Final rept.
D. J. Wineland, J. C. Bergquist, J. J. Bollinger, W. M. Itano, and D. J. Heinzen. 1989, 8p
Pub. in *Proceedings of Annual Symposium on Frequency Control* (43rd), Denver, CO., May 31-June 2, 1989, p143-150.

Keywords: *Atomic clocks, *Frequency standards, *Standards, Accuracy, Reprints, *Ion storage, Ion traps, Penning traps, Laser cooling, US NIST, Beryllium 9, Mercury 199.

Experiments at NIST, whose goal is to realize frequency standards of high accuracy using stored ions, are briefly summarized. In one experiment, an rf oscillator is locked to a nuclear spin-flip hyperfine transition (frequency approx = 3.03×10 to the 8 power Hz) in $(9)\text{Be}(1+)$ ions which are stored in a Penning trap and sympathetically laser-cooled. In a second experiment, a stable laser is used to probe an electric quadrupole transition (frequency approx = 1.07×10 to the 15 power Hz) in a single laser-cooled $(199)\text{Hg}(1+)$ ion stored in a Paul trap. The measured Q value of this

transition is approximately 10 to the 13 power. Future possible experiments are also discussed.

001,716
PB90-188624 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
High Accuracy Spectroscopy of Stored Ions.

Final rept.
D. J. Wineland, W. M. Itano, J. C. Bergquist, J. J. Bollinger, F. Diedrich, and S. L. Gilbert. 1989, 7p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in *Proceedings of Symposium on Frequency Standards and Metrology* (4th), Ancona, Italy, September 5-9, 1988, p71-77 1989.

Keywords: *Atomic spectroscopy, Frequency standards, Atomic clocks, Frequency stability, Doppler effect, Reprints, *Ion storage, Laser cooling, High resolution.

Physical limitations to the achievement of accurate, high resolution spectroscopy on stored ions are briefly discussed. For experiments on ion clouds, a compromise between frequency stability and second order Doppler shift uncertainty must be made. Expected performance for specific examples using single ions and ion clouds is discussed.

001,717
PB90-190711 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.
Analytical Method to Characterize the Performance of Multiple Section Straight-Sided Neutron Guide Systems.

Final rept.
J. R. D. Copley. 1990, 11p

Pub. in *Nuclear Instruments and Methods in Physics Research A* 287, p363-373 1990.

Keywords: Particle trajectories, Reflection, Performance, Reprints, *Neutron guides, Acceptance diagrams.

A method is presented to determine the trajectories of neutrons in multiple section straight-sided neutron guide systems. Nonreflecting sections can be handled, as well as reflecting sections with less than 100% reflectivity. It is also possible to trace the paths of neutrons which pass through a nonabsorbing guide surface, having been incident at an angle greater than the critical angle for reflection from the surface. Transverse displacements and angular misalignments between sections are readily included. The behavior of systems with nonuniform illumination can be determined. The approach, as presently formulated, is limited to one lateral dimension. A number of practical examples of the use of the method are described.

001,718
PB90-190802 Not available NTIS
National Bureau of Standards, Boulder, CO.
Hydrogen Treatment of Stark Effects in Rydberg Atoms.

Final rept.
D. A. Harmin. 1985, 30p
Pub. in *Atomic Excitation and Recombination in External Fields*, p39-68 1985.

Keywords: *Hydrogen, *Stark effect, Atomic spectra, Electric fields, Reprints, Rydberg series.

In an overview of the effects of constant electric fields on atomic spectra, particular emphasis is placed on hydrogen. Nonhydrogenic core interactions modify the spectra through the mixing of quasi-discrete and continuous channels. Interference effects stemming from the geometrical configurations of H Stark wave functions determine the extent of level shifts, anticrossings, intensity and width variations, and autoionization. A generalized analogy to Rydberg series helps to unify the connection to H.

001,719
PB90-193293 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Molecular Spectroscopy Div.

PHYSICS

General

Laser-Induced Photoassociation of Ultracold Sodium Atoms.

Final rept.

H. R. Thorsheim, J. Weiner, and P. S. Julienne.

1987, 4p

Pub. in Physical Review Letters 58, n23 p2420-2423 1987.

Keywords: Molecular spectroscopy, Reprints, *Sodium atoms, *Atom collisions, Ultracold atoms, Photoassociation, High resolution, Laser applications.

The authors present the theory of laser-induced radiative association in terms of a scattering resonance formalism and apply this theory to the specific case of Na atom collisions at a temperature of 10 mK. The basic two-step process proceeds by: (1) a free-bound photon absorption by the colliding atoms to an excited molecular state followed by (2) radiative decay of the molecular complex to the Na2 singlet ground state or lowest lying triplet state. The authors calculate the absorption coefficient for step (1) as well as the spectrum and emission rate for step (2). Use of ultracold atoms permits a new kind of high resolution free-bound spectroscopy of energy levels which are difficult to study by conventional bound state spectroscopy.

001,720

PB90-193533

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Energy Dependence of Polarization Observables in the (sup 2)H(d,gamma)(sup 4)He Reaction.

Final rept.

H. R. Weller, R. M. Whitton, J. Langenbrunner, E.

Hayward, W. R. Dodge, S. Kuhn, and D. R. Tilley.

1988, 6p

Pub. in Physics Letters B 213, n4 p413-418 1988.

Keywords: *Deuteron reactions, Alpha particles, Polarization, Asymmetry, Reprints, Energy dependence, KeV range 100-1000, MeV range 1-10, MeV range 10-100.

Measurements of the tensor and vector analyzing powers, $A_{yy}(130 \text{ deg})$ and $A_y(130 \text{ deg})$, have been obtained for the $(^2\text{H}(d, \gamma)^4\text{He})$ reaction for energies ranging from $E(d)(1ab) = 0.3 \text{ MeV}$ to $E(d)(1ab) = 50 \text{ MeV}$. The $A_{yy}(130 \text{ deg})$ data are sensitive to the D-state present in the ground state of (^4He) and are observed to have their maximum value near $E(d) = 30 \text{ MeV}$. The vector analyzing power data are compared with the results of a potential model calculation which includes in addition to $E2 \text{ } \Delta S = 1 \text{ E1 (or M2) radiation}$.

001,721

PB90-193582

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Calibration of a Neutron-Driven Gamma-Ray Source.

Final rept.

T. G. Williamson, G. P. Lamaze, and D. M. Gilliam.

1989, 5p

Pub. in Reactor Dosimetry: Methods, Applications, and Standardization, ASTM STP 1001, p751-755 1989.

Keywords: *Gamma rays, Fission foil dosimeters, Cadmium, Iron, Radiation counters, Cylindrical bodies, Reprints, *Radiation sources, *Calibration, Neutron capture.

Cadmium and iron cylinders in the thermal-column cavity of the National Bureau of Standards Reactor provide intense sources of neutron capture gamma-rays. The strength of the gamma-ray fields have been calculated from measurements of the neutron interaction rates in the cadmium and in the iron cylinders. The neutron interaction rates were measured by activation foils fixed on the surface of the cylinders and by direct counting of the activated cylinders. Miniature fission chambers have been used to measure the axial distributions.

001,722

PB90-193590

Not available NTIS

National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Measurement of the (93)Nb(n,n') Fission Spectrum Cross Section.

Final rept.

T. G. Williamson, T. A. Ayers, W. L. Hammersten, G. P. Lamaze, and F. J. Schima. 1989, 6p

Pub. in Reactor Dosimetry: Methods, Applications, and Standardization, ASTM STP 1001, p229-234 1989.

Keywords: *Neutron cross sections, *Scattering cross sections, *Fission cross sections, Measurement, Inelastic scattering, Fission foil dosimeters, Irradiation, X ray analysis, Radiation counters, Monte Carlo method, Reprints, *Niobium 93.

Niobium foil materials were irradiated in the cavity fission source of the National Bureau of Standards Reactor. The foils were counted directly with a germanium low-energy spectrometer. A Monte Carlo code was written to calculate the number of X-rays at the detector for each disintegration. The measured cross section for the reaction $(^{93}\text{Nb}(n,n'))(^{93\text{m}}\text{Nb})$ is $144 \pm 0.5\text{mb}$.

001,723

PB90-205766

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Electromagnetic Technology Div.

Superconductivity and the Quantization of Energy.

Final rept.

D. G. McDonald. 1990, 6p

Pub. in Science 247, p177-182, 12 Jan 90.

Keywords: *Superconductivity, *Energy levels, Fundamental constants, Josephson junctions, Precision, Arrays, Reprints, *Josephson effect, Quantization.

Ideas about quantized energy levels originated in atomic physics, but research in superconductivity has led to unparalleled precision in the measurement of energy levels. A comparison of levels produced by two Josephson junctions shows that they differ by no more than 3 parts in 10 to the 19 power at an energy of 0.0003 electron volt. The fact that the myriad of interactions of a trillion particles in a macroscopic body, a Josephson junction, can produce sharply defined energy levels suggests a dynamical state of effectively divorced from the complexities of its environment. The existence of this state, the macroscopic quantum state of superconductors, is well established, but its isolation from intrinsic perturbations has recently been shown to be extraordinary. These new results, with an improved precision of about ten orders of magnitude, are discussed in the context of highly accurate results from quantum electrodynamics, atomic spectroscopy, and the standards of metrology.

001,724

PB90-205832

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Low-Frequency Approximation for Simultaneous Electron-Photon Excitation of Atoms.

Final rept.

A. Maquet, and J. Cooper. 1990, 4p

Grant NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Physical Review A 41, n3 p1724-1727, 1 Feb 90.

Keywords: Approximation, Excitation, Reprints, *Electron-atom collisions, *Photon-atom collisions, Multiphoton processes, Laser radiation.

The authors discuss the limitations of some low-frequency approximations commonly used in the theory of laser-assisted electron-atom collisions resulting in the excitation of the target.

001,725

PB90-205857

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Differential Cross Section for Na Fine-Structure Transfer Induced by Na and K Collisions.

Final rept.

P. N. Arcuni, M. L. Troyer, and A. Gallagher. 1990,

9p

Grant NSF-PHY86-04054

Sponsored by National Science Foundation, Washington, DC.

Pub. in Physical Review A 41, n5 p2398-2406, 1 Mar 90.

Keywords: *Sodium, *Potassium, Differential cross sections, Energy transfer, Reprints, *Atom-atom collisions.

The electronic energy-transfer process $\text{Na}^*(3P(3/2)) + \text{M} \rightarrow \text{Na}^*(3P(1/2)) + \text{M}$, where M is an Na or K atom, has been measured differentially with respect to scattering angle. This has been done with crossed beams and by establishing the final $3P(1/2)$ state velocity distribution from the Doppler spectrum of $3P(1/2) \rightarrow 4D(3/2)$ absorption. The differential cross section for Na perturbers is highly forward peaked (within a few degrees) with a small but extended high-angle tail. Forward angles are also dominant for K perturbers, but these cover a larger angular range with a very substantial large-angle contribution.

2) $\rightarrow 4D(3/2)$ absorption. The differential cross section for Na perturbers is highly forward peaked (within a few degrees) with a small but extended high-angle tail. Forward angles are also dominant for K perturbers, but these cover a larger angular range with a very substantial large-angle contribution.

001,726

PB90-205873

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Harmonic Generation by a Classical Hydrogen Atom in the Presence of an Intense Radiation Field.

Final rept.

G. Bandarage, A. Maquet, and J. Cooper. 1990, 3p

Grant NSF-PHY86-04504

Sponsored by National Science Foundation, Washington, DC.

Pub. in Physical Review A 41, n3 p1744-1746, 1 Feb 90.

Keywords: Reprints, *Hydrogen atoms, *Harmonic generation, *Photon-atom collisions.

The authors present the results of a calculation of high-order harmonic generation by a classical hydrogen atom, submitted to an intense, single-mode, radiation field. The spectra showing these harmonics associated with different kinds of trajectories as well as with an ensemble average of trajectories are discussed.

001,727

PB90-205899

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Test of the Linearity of Quantum Mechanics by rf Spectroscopy of the (9)Be(1+) Ground State.

Final rept.

J. J. Bollinger, D. J. Heinzen, W. M. Itano, S. L.

Gilbert, and D. J. Wineland. 1989, 4p

Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in Physical Review Letters 63, n10 p1031-1034, 4 Sep 89.

Keywords: Radiofrequency spectroscopy, Hyperfine structure, Ground state, Linearity, Reprints, *Quantum mechanics, Beryllium ions, Beryllium 9, Ion storage.

A hyperfine transition in the ground state of $(^9\text{Be}(1+))$ was used to test a nonlinear generalization of quantum mechanics recently formulated by Weinberg. The authors searched for a dependence of the frequency of a coherent superposition of two hyperfine states on the populations of the states. The authors are able to set a limit of 4×10 to the -27 power on the fraction of binding energy per nucleon of the $(^9\text{Be}(1+))$ nucleus that could be due to nonlinear corrections to quantum mechanics.

001,728

PB90-205972

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Gyroscope-Weighing Experiment with a Null Result.

Final rept.

J. E. Faller, W. J. Hollander, P. G. Nelson, and M. P.

McHugh. 1990, 2p

Sponsored by Air Force Geophysics Lab., Hanscom AFB, MA.

Pub. in Physical Review Letters 64, n8 p825-826, 19 Feb 90.

Keywords: *Gravitation, Gyroscopes, Reprints, Weight reduction, Spinning(Motion), Spinning tops, Anomalies.

A recent experiment reporting an anomalous weight reduction for a spinning gyroscope weighed on a pan balance has been repeated in the author's laboratory. No anomalous weight changes were found of the magnitude reported that depend on rotor speed and/or rotational sense about the vertical axis.

001,729

PB90-206020

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Gauge Invariance and Approximate Multiphoton Calculations in Hydrogen.

Final rept.
Y. Justum, A. Maquet, and Y. Heno. 1990, 5p
Pub. in Physical Review A 41, n5 p2791-2795, 1 Mar 90.

Keywords: *Hydrogen, Stark effect, Reprints, Gauge invariance, Multi-photon processes.

It has been observed that fairly accurate estimates for two-photon bound-bound amplitudes in hydrogen can be obtained from a simple partial summation restricted to the discrete spectrum contribution, provided one uses the $E(\dot{r})$ form of the interaction Hamiltonian. It is shown that this conclusion does not hold when considering higher-order multiphoton processes. In fact, the corresponding multiple sums can be shown to be divergent and, consequently, no reliable estimates can be obtained from such an approximation. Using the $(1/c)A(\dot{r})^p$ form of the interaction does not lead to reliable estimates either. Those conclusions are based on a comparison with exact results for the second- and fourth-order contributions to the ac Stark shift of the ground state, computed with the help of a Sturmian basis.

001,730
PB90-206707 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div. **Calculation of Spectral Line Profiles of Multi-Electron Emitters in Plasmas.**
Final rept.

L. A. Woltz, and C. F. Hooper. 1988, 6p
Pub. in Physical Review A 38, n9 p4766-4771, 1 Nov 88.

Keywords: *Spectral lines, Krypton, Reprints, Laser-produced plasma, Line broadening, Multicharged ions.

A theoretical formalism and computer code have been developed to calculate spectra of multi-electron emitters in plasmas. The plasma electron broadening is treated by a quantum mechanical relaxation theory. The static ion approximation is used to treat plasma ion broadening of the atomic levels. Calculated lithium-like and beryllium-like krypton spectra are compared to experimental spectra obtained in laser implosion experiments at the LLE, University of Rochester.

001,731
PB90-206764 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div. **Laser Cooling.**
Final rept.

D. J. Wineland, and W. M. Itano. 1987, 7p
Pub. in Physics Today 40, n6 p34-40 Jun 87.

Keywords: Radiation pressure, Reprints, *Laser cooling, *Atom traps, *Ion traps.

Theory and experiments on laser cooling of neutral atoms and atomic ions is presented. A brief history of the mechanical forces of light is first given. Then, a simple theory of radiation pressure cooling (laser cooling) of free and bound atoms is presented, along with the temperature limits imposed by recoil. Experiments on trapped ions and neutral atoms are then described. Finally, the future of laser cooling is briefly discussed.

001,732
PB90-206798 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Electricity Div. **Measure $h/e(2)$ by Counting Electrons or Ions in a Storage Ring.**
Final rept.

E. R. Williams, and T. Tomimasu. 1987, 6p
Pub. in Physical Letters A 124, n3 p185-190, 21 Sep 87.

Keywords: *Fundamental constants, Reprints, *Electron charge, *Electron counting, Quantum Hall effect, Storage rings, SQUID devices.

Electron storage rings offer the possibility of realizing a current by counting the electrons per second passing through a detector. If several difficult technical problems can be solved, this technique offers the possibility of accurately measuring the quantity h/e squared and providing a stringent test of the quantum Hall effect. A SQUID current comparator design to do the 'counting' is presented with estimates of its performance on a specific storage ring. Characteristics of an ideal storage ring are suggested.

001,733
PB90-206863 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div. **Spectra of the Si I Isoelectronic Sequence from Cu XVI to Mo XXIX.**
Final rept.

J. Sugar, V. Kaufman, and W. L. Rowan. 1990, 7p
Sponsored by Department of Energy, Washington, DC., and Naval Research Lab., Washington, DC.
Pub. in Jnl. of the Optical Society of America B 7, n2 p152-158 Feb 90.

Keywords: *X ray spectra, *Ultraviolet spectra, Far ultraviolet radiation, Arsenic, Bromine, Copper, Gallium, Germanium, Krypton, Molybdenum, Niobium, Rubidium, Selenium, Strontium, Yttrium, Zinc, Zirconium, Reprints, Isoelectronic sequence, Multicharged ions, Laser-produced plasma.

Si-like spectra of Cu to Mo have been observed in tokamak-generated plasmas, and Cu to As in laser-produced plasmas. Wavelengths in the range of 86 to 300 Å were recorded photographically with a 2.2-m grazing-incidence spectrograph on the tokamak, and a 10.7-m grazing-incidence spectrograph for the laser plasmas. Wavelength accuracy is estimated to be ± 0.005 Å. The transition arrays $3s(2)3p(2)-3s3p(3)$ and $3s(2)3p(2)-3s(2)3p3d$ were identified. Classifications were established by comparison with Hartree-Fock calculations of wavelengths and relative intensities along isoelectronic sequences. Spectra of Rb and Sr were not observed, but interpolated values of wavelengths for these ions are derived from the rest of the data. Ground configuration intervals known from magnetic dipole transitions are compared with Dirac-Fock calculations to predict unknown values and to correct misidentifications.

001,734
PB90-206947 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div. **Distinct Alignment Effects for $Y_{(sub 2,0)}$ versus $Y_{(sub 2, + or - 1)}$ Angular Wave Functions Observed in Collisions of an Atomic Ca D State.**
Final rept.

R. L. Robinson, L. J. Kovalenko, and S. R. Leone. 1990, 4p
Grants NSF-CHE84-08430, NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Physical Review Letters 64, n4 p388-391, 22 Jan 90.

Keywords: *Calcium, Wave functions, Energy transfer, Excitation, Alignment, Neon, Reprints, Atom-atom collisions, D states, Laser radiation.

Two different angular wave functions of the $Ca(4p(2))$ singlet $D(2)$ state are prepared via a two-step laser excitation with parallel and perpendicular configurations of the two linear polarizations. These wave functions exhibit dramatically different alignment effects for the electronic-energy-transfer process $Ca(4p(2))$ singlet $D(2) + Ne \rightarrow Ca(3d4p)$ singlet $F(3) + Ne$. Relative cross sections for individual Ca singlet $D(2)$ magnetic sublevels are obtained from these measurements using the rotation properties of the two wave functions.

001,735
PB90-206954 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div. **Soft X-ray Optics Characterization on Surf II.**
Final rept.

J. R. Roberts, J. Kerner, and E. B. Saloman. 1990, 4p
Contract SDIO-WPD-B238
Sponsored by Aerospace Guidance and Metrology Center, Newark AFS, OH.
Pub. in Physica Scripta 41, p9-12 1990.

Keywords: Monochrometers, Reflectometers, Characteristics, Gratings(Spectra), Reprints, *SURF II storage ring, *Soft x rays, Multilayers.

The report describes the present capabilities and future plans for soft X-ray optics characterization at the NIST storage ring SURF II. The existing facility is made up of a monochromator and a reflectometer capable of characterizing the reflectivity of soft X ray devices including multilayers, gratings and grazing incidence optics. The system can also be used to characterize the transmission of components such as filters. Plans

to modernize and expand the capabilities of the facility are discussed.

001,736
PB90-207077 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Radiation Physics Div. **Theory of Spin-Polarized Metastable-Atom-Deexcitation Spectroscopy: Ni-He.**
Final rept.

D. R. Penn, and P. Apell. 1990, 13p
Pub. in Physical Review B Condensed Matter 41, n6 p3303-3315, 15 Feb 90.

Keywords: Metastable state, Nickel, Reprints, *Helium atoms, *Deexcitation, Atomic collisions, Surface reactions, Electron spin polarization, Excited states.

Metastable spin-polarized He* atoms incident on a Ni surface undergo deexcitation in a process which yields electrons from the Ni. The number produced is observed to depend on the relative spin of the Ni and the He* atoms. The normalized difference in the ejected-electron intensity produced by He* atoms with opposite spin polarizations increases dramatically with increasing kinetic energy of the electrons. A theory of this asymmetry is presented. It is found that the experimental results can be reproduced only by the use of a realistic potential for the Ni electrons in the vacuum region. With such a potential it is found that He(1+) ions which result from the He*-surface interaction are neutralized at about 4.5 Å from the Ni surface, a much larger distance than given by previous estimates. The experiment is shown to reflect the polarization of Ni electrons at the He ion, and it is estimated that the Ni magnetization at the Fermi energy and far from the Ni surface is approximately 20%.

001,737
PB90-207267 PC A04/MF A01
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Atomic, Molecular and Optical Physics.

Technical Activities 1989, Electron and Optical Physics Division.
C. W. Clark. Feb 90, 56p NISTIR-90/4287
See also PB90-161985 and PB90-185109.

Keywords: *Research, Far ultraviolet radiation, Synchrotron radiation, Radiometry, Atomic physics, Electron optics, Soft x-rays, SURF II storage ring, Multiphoton processes, Scanning tunneling microscopy.

The report summarizes technical activities of the NIST Electron and Optical Physics Division during Fiscal Year 1989. These fall into five general areas: soft x-ray radiometry, operation of the SURF-II synchrotron storage ring; electron microscopy and basic surface physics; soft x-ray emission studies; and multiphoton processes. A listing is given of calibration services, publications, talks, and other relevant activities of the Division's staff.

001,738
PB90-217738 Not available NTIS
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div. **Use of Acceptance Diagrams to Calculate the Performance of Multiple-Section Straight-Sided Neutron Guide Systems.**
Final rept.

J. R. D. Copley. 1988, 8p
Pub. in Proceedings of International Collaboration on Advanced Neutron Sources Conference (10th), Los Alamos, NM., October 3-7, 1988, p821-828.

Keywords: Collimators, Performance, Reprints, *Neutron guides, Neutron reflection, Acceptance diagrams.

The authors describe a method to calculate the performance of multiple section systems of straight-sided guides and collimators. The approach is based on the concept of acceptance diagrams, which display the transverse spatial and angular coordinates of the neutrons in the system. For a given section of guide the construction of the exit diagram, from the entrance diagram, is shown to be accomplished using a shear transformation followed by translational and rotational operations applied to polygons representing respectively even and odd numbers of reflections within the section. The reflected neutron polygons are then truncated leaving only the neutrons that never strike a surface at an angle greater than the critical angle for total reflection.

001,739

PB90-217761

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Threshold Cerenkov Radiation and Beam Diagnostics.

Final rept.

J. R. Neighbours, F. R. Buskirk, and X. K. Maruyama. 1987, 3p

Pub. in Proceedings of IEEE (Institute of Electrical and Electronics Engineers) Particle Accelerator Conference: Accelerator Engineering and Technology, Washington, DC., March 16-19, 1987, p655-657.

Keywords: *Cerenkov radiation, Coherent radiation, Reprints, *Beam diagnostics, Form factors.

Cerenkov and transition radiation occur for single particles or for beam bunches; for the latter, the intensity may be strong at long wave lengths as a result of the coherence of emission. Also, if the medium has finite length, the Cerenkov radiation is diffracted. Not only is the angle of emission broadened but the emission threshold is not sharp. At measurement angles in the vicinity of 90 deg, the Fourier transforms of the charge distribution within a bunch may be determined for both the Cerenkov and sub-Cerenkov cases.

001,740

PB90-218314

Not available NTIS

National Inst. of Standards and Technology (IMSE), Gaithersburg, MD. Reactor Radiation Div.

Effects of Chopper Jitter on the Time-Dependent Intensity Transmitted by Multiple-Slot Multiple Disk Chopper Systems.

Final rept.

J. R. D. Copley. 1988, 13p

Pub. in Proceedings of International Collaboration on Advanced Neutron Sources Conference (10th), Los Alamos, NM., October 3-7, 1988, p327-339.

Keywords: *Neutron spectroscopy, *Vibration, *Intensity, Monte Carlo method, Slots, Boolean functions, Reprints, *Electric choppers, Temporal resolution.

The paper presents Monte Carlo calculations of the time dependence of the intensity transmitted by single- and multiple-slot multiple disk chopper assemblies, taking into account the effects of chopper jitter. In the case of multiple-slot systems, where each of at least two choppers and a mask is fitted with two or more slots, a switching function is employed to suppress contaminated pulses, i.e., pulses in which neutrons can pass through slots that would never line up in the absence of jitter. Such pulses, if accepted, would degrade the time resolution of the system. The results for the time-integrated intensity are in good agreement with previously reported semi-analytic calculations. The need to reject contaminated pulses in multiple-slot systems is emphasized.

001,741

PB90-218363

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Surface Science Div.

Digital Video Data Acquisition/Analysis for Existing ESDIAD Apparatus.

Final rept.

A. L. Johnson, R. Stockbauer, D. Barak, and T. E. Madey. 1988, 5p

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of International Workshop on Desorption Induced by Electronic Transitions (DIET III) (3rd), Shelter Island, NY., May 20-22, 1987, p130-134 1988.

Keywords: Data acquisition, Digital techniques, Analysis(Mathematics), Display devices, Reprints, *Electron stimulated desorption ion angular distributions(ESDIAD), *Video data, Hardware, Computer software, Image processing.

Video digitization techniques have recently been applied to data acquisition and analysis of Electron Stimulated Desorption Ion Angular Distributions (ESDIAD) data. The various techniques for ESDIAD data are compared and the hardware and software used in the system are described. The techniques use readily available hardware to get quantitative ESDIAD patterns from display type analyzers without modifications in vacuum. The apparatus is capable of single ion sensitivity, time dependent investigations, and can be used at a number of different stations.

001,742

PB90-218371

Not available NTIS

National Bureau of Standards (NML), Gaithersburg,

MD. Center for Radiation Research.

Current View of the Iota/E System.

Final rept.

S. Meshkov, W. F. Palmer, and S. S. Pinsky. 1987,

7p

Pub. in Proceedings of Rencontre Moriond, Hadrons, Quarks Gluons 22, n2 p683-689 1987.

Keywords: *Mesons, Reprints, Pseudoscalar mesons, Quantum chromodynamics, Lota spectroscopy, Glueballs.

The Iota/E system is examined to elucidate the quark/gluon nature of this particle or particles. The authors view the system as comprised of at least two states: a high mass Iota around 1460-1500 MeV with J sup (PC) = 0 sup (-+) and a low mass E around 1420 MeV with J sup (PC) = 0 sup (-+) and/or 1 sup (++) . The Iota has a considerable admixture of glue in its wave function, and its quark content is near the electromagnetically 'inert' mixture $u(\bar{u}) + d(\bar{d}) - 5s(\bar{s})$. The authors propose a number of experimental tests which should enhance the understanding of this complex and interesting system.

001,743

PB90-218397

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Physics Div.

Concept of Secondary Laboratories.

Final rept.

E. H. Eisenhower. 1985, 9p

Contract DE-AC06-76RL01830

Sponsored by Department of Energy, Washington, DC. Pub. in Proceedings of Workshop on Radiation Survey Instruments and Calibrations, Gaithersburg, MD., July 10-12, 1984, p4-12 Nov 85.

Keywords: *Radiation measuring instruments, Ionizing radiation, Standards, Performance tests, Reprints, *Secondary laboratories, US NBS, Calibration.

The author presents an introductory paper for a workshop on radiation survey instruments and calibrations. It describes the primary function of the National Bureau of Standards (NBS) and the national support system for measurements of ionizing radiation. The mechanisms used to achieve consistency between field measurements and the national physical measurement standards are considered, with emphasis on the role of secondary standards laboratories. These laboratories serve as an important link between NBS and radiation measurers at the field (user) level. The use of performance tests to determine consistency with NBS is encouraged, and methods of conducting such tests are described. The importance of documentation is emphasized, particularly with regard to quality control and procedures used by secondary laboratories for routine services. One function of secondary laboratories, namely instrument testing, is considered in detail.

001,744

PB90-218470

Not available NTIS

National Bureau of Standards (NEL), Gaithersburg, MD. Building Equipment Div.

Algorithms for Calculating Radiation View Factors between Plane Convex Polygons with Obstructions.

Final rept.

G. N. Walton. 1987, 9p

See also PB89-114045.

Pub. in ASME (American Society of Mechanical Engineers), Heat Transfer Division, v72 p45-52 1987.

Keywords: *Algorithms, *Thermal radiation, Heat transfer, Differential equations, Numerical analysis, Integral equations, Measure and integration, Shape, Reprints, *Radiant heat transfer.

Methods for calculating view factors between plane polygons are described and compared. Gaussian integration significantly improves the performance of line integral methods. A shadow projection method combined with line integral evaluation is shown to be more accurate and possibly faster than conventional methods for evaluating view factors with obstructing surfaces.

001,745

PB90-218488

Not available NTIS

National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.

Accurate X-ray Spectroscopy.

Final rept.

R. D. Deslattes. 1987, 21p

Pub. in Proceedings of Workshop on Opportunities for Atomic Physics Using Slow, Highly-Charged Ions, Argonne, IL., January 12, 1987, p17-36.

Keywords: *X ray spectroscopy, Accuracy, Electrons, Reprints, *Heavy ion accelerators.

Heavy ion accelerators are the most flexible and readily accessible sources of highly charged ions. The ions having only one or two remaining electrons have spectra whose accurate measurement is of considerable theoretical significance. Certain features of ion production by accelerators tend to limit the accuracy which can be realized in measurement of the spectra. The report aims to provide background about spectroscopic limitations and discuss how accelerator operations may be selected to permit attaining intrinsically limited data.

001,746

PB90-227968

PC A06/MF A01

Maryland Univ., College Park. Dept. of Mechanical Engineering.

Transient Cooling of a Hot Surface by Droplets Evaporation.

Final rept. Oct. 90.

M. Klassen, and M. di Marzo. May 90, 109p NIST/

GCR-90/575

Grant 70NANB8H0890

Sponsored by National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Keywords: *Droplets, *Evaporation, *Cooling, *Surfaces, Heat transfer, Experimental data, Water, Thermal conductivity, Vaporizing, Temperature measurement, Test facilities.

An infrared thermographic technique is developed to obtain the transient solid surface temperatures surrounding the droplet during vaporization. The technique is appealing because it is non-intrusive, detailing the surface response to the droplet without affecting the evaporation process. Surface recovery can also be monitored using the thermographic method. The transient temperature distribution of a Macor solid is detailed. It is found that contact temperature is held in the vicinity of the droplet during the majority of the droplet's evaporation until the droplet thickness diminishes greatly, where upon the temperature of the solid surrounding the droplet begins to rise. The non-dimensional radius of influence of droplet cooling is also detailed. The data obtained on the cooling effect induced on aluminum and on Macor from previous studies is used in concert with new data obtained on a quartz surface to characterize the induced cooling of a hot surface by an evaporating droplet. The role of the droplet size and shape is investigated for various high and low thermal conductivity surfaces. Droplet evaporation time, surface heat transfer coefficient and droplet shape parameter are also examined.

001,747

PB90-241522

Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Improved Kennedy-Thorndike Experiment to Test Special Relativity.

Final rept.

D. Hils, and J. L. Hall. 1990, 4p

Contract NASA-NAGW-822, Grant NSF-PHY86-

04504

Sponsored in part by grant N00014-89-J-1227 Sponsored by National Aeronautics and Space Administration, Washington, DC., National Science Foundation, Washington, DC., and Office of Naval Research, Arlington, VA. Pub. in Physical Review Letters 64, n15 p1697-1700, 9 Apr 90.

Keywords: *Special relativity, Optical measurement, Tests, Reprints, *Kennedy-Thorndike experiment, Laser radiation, Interferometry.

The authors have carried out a modern version of the Kennedy-Thorndike experiment by searching for sidereal variations between the frequency of a laser locked to an I2 reference line and a laser locked to the resonance frequency of a highly stable cavity. No variations were found at the level of 2×10^{-13} power. This represents a 300-fold improvement over the original Kennedy-Thorndike experiment and allows

the Lorentz transformations to be deduced entirely from experiment at an accuracy level of 70 ppm.

001,748

PB90-242256 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Electricity Div.

High Accuracy Determination of the Fine Structure Constant via Measurement of the Proton Gyromagnetic Ratio.

Final rept.
E. R. Williams. 1990, 1p
Pub. in Bulletin of the American Physical Society 35,
n4 p1069 Apr 90.

Keywords: *Fundamental constants, Nuclear magnetic resonance, Solenoids, Electric current, Electrical measurement, Protons, Reprints, *Fine structure constant, *Sommerfeld constant, *Gyromagnetic ratio, Quantum Hall effect, Quantum electrodynamics.

The latest experiment at NIST to measure the gyromagnetic ratio of the proton in H₂O, gamma prime sub p by the low field method has an uncertainty of 0.11 ppm for gamma prime sub p (low). Using the experimental result a value for the fine structure constant 1/alpha = 137.0359840(51) (0.37 ppm) can be calculated. The uncertainty in alpha is limited by the uncertainty in the gamma prime sub p experiment. The most difficult part of the experiment was constructing a 2.1-m long solenoid with a precision of a few micrometers, then measuring its critical dimensions to 0.05 micrometer.

001,749

PB90-254384 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Microplasmas.
Final rept.
J. J. Bollinger, and D. J. Wineland. 1990, 7p
Pub. in Scientific American 262, n1 p124-130 Jan 90.

Keywords: Reprints, *Microplasmas, Laser cooling, Ion traps, Resonance fluorescence.

Unusual types of liquids and solids can be made with atomic ion plasmas held in electromagnetic traps. The ions are cooled to low temperatures by using radiation pressure from a laser. The resonance fluorescence induced by the laser is used to detect the ions. The relatively large spacings between the ions allow the structure of the microplasmas to be directly viewed with the aid of a sensitive camera.

001,750

PB90-254707 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Thermophysics Div.

Properties of a Soft-Sphere Liquid from Non-Newtonian Molecular Dynamics.

Final rept.
L. M. Hood, D. J. Evans, and H. J. M. Hanley. 1989,
16p
Sponsored by Department of Energy, Washington, DC.
Office of Basic Energy Sciences.
Pub. in Jnl. of Statistical Physics 57, n3/4 p729-743
Nov 89.

Keywords: *Liquids, Non-Newtonian fluids, Equations of state, Transport properties, Rheology, Simulation, Spheres, Reprints, Molecular dynamics.

A soft-sphere, inverse-12 liquid is simulated in both the isokinetic-isochoric and the isokinetic-isobaric ensemble using nonequilibrium molecular dynamics. The simulation for the isobaric ensemble is discussed in detail. The non-Newtonian characteristics of the liquid are clearly demonstrated; namely, the shear-rate-dependent pressure and density (shear dilatancy), the shear-rate-dependent shear viscosity (shear thinning), and evidence of normal pressure differences. For the first time, it is clearly shown that a significant component of isobaric shear thinning is due to shear dilatancy. The isochoric and isobaric results are checked for consistency. Simple empirical relations for the equation of state and transport properties of the fluid are presented.

001,751

PB90-254715 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Quantum Zeno Effect.

Final rept.
W. M. Itano, D. J. Heinzen, J. J. Bollinger, and D. J. Wineland. 1990, 7p
Sponsored by Air Force Office of Scientific Research,
Bolling AFB, DC., and Office of Naval Research,
Arlington, VA.
Pub. in Physical Review A 41, n5 p2295-2300, 1 Mar
90.

Keywords: Reprints, *Quantum Zeno effect, Beryllium ions, Beryllium 9, Penning traps, Laser cooling, Ion storage.

The quantum Zeno effect is the inhibition of transitions between quantum states by frequent measurements of the state. The inhibition arises because the measurement causes a collapse (reduction) of the wave function. If the time between measurements is short enough, the wave function usually collapses back to the initial state. The authors have observed this effect in an rf transition between two (9)Be(1+) ground-state hyperfine levels. The ions were confined in a Penning trap and laser cooled. Short pulses of light, applied at the same time as the rf field, made the measurements. If an ion was in one state, it scattered a few photons; if it was in the other, it scattered no photons. In the latter case the wave-function collapse was due to a null measurement. Good agreement was found with calculations.

001,752

PB90-254814 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Thermophysics Div.

Ergodic Convergence in Liquids and Glasses.

Final rept.
R. D. Mountain, and D. Thirumalai. 1990, 13p
Sponsored by National Science Foundation, Washington, DC.
Pub. in International Jnl. of Modern Physics C 1, n1
p77-89 1990.

Keywords: *Liquids, *Glass, Simulation, Spheres, Reprints, Molecular dynamics, Ergodic convergence, Time intervals.

A quantitative method for estimating the time interval needed for the convergence of time averages to ensemble average values in a molecular dynamics simulation is described. The essential feature of the way of estimating the time interval is the statistical equivalence of particles in a fluid in thermodynamic equilibrium. This method is quite general and should find application in many types of simulations. The soft-sphere system is used to illustrate the method and to show that it is capable of distinguishing between effectively ergodic states and nonergodic, glassy states. Finally, some observations on possibilities for future investigations are mentioned.

001,753

PB90-256793 PC A08
National Inst. of Standards and Technology, Gaithersburg, MD.

Journal of Research of the National Institute of Standards and Technology. May-June 1990. Volume 95, Number 3.

1990, 160p
Also available from Supt. of Docs. as SN703-027-00034-2. See also PB90-256801 through PB90-256843.

Keywords: *Standards, Temperature measurement, Strontium oxides, Bismuth oxides, Copper oxides, Superconductors, *Voltage standards, Calibration, Gas thermometry, Strontium bismuth cuprates, Vacuum ultraviolet radiation.

Contents:

Operation of NIST Josephson Array Voltage Standards;
The Calibration of dc Voltage Standards at NIST; NBS/NIST Gas Thermometry From 0 to 660 C; Phase Equilibria and Crystal Chemistry in Portions of the System SrO-CaO-Bi₂O₃-CuO, Part II - The System SrO-Bi₂O₃-CuO;
Scattered Light and Other Corrections in Absorption Coefficient Measurements in the Vacuum Ultraviolet--A Systems Approach.

001,754

PB90-256827 (Order as PB90-256793, PC A08)
National Inst. of Standards and Technology, Gaithersburg, MD.

NBS/NIST Gas Thermometry from 0 to 660C.

J. F. Schooley. 1990, 36p
Included in Jnl. of Research of the National Institute of Standards and Technology, v95 n3 p255-290 May-Jun 90.

Keywords: *Temperature measurement, *Gas thermometry, Gas thermometers, US NBS, US NIST, IPTS-68.

In the NBS/NIST Gas Thermometry program, constant-volume gas thermometers, a unique mercury manometer, and a highly accurate thermal expansion apparatus have been employed to evaluate temperatures on the Kelvin Thermodynamic Temperature Scale (KTTS) that correspond to particular temperatures on the 1968 International Practical Temperature Scale (IPTS-68). In the paper, the authors present a summary of the NBS/NIST Gas Thermometry project, which originated with planning activities in the late 1920s and was completed by measurements of the differences t(KTTS)-t(IPTS-68) in the range 0 to 669 C. Early results of the project were the first to demonstrate the surprisingly large inaccuracy of the IPTS-68 with respect to the KTTS above 0 C. Advances in several different measurement techniques, development of new, specialized instruments, and two distinct sets of gas thermometry observations have resulted from the project.

001,755

PB90-260928 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Hg(1+) Single Ion Spectroscopy.

Final rept.
J. C. Bergquist, F. Diedrich, W. M. Itano, and D. J. Wineland. 1989, 7p
Sponsored by Air Force Office of Scientific Research,
Bolling AFB, DC., and Office of Naval Research,
Arlington, VA.
Pub. in Frequency Standards and Metrology, p287-291
1989.

Keywords: Reprints, *Single ion microscopy, *Mercury ions, Laser cooling, High resolution.

A single Hg(1+) ion that is confined in an rf (Paul) trap can be laser cooled so that the amplitude of its motion is much less than a wavelength (the Dicke limit) for optical transitions. Recently, the authors have used the technique of optical sideband cooling to reach the zero point of motion. This realizes for the first time the fundamental limit of laser cooling for a bound atom and the ideal of an isolated atomic particle at rest in space to within the quantum mechanical limits imposed by the surrounding apparatus. In both limits, Doppler effects become negligible to all orders, the interrogation time is long, and the fundamental shot noise detection limit of a single atom is readily attained.

001,756

PB90-260977 Not available NTIS
National Inst. of Standards and Technology (IMSE),
Gaithersburg, MD. Reactor Radiation Div.

Optimized Design of the Chopper Disks and the Neutron Guide in a Disk Chopper Neutron Time-of-Flight Spectrometer.

Final rept.
J. R. D. Copley. 1990, 15p
Pub. in Nuclear Instruments and Methods in Physics Research A291, p519-532 1990.

Keywords: *Neutron spectrometers, Neutron scattering, Optimization, Intensity, Design, Reprints, *Time-of-flight spectrometers, Neutron choppers, Neutron guides.

Important aspects are considered of the performance of a disk chopper neutron time-of-flight spectrometer. The intensity at the sample position, and the contributions of the choppers to the resolution of the instrument, are evaluated as a function of the widths of the slots in the chopper disks and the width of the neutron guide between the disks. It was found that there is an optimum choice of the ratios of these widths and that this choice depends on a single parameter which, for elastic scattering, is a simple ratio of distances. When pairs of counter-rotating disks are employed, the widths of the slots can be modified by grossly changing the phase relationship between the members of a chopper pair. If the slot widths are changed, the width of the guide should also be altered in order to maintain the spectrometer in an optimized state. This change in

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the guide width may be effectively achieved using an arrangement of nested guides. Resolution and intensity calculations demonstrate the important gains which may be realized using this approach.

001,757
PB90-261074 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Electromagnetic Technology Div.
Liquid and Solid Phases of Laser Cooled Ions.
Final rept.
S. L. Gilbert, J. C. Bergquist, J. J. Bollinger, W. M. Itano, and D. J. Wineland. 1989, 16p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in Atomic Physics 11, p261-275 1989.

Keywords: Reprints, *Ion traps, Laser cooling, Penning traps.

Experiments on collections of strongly coupled laser cooled atomic ions performed at the National Bureau of Standards are summarized. The authors first discuss strong coupling of small numbers ($=$ or $<$ 20) of atomic ions confined in a Paul electrodynamic (rf) trap, in which crystalline structures are observed. The authors then discuss experiments in which shell structure is observed for up to 15,000 ions confined by static electric and magnetic fields. These clouds display liquid and solid-like behavior similar to that of a smectic liquid crystal. Future experiments are suggested, including some where infinite volume behavior may be observable.

001,758
PB90-261157 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Center for Basic Standards.
High Accuracy, Absolute Wavelength Determination of Capture Gamma Ray Energies for E less than or equal to 5 MeV and the Direct Determination of Binding Energies in Light Nuclei.
Final rept.
E. G. Kessler, G. L. Greene, M. S. Dewey, R. D. Deslattes, H. Borner, and F. Hoyer. 1988, 9p
Pub. in Institute of Physics, Conference Series Capture Gamma-Ray Spectroscopy 88, pS167-S174 1988.

Keywords: *Gamma spectrometers, Deuterium, Accuracy, Reprints, *Binding energy, Light nuclei, Carbon 13, Nitrogen 15.

A substantially improved double flat crystal gamma ray spectrometer (GAMS4) has been put into operation as a joint NBS/ILL facility at the HFR, Grenoble. This facility has the capability of determining gamma ray wavelengths, in absolute units, with uncertainties on the order of 0.1 ppm in the energy range from 0.1 to about 5 MeV. This new facility incorporates a number of major improvements over the earlier double flat crystal spectrometer used to determine the n-p 2.2 MeV line with an error of 1 ppm (2 eV). The operation of the instrument and the nature of the improvements will be discussed. Recent experimental results related to the direct determination of the binding energy of several light nuclei (for example D, ^{13}C , ^{15}N) will be given. The implications of this work for the atomic mass scale and for the determination of fundamental constants will be reviewed.

001,759
PB90-261397 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.
Frequency Standards in the Optical Spectrum.
Final rept.
D. J. Wineland, J. C. Bergquist, W. M. Itano, F. Diedrich, and C. S. Weimer. 1989, 12p
Pub. in Hydrogen Atom, p123-133 1989.

Keywords: *Frequency standards, Atomic spectroscopy, Frequency stability, Reprints, Laser spectroscopy, Ion storage.

The report discusses two aspects of frequency measurement in the optical region of the spectrum. First, the problem of frequency standards is considered. (An analogue in the microwave region of the spectrum is the cesium beam frequency standard). If one or a few reference frequencies can be accurately calibrated (perhaps by a frequency synthesis chain) then it may be possible to compare optical measurements to these standards. As an example of the precision that might be achieved, only optical standards based on stored ions are discussed. Second, the problem of fre-

quency comparison of unknown frequencies to the standards is discussed. Here discussion is restricted primarily to generation of wideband frequency 'combs'.

001,760
PB90-261819 PC A08/MF A01
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Electron and Optical Physics Div.
Proceedings of the International Symposium on Correlation and Polarization in Electronic and Atomic Collisions.
Special pub.
P. A. Neill, K. H. Becker, and M. H. Kelley. Jun 90,
165p NIST/SP-789
Also available from Supt. of Docs. as SN003-003-03023-6. Held at Stevens Institute of Technology in Hoboken, New Jersey on August 2-4, 1989. Prepared in cooperation with Nevada Univ., Las Vegas. Dept. of Physics, and City York. Dept. of Physics.

Keywords: *Meetings, Electron scattering, Polarization, Excitation, Ionization, Sodium, *Atomic collisions, *Electron collisions, Electron-atom collisions.

The International Symposium was held at the Stevens Institute of Technology, Hoboken, New Jersey on August 2-4, 1989. The previous meeting, held in Belfast, UK (1987), extended the scope of the Symposium to include ion-atom and atom-atom collisions. This was reflected in the Symposium title which was modified to replace the term 'electron-atom collisions' with 'electronic and atomic collisions.' The Hoboken meeting maintained this expanded area and included several talks in more loosely related areas. The attendance of 66 scientists represented 16 countries, and the talks described the work of 23 research groups from 9 countries.

001,761
PB90-271065 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
New Recombination Mechanism: Tidal Termolecular Ionic Recombination.
Final rept.
D. R. Bates, and W. L. Morgan. 1990, 3p
Contract AFOSR-88-0190
Sponsored by Air Force Weapons Lab., Kirtland AFB, NM.
Pub. in Physical Review Letters 64, n19 p2258-2260, 7 May 90.

Keywords: Reprints, *Molecular collisions, *Xenon ions, *Chlorine ions, *Ion recombination, Xenon chlorides, Excimer lasers.

The measured rate coefficient alpha for $\text{Xe2}(1+) + \text{Cl}(1-) \rightarrow \text{XeCl}^* + 2\text{Xe}$ (and similar processes) is far higher than had been expected. The exciting experimental results are reminiscent of assisted mutual neutralization, but this cannot occur. A Monte Carlo simulation that allows for the $\text{Cl}(1-)\text{-Xe}(+)$, $\text{Cl}(1-)\text{-Xe}$, and $\text{Xe}(1+)\text{-Xe}$ forces shows that the rotational and vibrational modes of $\text{Xe2}(1+)$ tend to be excited by the passage of $\text{Cl}(1-)$ through perihelion. Because of the electrostatic tidal action the orbit contracts and the internal energy of $\text{Xe2}(1+)$ increases, leading to dissociation. The measured values of alpha are reproduced satisfactorily.

001,762
PB90-271099 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Small Mercury Relativity Orbiter.
Final rept.
P. L. Bender, and M. A. Vincent. 1989, 4p
Contract NAGW-822
See also N90-19940. Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of NASA Workshop on Relativistic Gravitation Experiments in Space, Annapolis, MD., June 28-30, 1988, p144-147 1989.

Keywords: *Gravitational fields, *Relativity, Mercury(Planet), Librations, Spin stabilization, Tests, Reprints.

The accuracy of solar system tests of gravitational theory could be very much improved by range and Doppler measurements in a Small Mercury Relativity Orbiter. A nearly circular orbit at roughly 2400 km altitude is assumed in order to minimize problems with orbit determination and thermal radiation from the surface. The spacecraft is spin-stabilized and has a 30 cm diameter despun antenna. With K-band and X-band

ranging systems using a 50 MHz offset sidetone at K-band, a range accuracy of 3 cm appears to be realistically achievable. The estimated spacecraft mass is 50 kg.

001,763
PB90-271248 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Thermophysics Div.
Issues and Future Directions in Subsecond Thermophysics Research.
Final rept.
A. Cezairliyan, G. R. Gathers, A. M. Malvezzi, A. P. Miller, F. Righini, and J. W. Shaner. 1990, 15p
See also DE89014228.
Pub. in International Jnl. of Thermophysics 11, n4 p819-833 Jul 90.

Keywords: *Thermophysical properties, Experimental design, Reprints, Laser heating, High temperature.

The key issues and anticipated future directions in sub-second thermophysics research are presented and discussed. The main emphasis is placed on experimental techniques for measurements of selected thermophysical properties using rapid volume heating (resistive self-heating) and rapid surface heating (laser pulse-heating) methods. The time regime covered is from 1 to 10 to the -12 power. Specific research topics and key research areas are identified and discussed.

001,764
PB90-271305 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.
Measurements on Very Low-Energy Ion/Atom-Molecule Collisions.
Final rept.
G. H. Dunn, M. M. Schauer, and S. R. Jefferts. 1990, 6p
Grant NSF-PHY86-04504
Sponsored by National Science Foundation, Washington, DC.
Pub. in Proceedings of International Conference on the Physics of Electronic and Atomic Collisions (16th), New York, NY., July 1989, p574-579 1990.

Keywords: Reprints, *Ion-molecule collisions, Atom-molecule collisions, Penning traps.

Data were obtained on very-low energy ion-molecule collisions for the first time about eight years ago when the cooled Penning trap was introduced for the purpose of such studies. Several complementary techniques have been introduced since then. In this part, the various techniques are briefly described. A few results are presented, illustrating some kinds of physics accessible through such studies.

001,765
PB90-271420 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Atomic and Plasma Radiation Div.
Ion Quadrupole Moments from Term Energy Separations of High Angular Momentum States: Halogenlike Ions.
Final rept.
D. E. Kelleher. 1990, 5p
Pub. in Physical Review A 42, n3 p1151-1154, 1 Aug 90.

Keywords: Ground state, Ions, Reprints, *Quadrupole moments, Multicharged ions, Rydberg states.

A simple method is described to determine ion quadrupole moments from spectroscopic data. Quadrupole moments of the $np(5)$ doublet P (sup 0, sub 3/2) ground states of 12 halogenlike ions are determined. The ions include five fluorinelike, three chlorinelike, two brominelike, and two iodinelike ions. The values of r squared for the np electrons are determined from experimental energy separations within high angular momentum Rydberg configurations in the corresponding rare-gas-like ions. jI coupling is used in conjunction with an expression by Racah (Phys. Rev. 61, 537 (1942)) for the angular part of the quadrupole interaction between the ion core and the Rydberg electron. Hartree-Fock results for $\langle r^2 \rangle$ compare favorably with the authors' values obtained from experimental data, although small systematic differences do exist, which increase with increasing ion mass. Limitations of the technique are also discussed. Such methods constitute a useful supplement to single-channel quantum-defect parametrization of energy levels for Rydberg

states of atoms having cores with angular momentum (j_c) greater than $1/2$.

001,766
PB90-271461 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Laser Probing of Ion Collisions in Drift Fields: State Excitation, Velocity Distributions, and Alignment Effects.

Final rept.
S. R. Leone. 1989, 41p
Contract AFOSR-86-0018, Grant NSF-CHE84-08403
Sponsored by Air Force Weapons Lab., Kirtland AFB,
NM., and National Science Foundation, Washington,
DC.
Pub. in Gas Phase Bimolecular Reactions, Chapter 8,
p377-416 1989.

Keywords: Alignment, Mobility, Velocity, Reprints,
*Ion-ion collisions, Laser applications, Plasma.

Recent theoretical and experimental work on the mobility, diffusion and velocity distributions of ions in gaseous plasmas is reviewed. In the review, the author explores the relationship between the interaction potentials, internal excitation, and ion velocity and mobility. A brief description of the theoretical treatment of ion collisions is given, followed by the experimental details for laser probing of ions in a flowing afterglow apparatus. Specific examples of measurements which have been used to probe population distributions, molecular alignment, and velocity distributions are discussed. An extensive bibliography is provided.

001,767
PB90-271487 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Alignment Effects in Ca-He (5(1)P1 - 5(3)PJ) Energy Transfer Half-Collisions.

Final rept.
K. C. Lin, S. Ananthamurthy, P. D. Kleiber, J. X. Wang, W. C. Stwalley, and S. R. Leone. 1989, 5p
Pub. in Proceedings of International Laser Science Conference (4th), Atlanta, GA., October 3-7, 1988,
p630-633 1989.

Keywords: *Calcium, *Helium, Atomic orbitals, Light scattering, Reprints, *Atom-atom collisions, *Spin exchange.

The authors have studied Ca-He spin changing collisions using far wing laser scattering "half-collision" techniques. They have observed a strong red wing-blue wing asymmetry which they interpret in terms of an orbital alignment preference in the energy transfer cross section. This orbital alignment effect approaches 100%.

001,768
PB90-271610 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Atomic and Plasma Radiation Div.

Spectra and Energy Levels of Sodiumlike Ions from Y(28+) to Sn(39+).

Final rept.
J. Reader, J. O. Ekberg, U. Feldman, C. M. Brown, and J. F. Seely. 1990, 6p
Pub. in Jnl. of the Optical Society of America B 7, n7
p1176-1181 Jul 90.

Keywords: Atomic energy levels, Ionization, Spectra, Reprints, *Multicharged ions, Isoelectronic sequence, Yttrium ions, Tin ions, Potassium ions, Rhodium ions, Lamb shift, Laser-produced plasma.

Spectra of ten sodiumlike ions from Y(28+) to Sn(39+) were observed with laser-produced plasmas and grazing-incidence spectrographs. Wavelengths, energy levels, and ionization energies were determined for all ions of the isoelectronic sequence from Y to Sn. Revised *ab initio* and fitted values are given for the 3d-4f wave-lengths of the sodiumlike ions K(8+) and Rh(34+).

001,769
PB91-101246 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Electron and Optical Physics Div.

Quantum Fluctuations and the Single-Junction Coulomb Blockade.

Final rept.
S. M. Girvin, L. I. Glazman, M. Jonson, D. R. Penn, and M. D. Stiles. 1990, 4p
Pub. in Physical Review Letters 64, n26 p3183-3186,
25 Jun 90.

Keywords: Electron tunneling, Transmission lines, Quantum theory, Reprints, *Tunneling(Electronics), *Coulomb field.

The authors investigate the effect of quantum fluctuations on the Coulomb blockade in a single tunnel junction coupled to its environment by a transmission line of arbitrary impedance $Z(\omega)$. The quantized oscillating modes of the transmission line are suddenly displaced when an electron tunnels through the junction. For small Z (relative to the quantum of resistance), a weak power-law zero-bias anomaly occurs associated with the infrared-divergent shakeup of low-frequency transmission-line modes. For large Z , the full blockade is recovered. Comparison with recent experiments is made.

001,770
PB91-101253 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Molecular Physics Div.

Above-Threshold Dissociation of (H sub 2, sup +) in Intense Laser Fields.

Final rept.
A. Giusti-Suzor, X. He, O. Atabek, and F. H. Mies. 1990, 4p
Pub. in Physical Review Letters 64, n5 p515-518, 29
Jan 90.

Keywords: Reprints, *Hydrogen ions two plus, *Photodissociation, Multiphoton absorption, Laser radiation, Predissociation.

The authors present nonperturbative, time-independent calculations of the photodissociation rate of H₂(1+) in intense laser fields. The energy distribution of the protons consists of a sequence of peaks evenly spaced by half the photon energy, all of equal width but of varying heights. They result from multiphoton absorption above the dissociation threshold, with equal sharing of the excess photon energy between H and H(1+). Surprisingly, the distribution of higher-energy peaks decreases with increasing intensity, due to stimulated free-free emission of the dissociating fragments. The authors also predict a sharp angular distribution of the protons along the electric field vector of a linear polarized laser.

001,771
PB91-101287 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Quantum Physics Div.

Differential, Partial Cross Sections for Electron Excitation of the Sodium 3P State.

Final rept.
X. L. Han, G. W. Schinn, and A. Gallagher. 1990,
13p
Contract DE-FG02-87ER13720
Sponsored by Department of Energy, Washington, DC.
Office of Basic Energy Sciences.
Pub. in Physical Review A 42, n3 p1245-1257, 1 Aug
90.

Keywords: Differential cross sections, Electron scattering, Reprints, *Electron-atom collisions, *Sodium atoms, Excited states, EV range 01-10.

Using a powerful laser-based experimental method, the cross section for electron excitation of Na(3S) atoms to the Na(3P) state has been decomposed into partial components with respect to changes in the spin and angular momentum of the atomic electron, and these partial cross sections are further reduced to their differential character with respect to the electron scattering angle. Partial, differential cross sections are reported for electron collisional energies from threshold 2.1 to 3.6 eV, and compared to available calculations.

001,772
PB91-101303 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Quantum Metrology Div.

Effect of Hyperfine Structure on the 2 (3)P1 and the 2 (3)P0 Lifetime in Heliumlike Ions.

Final rept.
P. Indelicato, F. Parente, and R. Marrus. 1989, 10p
Pub. in Physical Review A 40, n7 p3505-3514, 1 Oct
89.

Keywords: *Atomic energy levels, Hyperfine structure, Reprints, Multicharged ions, Forbidden transitions, Lifetime.

The magnetic interaction has been shown to produce inversion of 1s2p triplet P(1) and 1s2p triplet P(0) for $Z =$ or < 3 and $Z =$ or > 46 . In the paper the authors

have used the multiconfiguration Dirac-Fock method to compute with high precision the 2 triplet P(1)-2 triplet P(0) separation energy, including relativistic contributions to electron-electron correlations and radiative corrections. This energy happens to be very small around the crossing, so that the hyperfine interaction can mix both levels significantly. The authors have then computed the effect of this mixing on both the energy and lifetime of those levels.

001,773
PB91-101451 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Inorganic Analytical Research Div.
Acceptance Diagrams for Curved Neutron Guides.
Final rept.
D. F. R. Mildner. 1990, 8p
Pub. in Nuclear Instruments and Methods in Physics
Research A290, p189-196 1990.

Keywords: Reprints, *Neutron guides, Neutron reflections, Acceptance diagrams.

The method of acceptance diagrams is used to obtain analytic expressions for the intensity and spatial and angular distributions of the neutrons transmitted along a one-dimensional curved guide, provided that the length of the guide is greater than the minimum length necessary to eliminate direct radiation. The acceptance area for curved guides is parabolic in shape, and shows the asymmetry in the spatial distribution of the transmitted neutrons. From these formulations, the average number of reflections can be determined as a function of wavelength.

001,774
PB91-101469 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Inorganic Analytical Research Div.

Comments on 'Design Optimization of a Small-Angle Neutron Scattering Spectrometer.'

Final rept.
D. F. R. Mildner. 1990, 4p
Pub. in Nuclear Instruments and Methods in Physics
Research A290, p259-262 1990.

Keywords: *Neutron spectrometers, Optimization, Resolution, Intensity, Design, Reprints, Small angle scattering.

Margaca, Falcao, Salgado and Carvahlo (Nucl. Instr. and Meth. A274 (1989) 606, and Proc. Int. Conf. on Neutron Scattering. Grenoble, Physica B156/157 (1989) 608) have recently discussed the design parameters of a small-angle scattering spectrometer. They claim to have shown that the instrument can be optimized for constant angular resolution and a fixed neutron source area, such that the detector count rate is higher than that obtained with a spectrometer optimized for a fixed total length and having the same angular resolution. They also claim that the relative gain in intensity depends upon the size of the neutron emitting surface available to the spectrometer. The initial assumptions made by the authors are too constrained to be generally applicable, and therefore misleading conclusions could be drawn, and, in fact, the equal path length arrangement is optimum.

001,775
PB91-101477 Not available NTIS
National Inst. of Standards and Technology (NML),
Gaithersburg, MD. Inorganic Analytical Research Div.

Multiple Reflections within Neutron Optical Devices.

Final rept.
D. F. R. Mildner. 1990, 7p
Pub. in Nuclear Instruments and Methods in Physics
Research A292, p693-699 1990.

Keywords: Thermal neutrons, Reprints, *Neutron guides, *Beam optics, Neutron reflections, Cold neutrons, Acceptance diagrams.

Various types of totally reflecting neutron guides are used as neutron optical elements in which thermal or cold neutrons are conducted by multiple reflections. Losses in transmission caused by imperfect reflection from the surfaces of these guides compound geometrically with the number of reflections. The acceptance technique used for determining analytic expressions for the transmission of these devices can also give the average number of reflections as a function of critical angle or wavelength. This has been performed for the straight conducting guide viewing a finite source, the converging guide and the curved guide.

001,776

PB91-107441 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Center for Radiation Research.

Piece-Wise Analytic Evaluation of the Radiative Tail from Elastic and Inelastic Electron Scattering. Final rept.

L. C. Maximon, and S. E. Williamson. 1987, 16p Grant NSF-PHY80-23603 See also PB84-155290. Sponsored by National Science Foundation, Washington, DC. Pub. in Nuclear Instruments and Methods in Physics Research A258, p95-110 1987.

Keywords: *Electron scattering, Elastic scattering, Inelastic scattering, Scattering cross sections, Reprints, *Electron-nucleon interactions.

The authors consider the calculation of the radiative tail from the elastic peak in medium and high energy scattering as well as from a discrete inelastic level of the recoiling nucleus. They examine the method generally used for this calculation, viz., a numerical integration of the differential cross section over the angles of the unobserved photon, and discuss the difficulties inherent in this numerical integration due to the sharp peaking of the integrand. They present an alternative method for calculating the radiative tail, in which the region of integration is divided into an arbitrary number of subintervals, the structure functions are fitted by cubic spline functions in each subinterval, and the integrations are then performed analytically in closed form. This method has the advantages of greatly increased accuracy and a reduction of the computation time by a factor which can vary between 10 and 1000, depending on the kinematics.

001,777

PB91-112078 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Standardization and Decay Scheme of (201)Tl.

Final rept. B. M. Coursey, D. D. Hoppes, A. T. Hirschfeld, S. M. Judge, D. H. Woods, E. Funck, H. Schrader, and A. G. Tuck. 1990, 3p Pub. in Applied Radiation and Isotopes 41, n3 p289-291 1990.

Keywords: Decay schemes, Standardization, Solutions, Reprints, *Thallium 201, Interlaboratory comparisons, Gamma decay, Nuclear medicine, Activity levels.

An intercomparison exercise was conducted among three national standards laboratories and a commercial supplier to determine the degree of agreement between directly determined values of the activity concentration of a solution of (201)Tl. The gamma-ray emission probabilities of (201)Tl were also determined, providing an emission probability for the 167.4 keV gamma ray of 0.1000 + or - 0.0006.

001,778

PB91-112094 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

3P1-3P2 Magnetic-Dipole Transition in the Ground Configuration of Co XX.

Final rept. R. U. Datla, J. R. Roberts, and W. L. Rowan. 1987, 2p Sponsored by Department of Energy, Washington, DC. Office of Energy Research. Pub. in Jnl. of the Optical Society of America B 4, n3 p428-429 Mar 87.

Keywords: Reprints, *M1-transitions, *Cobalt ions, Multicharged ions, Forbidden transitions, Plasma.

The magnetic-dipole transition between the triplet P(1) - triplet P(2) levels of 2s(2)2p(4) ground configuration in Co XX has been identified from the emission of a cobalt-seeded plasma in the Texas Experimental Tokamak. The wavelength for the transition is 930.2 + or - 0.3 Å.

001,779

PB91-112243 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Proposed Test of the Symmetrization Postulate and Exclusion Principle.

Final rept. J. D. Gillaspay, K. Deilamian, and D. E. Kelleher. 1990, 2p

Pub. in Proceedings of the International Conference on Atomic Physics (12th), Ann Arbor, MI., July 29-August 3, 1990, I-14p.

Keywords: Tests, Reprints, *Pauli principle, *Symmetrization postulate, Photon burst spectroscopy.

The Pauli exclusion principle (PEP) dictates the stability of matter and the shell structure of atoms and nuclei. Yet, despite this pervasive influence, PEP stems from the symmetrization postulate (SP) which cannot be derived from more fundamental principles without unproven assumptions. In his 1945 Noble address, Pauli stated: 'Already in my original paper I stressed the circumstances that I was unable to give a logical reason for the exclusion principle or to deduce it from more general assumptions.' In his book General Principles of Quantum Mechanics, Pauli noted that 'The fact that quantum mechanics yields more states than actually occur in nature (and all of the equally possible) is still a puzzle.' These statements were made years after the spin-statistics theorem was established. The symmetrization postulate states that the wavefunction of a system of identical fermions is antisymmetric under exchange of any two of the particles (and symmetric for bosons). The two-electron helium atom provides the simplest atomic example of an antisymmetric system.

001,780

PB91-112474 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Atomic and Plasma Radiation Div.

Pd-Na/F Double Exploding Foil Photoionization Experiment.

Final rept. P. D. Morley, G. Charatis, Z. Koenig, and J. Sugar. 1990, 3p

Pub. in Applied Physics B 50, p173-175 1990.

Keywords: Palladium, Reprints, *Inner-shell ionization, *Photoionization, Soft X rays, Exploding foils, Multicharged ions, X ray lasers.

By means of two exploding foils, the authors have achieved inner-shell photoionization of Zn-like Pd resulting in the soft X-ray transition 3d(9) 4s(2) -> 3d(10) 4p at 46 Å.

001,781

PB91-112680 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Ionizing Radiation Div.

Average L-Shell Fluorescence Yields for Elements 56 < Z < 92.

Final rept. S. Singh, D. Mehta, R. R. Garg, S. Kumar, M. L. Garg, N. Singh, P. C. Mangal, J. H. Hubbell, and P. N. Trehan. 1990, 6p Pub. in Nuclear Instruments and Methods in Physics Research B51, p5-10 1990.

Keywords: *Fluorescence, Cross sections, X rays, Reprints, *L shell, Photoionization.

The average L-shell fluorescence yields have been evaluated for the elements with 56 = or < Z = or < 92 using the authors' measured values of photon induced total L X-ray production cross-sections and Scofield's (1973) theoretical total L shell photo-ionization cross-sections. These values are compared with the values tabulated by earlier workers and with theoretical values based on relativistic Hartree-Dirac-Slater (RHDS) calculations (Chen et al. Phys. Rev. A24 (1981) 177). A good agreement is found with the values based on RHDS calculations for the elements 56 = or < Z = or < 92.

001,782

PB91-112706 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Electron Inelastic Mean Free Paths in Solids at Low Energies.

Final rept. S. Tanuma, C. J. Powell, and D. R. Penn. 1990, 7p Pub. in Jnl. of Electron Spectroscopy and Related Phenomena 52, p285-291 1990.

Keywords: Mean free path, Magnesium, Aluminum, Silicon, Nickel, Copper, Gold, Reprints, *Electron trajectories, EV range 10-100, EV range 100-1000.

The authors have calculated electron inelastic mean free paths (IMFPs) for 50-200 eV electrons in 31 materials (27 elements and 4 compounds). These calculations extend those previously reported for 200-2000 eV electrons in the same materials but avoid an approximation valid for electron energies above 200 eV. IMFP results are presented in the paper for magnesium, aluminum, silicon, nickel, copper, and gold. The IMFP dependence on electron energy in the range 50-200 eV varies considerably from material to material; these variations are associated with substantial differences in the electron energy-loss functions amongst the materials. The authors have also extended the general IMFP formula derived earlier to describe the calculated IMFPs over the 50-2000 eV energy range.

001,783

PB91-112854 PC A09/MF A02 National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Chemical Technology.

Guidelines for Realizing the International Temperature Scale of 1990 (ITS-90). Technical note (Final). B. W. Mangum, and G. T. Furukawa. Aug 90, 193p NIST/TN-1265 Also available from Supt. of Docs.

Keywords: *Temperature measurement, Guidelines, *International Temperature Scale of 1990, *ITS-90, Thermometers, Calibration, Fixed points.

The Technical Note describes the International Temperature Scale of 1990 (ITS-90) that became the official international temperature scale on 1 January 1990, superseding the previous scales, and provides information on how the scale may be realized at different levels of accuracy. The ITS-90 extends upward from 0.65 K, is in close agreement with the Kelvin Thermodynamic Temperature Scale, has much improved continuity, precision and reproducibility throughout its ranges over that of previous scales, and has subranges and alternative definitions in certain ranges that greatly facilitate its use. In addition to a description of the ITS-90 and how it can be realized, there are included in the document reproductions of some articles or excerpts from articles concerned with the ITS-90. The composition of the Comité Consultatif de Thermométrie (CCT) of the Comité International des Poids et Mesures (CIPM) at the time of the adoption of the ITS-90 is given. The differences between the temperatures on the ITS-90 and those on the International Practical Temperature Scale of 1968, Amended Edition of 1975, (IPTS-68(75)) and those on the 1976 Provisional 0.5 K to 30 K Temperature Scale (EPT-76) are tabulated. Measurement procedures for realizing the ITS-90 throughout the various ranges of the scale are given.

001,784

PB91-117960 Not available NTIS National Bureau of Standards (NML), Gaithersburg, MD. Molecular Spectroscopy Div.

Nomenclature for Lambda Doublet Levels in Rotating Linear Molecules.

Final rept. M. Alexander, R. Bacis, P. Dagdigian, G. Flynn, and R. Field. 1988, 5p Pub. in Jnl. of Chemical Physics 89, n4 p1749-1753 1988.

Keywords: *Molecular energy levels, Linear systems, Diatomic molecules, Nomenclature, Rotation, Reprints.

It is proposed that the two Lambda-doublet levels of linear molecules with non-zero electronic orbital angular momentum be labelled Lambda(A prime) and Lambda(A double prime), e.g., Pi(A prime) and Pi(A double prime) for Pi states, etc., depending on whether in the high-J limit the electronic wavefunction is symmetric or antisymmetric with respect to reflection of the spatial coordinates of all the electrons in the plane of rotation of the molecule. This notation supplements the accepted spectroscopic e/f labelling, can be directly correlated with observed spectroscopic intensities, and is of most relevance in the mechanistic interpretation of reactive or photodissociative processes involving open-shell molecules.

001,785

PB91-118026 Not available NTIS National Inst. of Standards and Technology (NML), Gaithersburg, MD. Quantum Metrology Div.

Measurement of the Neutron Lifetime by Counting Trapped Protons.

Final rept.
J. Byrne, P. G. Dawber, J. A. Spain, A. P. Williams, and M. S. Dewey. 1990, 4p
Contract DE-AL05-87ER40340
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review Letters 65, n3 p289-292, 16 Jul 90.

Keywords: *Neutrons, Measurement, Counting, Reprints, Penning traps, Lifetime.

The neutron lifetime ($\tau_{\text{sub } s}$) has been measured by counting decay protons stored in a Penning trap whose magnetic axis coincided with a neutron-beam axis. The result of the measurement is ($\tau_{\text{sub } s}$) = 893.6 ± 0.5 s which agrees well with the value predicted by precise measurements of the beta-decay asymmetry parameter A and the standard model.

001,786

PB91-118182 Not available NTIS
National Bureau of Standards (NML), Gaithersburg, MD. Ionizing Radiation Div.

Anisotropic Neutron Emission from a Californium-252 Source.

Final rept.
C. M. Eisenhauer, and J. B. Hunt. 1988, 6p
Pub. in Radiation Protection Dosimetry 22, n4 p253-258 1988.

Keywords: Nuclear fission, Neutron sources, Radiation protection, Monte Carlo method, Anisotropy, Reprints, *Californium 252, *Neutron emission, Calibration.

Neutron-sensitive devices used for radiation protection purposes are usually calibrated by determining their response to radionuclide neutron sources of known neutron output. The neutron emission from the source material is intrinsically isotropic, with negligible scattering. However, the material must be encapsulated, and there will be a finite amount of scattering, both elastic and inelastic, from the encapsulation. In the present work, the experimental determination of the anisotropic neutron emission from a californium spontaneous fission source is compared with Monte Carlo calculations of the neutron emission.

001,787

PB91-118372 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Center for Radiation Research.

Generational Mass Generation and Symmetry Breaking.

Final rept.
P. Kaus, and S. Meshkov. 1990, 5p
Contract DE-AC0381-ER40050
Sponsored by Department of Energy, Washington, DC.
Pub. in Physical Review D 42, n5 p1863-1867, 1 Sep 90.

Keywords: Lagrangian functions, BCS theory, Quarks, Leptons, Mass, Reprints, *Symmetry breaking, Kobayashi-Maskawa matrix.

A BCS theory of quark and lepton mass generation leads to a nonlinear self-interaction term in the Lagrangian whose natural representation is the 'democratic' basis. It is shown, within the BCS framework, how the original $U(3)_{\text{sub } L} \times U(3)_{\text{sub } R}$ symmetry of the massless u quarks and ν leptons is systematically broken so as to lead to the observed quark and lepton spectra, consistent with their mass hierarchies, and the additional hierarchy of weak mixing angles manifested in the Kobayashi-Maskawa matrix. Experiment cannot currently distinguish between such symmetry breaking as proposed by Fritzsch and Plankl, by the authors, or by others.

001,788

PB91-118547 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Surface Science Div.

Molecular Dynamics Simulation of Collisional Excitation in Sputtering from Al.

Final rept.
M. H. Shapiro, and J. Fine. 1989, 11p
Pub. in Nuclear Instruments and Methods in Physics Research B44, p43-53 1989.

Keywords: *Aluminum, Computerized simulation, Sputtering, Single crystals, Excitation, Reprints, *Ion-atom collisions, Ion bombardment, Argon ions, Molecular dynamics, KeV range 01-10.

The molecular dynamics sputtering code SPUT2 was modified to permit investigation of core excitation in Al

following bombardment with 5 keV $\text{Ar}(1+)$ ions. This code was used to investigate sputtering mechanisms responsible for the ejection of core-excited atoms from solid surfaces. Simulations were carried out with the ion incident along both low- and high-index directions. In contrast to most previous studies, essentially all ejection of core-excited atoms resulted from asymmetric collisions (i.e. collisions between the incident ion and a target atom). When the ion is incident along a low-index direction, core-excited atoms arise almost exclusively from the first layer of the target. When the ion is incident along a high-index direction, core-excited atoms are found to eject from deeper layers as well.

001,789

PB91-118588 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Very Low Frequency Isolation Systems for Ground-Based Gravitational Wave Detectors.

Final rept.
R. T. Stebbins, M. Ashby, M. H. Anderson, P. L. Bender, and J. E. Faller. 1989, 6p
Pub. in Proceedings of Marcel Grossman Meeting on General Relativity (5th), Perth, Australia, August 8-13, 1988, p1769-1774 1989.

Keywords: *Vibration isolators, Very low frequencies, Servomechanisms, Reprints, *Gravitational wave detectors, Ground motion.

The performance of existing and contemplated ground-based gravitational wave detectors could be extended through augmented seismic isolation. For example, the ground noise spectrum, which increases toward lower frequency, establishes the low frequency limit in present interferometer designs. Extending the operating band from 10 Hz down to 1 Hz through better vibration isolation would afford access to a band which may contain signals indicative of massive black hole formation or collisions in galactic or pre-galactic times. An isolation factor of 10 to the -5 power to 10 to the -6 power appears to be needed in order to bring the vibrational noise at the support points of the test mass pendulums in interferometric detectors such as LIGO down to the desired level at 1 Hz. A new method has been developed which decreases the effective damping by using a servo system to sense the bending and then rotate the support point to reduce the bending. A simple pendulum was constructed to test this scheme. The servo system increased the damping time by a factor of 5.

001,790

PB91-118596 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Laser Interferometer for Gravitational Wave Astronomy in Space.

Final rept.
R. T. Stebbins, P. L. Bender, J. E. Faller, J. L. Hall, D. Hils, and M. A. Vincent. 1989, 9p
Contract NAGW-822
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in Proceedings of Marcel Grossman Meeting on General Relativity (5th), Perth, Australia, August 8-13, 1988, p1759-1767 1989.

Keywords: Relativity, Sensitivity, Noise, Reprints, *Gravitational wave detectors, *Laser interferometers, Gravitational wave antennas, Spaceborne, Michelson interferometers.

A space-based, laser interferometer for detecting gravitational waves could probe low frequency bands expected to be rich in gravitational signals. An interferometer of roughly one million km path length could detect both the continuous periodic radiation from very many binary star systems and pulses which may have been emitted during galaxy formation. Such an instrument has been proposed, and a preliminary design concept has been developed. In principle, it consists of a Michelson interferometer with the beamsplitter and the two end mirrors mounted on carefully shielded test masses inside three separate spacecraft. The cluster of spacecraft would follow 30 deg to 60 deg behind the earth in its orbit about the sun. The progress during the last two years reported here centers on refinements of the basic design parameters to increase the sensitivity of the antenna and on better estimates of various noise sources.

001,791

PB91-118620 Not available NTIS

National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Electricity Div.

Stochastic Properties of Trichel-Pulse Corona: A Non-Markovian Random Point Process.

Final rept.
R. J. Van Brunt, and S. V. Kulkarni. 1990, 25p
Sponsored by Department of Energy, Washington, DC. Div. of Electric Energy Systems.
Pub. in Physical Review A 42, n8 p4908-4932, 15 Oct 90.

Keywords: *Electric corona, Random processes, Neon, Nitrogen, Oxygen, Space charge, Stochastic presses, Reprints, *Corona discharges.

The stochastic properties of negative, point-to-plane, Trichel-pulse corona discharges are completely characterized in terms of a set of measured conditional and unconditional discharge pulse-amplitude and pulse-time-separation distributions. The Trichel-pulse phenomenon is shown to be a clear example of a non-Markovian, marked random point process in which memory effects play an important role. Strong correlations are shown to exist among the amplitudes and time separations of successive discharge pulses that indicate how initiation and growth of a discharge pulse are affected by the presence of residual ion space charge and metastable species from previous pulses. The analysis required to assess consistency among the various measured probability distributions is discussed and used to interpret observed variations in distribution profiles. Because of the observed dependence of discharge pulse amplitude on both the amplitude of and time separation from the previous pulse, memory can propagate indefinitely back in time. The experimental limitations to verify the extent of memory propagation are analyzed.

001,792

PB91-118653 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electron and Optical Physics Div.

Peak Reflectivity Measurements of W/C, Mo/Si, and Mo/B4C Multilayer Mirrors in the 8-190-Angstrom Range Using Both Kalpha Line and Synchrotron Radiation.

Final rept.
A. P. Zwickler, S. Regan, M. Finkenthal, H. W. Moos, E. B. Saloman, R. Watts, and J. R. Roberts. 1990, 5p
Contract DE-FG02-85ER53214
Sponsored by Department of Energy, Washington, DC.
Pub. in Applied Optics 29, n25 p3694-3698, 1 Sep 90.

Keywords: *Mirrors, Synchrotron radiation, Reflectivity, Molybdenum, Tungsten, Silicon, Boron carbides, Reprints, *X ray mirrors, Soft x rays, Multilayers.

Peak reflectivity measurements of W/C, Mo/Si, and Mo/B4C multilayer mirrors have been performed using line and synchrotron radiation in the 8-190 A wavelength range. Short wavelength measurements using a line source were corrected for nonmonochromatic and divergent incident radiation. Reflectivities of Mo/Si mirrors, measured with a synchrotron radiation, ranged from 25 to 44% but decreased significantly around the Si absorption edge. Mo/B4C multilayer mirrors were measured that had peak reflectivities from 10 to 25% between 90 and 200 A and bandpasses as small as 3A.

001,793

PB91-133793 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Synchronization of Clocks.

Final rept.
D. W. Allan. 1989, 18p
Pub. in Proceedings of Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (21st), Redondo Beach, CA., November 28-30, 1989, p1-18.

Keywords: *Atomic clocks, Frequency stability, Synchronization, Time measurement, Metrology, Comparison, Accuracy, Reprints, Global positioning system.

Time metrology has moved from milliseconds to picoseconds in the last four decades, and frequency metrology from nine significant digits to sixteen. The ability to synchronize remote clocks has improved dramatically as well. With implementation of GPS(Global Positioning System), the full long-term frequency stability as well as the frequency accuracy of the best atomic clocks can now be transferred to remote sites. GPS's selective availability, an intentional degradation of

system performance, will adversely affect the accuracy and stability of GPS time and frequency for the average civilian user. In the paper the author defines terms of reference, discuss various alternatives for clock synchronization and syntonization, and make some comparisons between various techniques used in synchronizing and syntonizing clocks. In the process the authors review the concepts of time stability and accuracy, frequency stability and accuracy.

001,794

PB91-133801 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Chemical Engineering Science Div.
State Equation of Liquid Helium - 4 from 0.8 to 2.5 K.

Final rept.

V. D. Arp, 1990, 21p

Sponsored by National Aeronautics and Space Administration, Moffett Field, CA. Ames Research Center.
Pub. in *Jnl. of Low Temperature Physics* 79, n1-2 p93-113 1990.

Keywords: *Liquid helium, *Helium 4, *Equations of state, Reprints, Cryogenic fluids.

A state equation for liquid helium is constructed in the range from 0.8 K to about 2.5 K, based on density and temperature as independent parameters. The equation has been fitted to experimental PVT, specific heat, (partial derivative of P with respect to T)_{sub v}, sound velocity, and lambda line properties from 14 different authors to an accuracy comparable with reasonable experimental errors in the measured quantities. Inclusion of logarithmic terms leads to agreement with experimental data as close as 100 (mu)K from the lambda line. It is found that the logarithmic amplitude ratio is not constant as a function of distance along the lambda line. A new determination of lambda line density is also presented. The equation is available in computer form.

001,795

PB91-133819 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Observation of Shell Structures with Ions Stored in Traps.

Final rept.

J. J. Bollinger, S. L. Gilbert, and D. J. Wineland.

1989, 10p

Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.

Pub. in *Proceedings of Workshop on Crystalline Ion Beams*, Wertheim, FRG, October 4-7, 1988, p231-240 1989.

Keywords: Shells(Structural forms), Reprints, *Ion storage, Laser induced fluorescence, Laser cooling, Penning traps, Ion traps, Beryllium ions.

The authors briefly discuss the possibility of using ions stored in traps to experimentally test the predictions of the one-component plasma (OCP) theory. They then report the observation of shell structures, a predicted feature of the finite OCP, with Be(1+) ions stored in a Penning trap. Clouds containing up to 15,000 ions (density approx 100 million/cc) were laser-cooled to temperatures of about 10mK. Under these conditions, the ions are strongly coupled and exhibit liquidlike and solidlike behavior through the formation of concentric shells. The shells were observed by direct imaging of the laser-induced ion fluorescence for values of the Coulomb coupling constant ranging from about 20 to 200.

001,796

PB91-133991 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Thermophysics Div.

Heat Induced Instability in a Model Liquid.

Final rept.

D. J. Evans, and H. J. M. Hanley, 1989, 9p

Sponsored by Department of Energy, Washington, DC. Office of Basic Energy Sciences.
Pub. in *Molecular Physics* 68, n1 p97-105 1989.

Keywords: *Liquids, Thermal conductivity, Conductance, Reprints, *Thermal instability, Molecular dynamics, Evans algorithm.

The stability of the homogeneous nonequilibrium molecular dynamics (NEMD) heat flow algorithm due to Evans is discussed with respect to a two dimensional soft disc inverse-twelve N-particle liquid. The thermal

conductivity coefficient is evaluated as a function of an induced heat field, related to $\Delta \ln T$, for $N = 56, 224, 896$ and 3584 . It is shown that homogeneous heat conduction becomes unstable for large systems ($N =$ or > 896) at sufficiently large values of the field; the conductivity increases and the system conducts heat by generating a solitary shock wave. The results are strongly dependent on N and differ in this respect from parallel NEMD studies on a liquid subjected to a shear.

001,797

PB91-134023 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Chemical Engineering Science Div.

Transient Heat-Transfer Studies in Low-Gravity Using Optical Measurement Techniques.

Final rept.

P. J. Giarratano, A. Kumakawa, V. D. Arp, and R. B. Owen, 1990, 6p

Pub. in *Jnl. of Thermophysics and Heat Transfer* 4, n1 p53-58 Jan 90.

Keywords: *Heat measurement, *Heat transfer, Reduced gravity, Electrical measurement, Optical measurement, Holography, Reprints, Transients.

The paper summarizes heat-transfer measurements where a transient heat pulse in a metal surface induces a fluid velocity perpendicular to that surface. Surface temperatures are measured electrically and temperature profiles in the heated fluid are determined optically. A low-gravity environment is used to suppress gravitational convection. Diffuse-light holographic observations are shown to produce better fringe resolution than collimated-light interferometry within the heated boundary layer. Theoretical analysis is in excellent agreement with the electrical measurements, and satisfactory agreement with the optical measurements.

001,798

PB91-134049 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Electromagnetic Technology Div.

Magnetic Characteristics and Measurements of Filamentary Nb-Ti Wire for the Superconducting Super Collider.

Final rept.

R. B. Goldfarb, and R. L. Spomer, 1990, 8p

Pub. in *Advances in Cryogenic Engineering Materials*, v36 p215-222 1990.

Keywords: *Superconducting magnets, Magnetic measurement, Magnetic hysteresis, Magnetization, Prototypes, Reprints, *Superconducting super collider, *Superconducting wires, *Superconducting cables, Niobium titanium, Magnetic susceptibility, Instability.

In synchrotron accelerator applications, such as the Superconducting Super Collider (SSC), superconducting magnets are cycled in a magnetic field. Desirable properties of the magnets include field uniformity, field stability with time, small residual field, and fairly small energy losses upon cycling. The paper discusses potential sources of problems in achieving these goals, describes important magnetic characteristics to be considered, and reviews measurement techniques for magnetic evaluation of candidate SSC wires. Instrumentation that might be practical for use in a wire-fabrication environment is described. The authors report on magnetic measurements of prototype SSC wires and cables and speculate on causes for instability in multipole fields of dipole magnets constructed with such cables.

001,799

PB91-134122 Not available NTIS
National Bureau of Standards (NML), Gaithersburg,
MD. Ionizing Radiation Div.

Low-Level Radioactivity Standards at the National Bureau of Standards.

Final rept.

J. M. R. Hutchinson, K. G. W. Inn, and S. J. Bright.

1988, 13p

Pub. in *Proceedings of International Summer School Low-Level Measurements and Their Applications to Environmental Radioactivity (1st)*, Huelva, Spain, September 28-October 9, 1987, p56-78 1988.

Keywords: *Radioactivity, *Radiation measuring instruments, *Standards, *Metrology, Alpha particles, Mass spectroscopy, Reprints, Radioisotopes, Isotope ratio, US NBS, US NIST.

Instrumentation and programs in low-level radionuclide metrology at the National Bureau of Standards (NBS) are summarized.

001,800

PB91-134155 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Coulomb Clusters of Ions in a Paul Trap.

Final rept.

W. M. Itano, J. C. Bergquist, and D. J. Wineland.

1989, 14p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.

Pub. in *Proceedings of Workshop on Crystalline Ion Beams*, Wertheim, FRG, October 4-7, 1988, p241-254 1989.

Keywords: Electron transitions, Clustering, Clumps, Reprints, *Ion storage, Mercury ions, Laser cooling, Paul traps.

Ordered structures of as many as 16 laser-cooled Hg(1+) ions, confined in a Paul trap, have been observed. These structures, called Coulomb clusters, match those calculated by minimizing the effective potential energy of the system. The 5d(10)6s doublet S(1/2) to 5d(9)6s(2) doublet D(5/2) transition in Hg(1+) has been observed by optical-optical double resonance. The resolution was high enough that Doppler-induced sidebands, due to the harmonic motion of a single ion in the trap, were clearly resolved. Additional sidebands, due to the relative vibration of two ions forming a pseudomolecule, have also been observed.

001,801

PB91-134163 Not available NTIS
National Inst. of Standards and Technology (NML),
Boulder, CO. Time and Frequency Div.

Quantitative Study of Laser Cooling in a Penning Trap.

Final rept.

W. M. Itano, L. R. Brewer, D. J. Larson, J. J.

Bollinger, S. L. Gilbert, and D. J. Wineland, 1989, 2p

Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.

Pub. in *Proceedings of Symposium on Frequency Standards and Metrology (4th)*, Ancona, Italy, September 5-9, 1988, p447-448 1989.

Keywords: Temperature measurement, Frequency standards, Reprints, *Ion temperature, Ion storage, Penning traps, Laser cooling, Beryllium ions.

The temperature of an ion plasma in a Penning trap, cooled by a laser beam perpendicular to the trap axis, has been calculated and measured. The measurements are in agreement with the calculations. Strong oscillations have been observed in the total fluorescence, with periods ranging from less than 1 second to a minute. The changes in fluorescence are accompanied by changes in the radius of the plasma.

001,802

PB91-134379 Not available NTIS
National Bureau of Standards (NEL), Gaithersburg,
MD. Mechanical Production Metrology Div.

Causal Green Function in Relativistic Quantum Mechanics.

Final rept.

E. Marx, 1987, 16p

Pub. in *International Jnl. of Theoretical Physics* 26, n8 p725-740 1987.

Keywords: Perturbation theory, Greens function, Charged particles, Convergence, Relativity, Reprints, *Quantum mechanics, Klein-Gordon equation.

The causal Green function or Feynman propagator for the Klein-Gordon equation is defined within the framework of the theory of distributions. Solutions of the equation with causal time-boundary conditions are related to the probabilistic interpretation of the wave function in relativistic quantum mechanics. The problem of a scalar charged particle in an external electromagnetic field is solved by perturbation expansion, and the convergence of the series is shown for potentials that are well behaved.

001,803

PB91-134791 Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Heterodyne Frequency Measurements on SO₂ Near 41 THz (1370 cm⁻¹).

Final rept.
M. D. Vanek, J. S. Wells, A. G. Maki, and J. B. Burkholder. 1990, 2p
Pub. in *Jnl. of Molecular Spectroscopy* 141, p346-347 1990.

Keywords: *Sulfur dioxide, *Frequency measurement, Frequency standards, Band spectra, Infrared spectra, Heterodyning, Reprints, Calibration standards.

New heterodyne frequency measurements are reported for the (nu sub 3) band of SO₂ between 40.45 and 41.80 THz (1349 and 1395/cm). A new band center at 1362.06022(5)/cm is determined. Weak perturbations with nearby bands make it impossible to calculate accurate energy levels and transitions without including an analysis of the perturbations.

001,804
PB91-134973 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Electricity Div.

Latest Results from the Proton Gyromagnetic Ratio in Water and Related Experiments.

Final rept.
E. R. Williams, Y. Sheng, P. T. Olsen, R. E. Elmquist, L. Ruimin, and G. R. Jones. 1989, 5p
Pub. in *Proceedings of International Symposium on Electromagnetic Metrology*, Beijing, China, August 19-22, 1989, p165-169.

Keywords: *Fundamental constants, Protons, Reprints, *Gyromagnetic ratio, Fine structure constant, Sommerfeld constant, Quantum Hall effect, Storage rings, Ohm.

The results of the latest measurement made at the National Institute of Standards and Technology (NIST) of the proton gyromagnetic ratio are presented, and the resultant value of the quantized Hall resistance, and the fine structure constant are compared. A discussion of possible sources for the (-0.102 + or - 0.043) ppm discrepancy between the absolute ohm and this measurement is included along with a new method to measure h/(e squared) by counting electrons in a storage ring.

001,805
PB91-134999 Not available NTIS
National Bureau of Standards (NML), Boulder, CO. Time and Frequency Div.

Ion Traps for Large Storage Capacity.

Final rept.
D. J. Wineland. 1987, 14p
Sponsored by Office of Naval Research, Arlington, VA., and Air Force Office of Scientific Research, Bolling AFB, DC.
Pub. in *Proceedings of Conference on Cooling, Condensation, and Storage of Hydrogen Cluster Ions*, Menlo Park, CA., January 8-9, 1987, p181-194.

Keywords: *Ion traps (Instrumentation), Antiparticles, Reprints, *Ion storage, Penning traps, Paul traps.

Ion storage in Penning-type or rf (Paul)-type traps is discussed. Emphasis is given to low-energy, long-term confinement of high densities and large numbers of ions. Maximum densities and numbers are estimated using a low-temperature, static model of the ion plasmas in the traps. Destabilizing mechanisms are briefly discussed.

001,806
PB91-135004 Not available NTIS
National Inst. of Standards and Technology (NML), Boulder, CO. Time and Frequency Div.

Digitized Atom and Optical Pumping.

Final rept.
D. J. Wineland, W. M. Itano, J. C. Bergquist, and R. G. Hulet. 1989, 5p
Sponsored by Air Force Office of Scientific Research, Bolling AFB, DC., and Office of Naval Research, Arlington, VA.
Pub. in *Atomic Physics* 11, p741-745 1989.

Keywords: *Atomic spectroscopy, Optical pumping, Reprints, Trapping (Charged particles), Laser spectroscopy, Laser cooling, Quantum jumps, Ion traps.

The authors discuss how optical-pumping and double-resonance experiments on single atoms alter one's experimental approach. One's knowledge of the atom

can be in digital form; this allows an analysis quite different from experiments on ensembles of atoms.

001,807
PB91-144469

(Order as PB91-144451, PC A05/MF A01)
National Inst. of Standards and Technology, Gaithersburg, MD.

Recommended Values of the Fundamental Physical Constants: A Status Report.

B. N. Taylor, and E. R. Cohen. 1990, 27p
Prepared in cooperation with Rockwell International, Thousand Oaks, CA. Science Center.
Included in *Jnl. of Research of the National Institute of Standards and Technology*, v95 n5 p497-523 Sep/Oct 90.

Keywords: *Fundamental constants, Units of measurement, Josephson effect, Least squares method, Plancks constant, Sommerfeld constant, Recommendations, Quantum Hall effect, Fine structure constant, CODATA.

The authors summarize the principal advances made in the fundamental physical constants field since the completion of the 1986 CODATA least-squares adjustment of the constants and discuss their implications for both the 1986 set of recommended values and the next least-squares adjustment. Although much new data has become available since 1986, three new results dominate the analysis: a value of the Planck constant obtained from a realization of the watt; a value of the fine-structure constant obtained from the magnetic moment anomaly of the electron; and a value of the molar gas constant obtained from the speed of sound in argon. Because of their dominant role in determining the values and uncertainties of many of the constants, it is highly desirable that additional results of comparable uncertainty that corroborate these three data items be obtained before the next adjustment is carried out. Until then, the 1986 CODATA set of recommended values will remain the set of choice.

001,808
PB91-167411 PC A05/MF A01

National Inst. of Standards and Technology, Gaithersburg, MD.

Journal of Research of the National Institute of Standards and Technology.

1990, 95p
Also available from Supt. of Docs. as SN703-027-00037-7. See also PB91-167429 through PB91-167460 and PB91-144451.

Keywords: *Radiometry, Temperature measurement, Temperature scales, Infrared imagery, Infrared photometry, Molybdenum ions, Atomic energy levels, Ultraviolet spectra, Process control, Metrology, Carbon dioxide, Butanes, Liquid-vapor equilibrium, Thermal resolution targets.

Contents:
The 1990 NIST Scales of Thermal Radiometry; Low-Contrast Thermal Resolution Test Targets--A New Approach;
Analysis of the Spectrum of Doubly Ionized Molybdenum (Mo III);
Survey of Industrial, Agricultural, and Medical Applications of Radiometric Gauging and Process Control;
Vapor-Liquid Equilibrium of Carbon Dioxide with Isobutane and n-Butane--Modified Leung-Griffiths Correlations and Data Evaluation.

001,809
PB91-167429

(Order as PB91-167411, PC A05/MF A01)
National Inst. of Standards and Technology, Gaithersburg, MD.

1990 NIST Scales of Thermal Radiometry.

K. D. Mielenz, R. D. Saunders, A. C. Parr, and J. J. Hsia. 1990, 9p
Included in *Jnl. of Research of the National Institute of Standards and Technology*, v95 n6 p421-429, Nov/Dec 90.

Keywords: *Temperature measurement, *Temperature scales, *Radiometry, Blackbody radiation, Photometry, Calibration, Gold, US NIST.

Following an absolute NIST measurement of the freezing temperature of gold and the adoption of the International Temperature Scale of 1990 (ITS-90), NIST has adopted new measurement scales for the calibration services based on thermal radiometry. In this paper, the new scales are defined and compared to

the ITS-90, and the effects of the scale changes on NIST measurement services in optical pyrometry, radiometry, and photometry are assessed quantitatively. The changes in reported calibration values are within quoted uncertainties, and have resulted in small improvements in accuracy and better consistency with other radiometric scales.

001,810
PB91-167445

(Order as PB91-167411, PC A05/MF A01)
National Inst. of Standards and Technology, Gaithersburg, MD.

Analysis of the Spectrum of Doubly Ionized Molybdenum (Mo III).

I. Iglesias, M. I. Cabeza, and V. Kaufman. 1990, 42p
Included in *Jnl. of Research of the National Institute of Standards and Technology*, v95 n6 p647-688, Nov/Dec 90.

Keywords: *Molybdenum ions, *Ultraviolet spectra, *Atomic energy levels, Multicharged ions, Tables(Data).

The spectrum of doubly ionized molybdenum (Mo III) was produced in a sliding spark discharge and recorded photographically on the NIST 10.7-m normal incidence spectrograph in the 800-3250 Å spectral region. The analysis has led to the establishment of 76 levels of the interacting 4d(4), 4d(3)5s and 4d(2)5s(2) even configurations, 73 levels of the interacting 4d(3)5d and 4d(3)6s even configurations, and 181 levels of the interacting 4d(3)5p and 4d(2)5s5p odd configurations. Approximately 3100 lines have been classified as transitions between these experimentally determined levels. Comparison between the observed levels and those calculated from matrix diagonalization with least-squares fitted parameters shows standard deviations of 44, 33, and 183/cm, respectively, for the levels of the three sets of configurations.

SPACE TECHNOLOGY

Extraterrestrial Exploration

001,811
PB90-254525 Not available NTIS

National Inst. of Standards and Technology (NML), Boulder, CO. Quantum Physics Div.

Apollo Retroreflector Arrays Revisited: A Lunar Beaconed Array.

Final rept.
J. E. Faller. 1990, 4p
Pub. in *AIP (American Institute of Physics) Conference Proceedings* 202, Physics and Astrophysics from a Lunar Base, NASA (National Aeronautics and Space Administration) Workshop (1st), Stanford, CA., May 19-20, 1989, p153-156 1990.

Keywords: Reprints, *Lunar ranging, Lunar bases, Lunar core, Lunar tides, Laser applications, Retroreflectors, Apollo project.

A suggestion was made to take advantage of the proposed lunar base by locating, at any earthward-facing lunar base, a new Apollo-type retroreflector array together with an earth-pointing laser beacon. The latter would greatly simplify guiding on this site by the ground stations. The retroreflector array would be similar to those placed at the Apollo sites.

Manned Spacecraft

001,812
N88-12522/4

(Order as N88-12520/8, PC A07/MF A01)
National Bureau of Standards (NML), Gaithersburg, MD. Center for Fire Research.

Manned Spacecraft

Fire-Related Standards and Testing.

V. Babrauskas. 1987, 11p
In NASA, Lewis Research Center, Spacecraft Fire Safety, p31-41.

Keywords: *Combustion, *Fires, *Flame propagation, *Flammability, *Requirements, *Spacecraft components, *Spacecraft construction materials, *Standards, *Tests, Atmospheric composition, Composite materials, Gravitation, Ignition, Mechanical properties, Oxygen, Pressure, Quality control.

The state of the art of flammability testing has been changing rapidly. Here, the progress in developing general test methods for solid materials and products exposed to an external fire are reviewed. The special requirements pertinent to environments of concern to NASA are examined and some suggestions for possible directions for future test method developments are given.

001,813

N89-23501/4 PC A03/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Fire Research.
Expert Systems Applied to Spacecraft Fire Safety.
Final Report.

R. L. Smith, and T. Kashiwagi. Jun 89, 13p NAS 1.26:182266, E-4812, NASA-CR-182266
NASA ORDER C-32000-M

Keywords: *Aerospace safety, *Expert systems, *Fire prevention, Fires, Knowledge bases (Artificial intelligence), *Space stations, Autonomy, Decision making, Fire extinguishers, Flammability, Reduced gravity, Ventilation.

Expert systems are problem-solving programs that combine a knowledge base and a reasoning mechanism to simulate a human expert. The development of an expert system to manage fire safety in spacecraft, in particular the NASA Space Station Freedom, is difficult but clearly advantageous in the long-term. Some needs in low-gravity flammability characteristics, ventilating-flow effects, fire detection, fire extinguishment, and decision models, all necessary to establish the knowledge base for an expert system, are discussed.

001,814

N89-26471/7
(Order as N89-26454/3, PC A16/MF A01)
National Bureau of Standards, Gaithersburg, MD.
Hierarchical Control of Intelligent Machines Applied to Space Station Telerobots.
J. S. Albus, R. Lumia, and H. McCain. 1 Jul 87, 11p
In Jet Propulsion Lab., California Inst. Of Tech., Proceedings of the Workshop on Space Telerobotics, Volume 1 p 155-165.

Keywords: *Architecture (Computers), *Artificial intelligence, *Control systems design, *Control theory, *Hierarchies, *Robots, *Space stations, *Teleoperators, Actuators, Computer vision, Man machine systems, Mathematical models, Operators (Personnel), Pattern recognition, Planning, Robotics, Tasks, Trajectories, Reprints.

A hierarchical architecture is described which supports space station telerobots in a variety of modes. The system is divided into three hierarchies: task decomposition, world model, and sensory processing. Goals at each level of the task decomposition hierarchy are divided both spatially and temporally into simpler commands for the next lower level. This decomposition is repeated until, at the lowest level, the drive signals to the robot actuators are generated. To accomplish its goals, task decomposition modules must often use information stored in the world model. The purpose of the sensory system is to update the world model as rapidly as possible to keep the model in registration with the physical world. The architecture of the entire control system hierarchy and how it can be applied to space telerobot applications are discussed.

001,815

N90-24325/4
(Order as N90-24280/1, PC A19/MF A03)
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Intelligent Controls Group.
NASREM: A Functional Architecture for Control of the Flight Telerobotic Servicer.
R. Lumia. cDec 89, 5p
In Esa, Second European in-Orbit Operations Technology Symposium p 361-365.

Keywords: Architecture(Computers), *Control systems design, *Orbital servicing, *Robots, Teleoperators, Interfaces, Nasa space programs, Robotics.

The NASA/NBS (National Bureau of Standards) Standard Reference Model for Telerobot Control System Architecture (NASREM), adopted by NASA for use in the Flight Telerobotic Servicer (FTS), a two armed telerobotic manipulator which will build and maintain the Space Station is addressed. NASREM is technology independent; the same functions must be performed by all controllers. NASREM provides the paradigm which allows the FTS to evolve with technology because standard interfaces can be defined so that functionally equivalent software and hardware modules may be interchanged. After a brief tutorial on the NASREM functional architecture, the approach to its implementation is shown. Interfaces must be defined which are capable of supporting the known algorithms. This is illustrated by considering the interfaces required for the servolevel of the NASREM functional architecture. After interface definition, the specific computer architecture for the implementation must be determined. This choice is obviously technology dependent. An example illustrating one possible mapping of the NASREM functional architecture to a particular set of computers which implements it is shown. The result of choosing the NASREM functional architecture is that it provides a technology independent paradigm which can be mapped into a technology dependent implementation capable of evolving with technology in the laboratory as well as in space.

001,816

N90-29823/3
(Order as N90-29780/5, PC A23/MF A04)
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Robot Systems Div.
Flight Telerobotic Services: From Functional Architecture to Computer Architecture.
R. Lumia, and J. Fiala. 31 Jan 89, 10p
In JPL, California Inst. of Tech., Proceedings of the NASA Conference on Space Telerobotics, Volume 3 p473-482.

Keywords: *Algorithms, *Architecture(Computers), *Control systems design, *Robotics, *Teleoperators, *Space stations.

After a brief tutorial on the NASA/National Bureau of Standards Standard Reference Model for Telerobot Control System Architecture (NASREM) functional architecture, the approach to its implementation is shown. First, interfaces must be defined which are capable of supporting the known algorithms. This is illustrated by considering the interfaces required for the SERVO level of the NASREM functional architecture. After interface definition, the specific computer architecture for the implementation must be determined. This choice is obviously technology dependent. An example illustrating one possible mapping of the NASREM functional architecture to a particular set of computers which implements it is shown. The result of choosing the NASREM functional architecture is that it provides a technology independent paradigm which can be mapped into a technology dependent implementation capable of evolving with technology in the laboratory and in space.

001,817

PB90-148362 PC A05/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Precision Engineering Div.
Accuracy Analysis of the Space Shuttle Solid Rocket Motor Profile Measuring Device.
W. T. Estler. Nov 89, 79p NISTIR-89/417
Also available from Supt. of Docs. Sponsored by National Aeronautics and Space Administration, George C. Marshall Space Flight Center, Huntsville, AL.

Keywords: *Accuracy, *Measuring instruments, Tolerances(Mechanics), Metrology, Joints(Junctions), Rocket engines, *Space shuttle solid rocket engine.

The Profile Measuring Device (PMD) was developed at the George C. Marshall Space Flight Center following the loss of the Space Shuttle Challenger. It is a rotating gauge used to measure the absolute diameters of mating features of redesigned Solid Rocket Motor field joints. Diameter tolerances of these features are typically plus or minus 0.005 inches and it is required that the PMD absolute measurement uncertainty be within this tolerance. In this analysis we find the absolute accuracy of these measurements to be plus or minus 0.00375 inches, worst case, with a potential accuracy of plus or minus 0.0021 inches achievable by improved temperature control.

001,818

PB90-183302 PC A03/MF A01
National Inst. of Standards and Technology (NIST), Gaithersburg, MD. Center for Building Technology.
Autonomous Propulsion System Requirements for Placement of an STS (Space Transportation System) External Tank in Low Earth Orbit.
W. C. Stone, and G. S. Cheok. Nov 89, 17p NISTIR-89/4208

Keywords: Computerized simulation, Equations of motion, Aerodynamic drag, *Propulsion systems, *Space transportation system, *External tanks, Space shuttle orbiters, Orbital mechanics.

The paper discusses the findings of an extensive series of computer simulations carried out at the National Institute of Standards and Technology to investigate the requirements for powered flight of the external tank through the thermosphere following separation from the Shuttle orbiter at main engine cutoff. The object of the investigation was to determine the minimum thrust and fuel requirements for an autonomous exterior propulsion package attached to the external tank in order to avoid re-entry on the critical first orbit, and to place the tank in a short term stable orbit from which customary orbit maintenance procedures may be carried out. Descriptions are given for the differential equations of motion, and the atmospheric drag and propulsion models used in the equations.

001,819

PB90-196510 PC A05/MF A01
National Inst. of Standards and Technology (NIST), Boulder, CO. Chemical Engineering Science Div.
Nontoxic Heat Transport Fluids for Spacecraft Two-Phase Thermal Control Systems.
Rept. for Sep 88-89.
P. J. Giarratano, and J. F. Welch. Jan 90, 87p
NISTIR-89/3932
Contract NASA-T-4528P
Sponsored by National Aeronautics and Space Administration, Houston, TX. Lyndon B. Johnson Space Center.

Keywords: *Manned spacecraft, *Temperature control, *Refrigerants, Thermodynamic properties, Computer programs, Tables(Data), *Heat transfer fluids, *Spacecraft temperature, Binary systems(Materials).

The report summarizes an investigation to determine the availability of a nontoxic, nonflammable, noncorrosive and thermally stable heat transport fluid suitable for two-phase thermal control systems in manned spacecraft. Approximately 860 chemical substances were sorted and ranked according to parameters that were defined and calculated to quantitatively evaluate fluids for the proposed application. A methodology was developed for the evaluation and ranking. A survey of world suppliers of heat transport fluids was also conducted to determine whether a suitable fluid is available. The investigation did not identify a fluid that can meet all the environmental and thermal property requirements required for safe and efficient performance in the spacecraft application.

001,820

PB91-101428 Not available NTIS
National Bureau of Standards (NIST), Gaithersburg, MD. Robot Systems Div.
Architecture to Support Teleoperation and Autonomy.
Final rept.
R. Lumia, and J. S. Albus. 1987, 6p
Pub. in Proceedings of International Conference on Systems, Man, and Cybernetics, Alexandria, VA., October 20-23, 1987, v3 p1160-1164.

Keywords: *Space stations, Reprints, *Teleoperators, *Spacecraft maintenance, Robotics, Autonomy, Computer architecture.

The Flight Telerobotic Servicer (FTS) will support assembly and maintenance activities for the Space Station. In order for the FTS to evolve with technology, careful attention must be paid to the system's functional architecture. The paper describes an approach to the functional architecture so that teleoperation, slated for beginning of the program, and autonomy, scheduled later in the program, can both be supported. The system is hierarchically organized where task decomposition, world modeling, and sensory processing are explicitly represented. Goals at each level of the hierarchy are decomposed spatially and temporally into

simpler tasks which become goals for lower levels. The spatial decomposition facilitates control and coordination of multiarm robots.

Spacecraft Trajectories & Flight Mechanics

001,821
PB90-205758 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Mathematical Analysis Div.
Simplifications in the Theory of Artificial Satellites. Final rept.
A. Deprit, and S. Ferrer. 1989, 13p
Pub. in *Jnl. of the Astronautical Sciences* 37, n4 p451-463 Oct-Dec 89.

Keywords: Artificial satellites, Hamiltonian functions, Average, Reprints, *Satellite theory, Lie transformations, Symbolic algebra.

The concept of simplification in the study of Hamiltonian systems is given a precise algebraic definition as that of a Lie transformation mapping a Poisson algebra A of perturbation functions into a proper submodule of A. A case in point is the elimination of the parallax in the theory of artificial satellites; so is Cid's first order treatment of the main problem which, it is shown here, may be extended to any order without producing mixed secular-periodic terms in the transformation. The procedure, in that case, leads to a radial intermediary with the remarkable property that, although inclusive of all second order effects, the approximate system is still integrable—in elliptic functions—away from the critical inclinations. The concept of simplification presented here reveals that the elimination of the perigee proposed by Alfriend and Coffey amounts to a normalization in the sense of Meyer and Marsden-Weinstein by which the zonal problem of artificial satellite theory is rendered symmetric with respect to the group of rotations about the normal to the instantaneous orbital plane.

General

001,822
N89-20317/8
(Order as N89-20305/3, PC A13/MF A01)
National Bureau of Standards, Gaithersburg, MD. Thermophysics Div.
Dynamic Thermophysical Measurements in Space. A. Cezairliyan, and A. P. Miller. Oct 88, 9p
In *NASA, Washington, Microgravity Science and Applications Flight Programs, January - March 1987, Selected Papers, Volume 2* p 763-771.

Keywords: *Liquids, *Mathematical models, *Reduced gravity, *Refractory metals, *Thermophysical properties, C-135 aircraft, Equipment specifications, Geometry, Heating, Pyrometers, Space shuttle payloads.

The objective is to develop an accurate dynamic technique which, in a microgravity environment, would enable performance of thermophysical measurements on high-melting-point electrically conducting substances in their liquid state. In spite of the critical need in high temperature technologies related to spacecraft, nuclear reactors, effects of power laser radiation, and in validating theoretical models in related areas, no accurate data on thermophysical properties exist. This is primarily due to the limitation of the reliable steady-state techniques to temperatures below about 2000 K, and the accurate millisecond-resolution pulse heating techniques to the solid state of the specimen. The limitation of the millisecond-resolution techniques to temperatures below the melting point stems from the fact that the specimen collapses due to the gravitational force once it starts to melt. The rationale for the use of the microgravity is that by performing the dynamic experiments in a microgravity environment the specimen will retain its geometry, and thus it will be possible to extend the accurate thermophysical measurements to temperatures above the melting point of high-melting-point substances.

001,823
PB90-218033 Not available NTIS

National Bureau of Standards (IMSE), Boulder, CO. Fracture and Deformation Div.
Next-Generation Tension Strap Supports for Spaceborne Dewars.

Final rept.
R. A. Hopkins, D. A. Payne, R. D. Kriz, and E. E. Morris. 1987, 9p
Pub. in *Proceedings of AIAA (American Institute of Aeronautics and Astronautics) Thermophysics Conference (22nd)*, Honolulu, HI., June 8-10, 1987, 9p.

Keywords: *Supports, *Fiber composites, Thermal conductivity, Aluminum oxide, Fatigue strength at N cycles, Modulus of elasticity, Reprints, *Dewars, *Epoxy matrix composites, Spaceborne.

In the design of long-life, spaceborne dewars the supports must be considered not only as a structural member, but also as part of the thermal isolation of the cold assembly. Filament-wound composite tension straps provide the strength needed for the launch environment while minimizing heat conduction into the dewar. The optimum material for this application has a large ratio of fatigue strength-to-thermal conductivity to minimize heat input and a high modulus of elasticity to maximize the system resonant frequency. The material that exhibits the best combination of these properties and has been used in numerous spaceborne dewars is fiberglass/epoxy. The paper presents measurements of mechanical and thermal properties of straps made of a newly-developed alumina fiber with epoxy resin. This composite has significantly higher fatigue strength and modulus of elasticity than fiberglass/epoxy and similar thermal conductivity. This material therefore appears to be the best available choice in the future for a dewar tension strap support.

001,824
PB90-271255 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Thermophysics Div.
Dynamic Technique for Thermophysical Measurements at High Temperatures in a Microgravity Environment. Final rept.
A. Cezairliyan, and A. P. Miller. 1990, 10p
Pub. in *International Jnl. of Thermophysics* 11, n4 p653-662 Jul 90.

Keywords: *Thermophysical properties, *Dynamic tests, *Liquid metals, *Refractory materials, *Reduced gravity, Measurement, High temperature tests, Solid phases, Melting points, Electric conductors, Pulse heating, Metals, Reprints.

Millisecond-resolution dynamic techniques for thermophysical measurements, when utilized in the laboratory, are limited to the study of materials in the solid phase because the specimen becomes geometrically unstable during melting and collapses, due (at least in part) to the influence of gravity. Therefore, a millisecond-resolution dynamic technique is being developed for use in a microgravity environment in order to extend accurate measurements of selected thermophysical properties of electrically conducting refractory materials to temperatures above the melting point. The basic method involves heating the specimen resistively from ambient temperature to temperatures above its melting point in about 1 s by passing an electrical current pulse through it, while simultaneously recording the pertinent experimental quantities. A compact pulse-heating system, suitable for microgravity simulations with NASA's KC-135 aircraft, has been constructed and initial experiments have been performed to study the geometrical stability of rapidly melting specimens. Preliminary results show that rod-shaped specimens can be successfully pulse-heated into the liquid phase.

001,825
PB90-271578 Not available NTIS
National Inst. of Standards and Technology (NML), Gaithersburg, MD. Thermophysics Div.
Dynamic Technique for Measuring Surface Tension at High Temperatures in a Microgravity Environment. Final rept.
A. P. Miller, and A. Cezairliyan. Jul 90, 13p
Pub. in *International Jnl. of Thermophysics* 11, n4 p663-674 Jul 90.

Keywords: *Copper, *Reduced gravity, *Interfacial tension, *Liquid metals, Dynamic tests, High temperature tests, Feasibility, Pulse heating, Liquid metals, Melting points, Reprints.

The feasibility of a dynamic technique for measuring surface tension of liquid metals at high temperatures in a microgravity environment is considered. The basic method involves heating a tubular specimen resistively from ambient temperature through its melting point in about 1 s by passing an electrical current pulse through it, while simultaneously recording the pertinent experimental quantities. Static equilibrium for the molten specimen may be achieved (at least for a short time) in a microgravity environment by splitting the current after it passes through the specimen tube and returning a fraction along the tube axis and the remaining fraction outside the specimen. Adjustments to the current split enable a balance between the magnetic and surface tension forces acting on the specimen. Values for surface tension are determined from measurements of the equilibrium dimensions of the molten specimen tube, and the magnitudes of the currents. Preliminary rapid melting experiments, performed during microgravity simulations with NASA's KC-135 aircraft, yield a value for the surface tension of copper at its melting point which is in reasonable agreement with literature data.

001,826
PB91-134783 Not available NTIS
National Inst. of Standards and Technology (NEL), Boulder, CO. Chemical Engineering Science Div.
Investigations on Gel Forming Media for Use in Low Gravity Bioseparations Research. Final rept.
P. Todd, D. C. Szlag, L. D. Plank, S. G. Delcourt, M. E. Kunze, F. H. Kirkpatrick, and R. G. Pike. 1989, 7p
Contract NAS9-15584
Sponsored by National Aeronautics and Space Administration, Washington, DC.
Pub. in *Advanced Space Research* 9, n11 p97-103 1989.

Keywords: *Reduced gravity, *Culture media, Cells(Biology), Extraction, Gels, Reprints, *Cell separation, Agar gel electrophoresis.

Microgravity research includes investigations designed to gain insight on methods of separating living cells. During a typical separation certain real-time measurements can be made by optical methods, but some materials must also be subjected to subsequent analyses, sometimes including cultivation of the separated cells. In the absence of on-orbit analytical or fraction collecting procedures, some means is required to capture cells after separation. The use of solutions that form gels was therefore investigated as a means of maintaining cells and/or macromolecules in the separated state after two types of simple ground-based experiments. Microgravity electrophoresis experiments were simulated by separating model cell types (rat, chicken, human and rabbit erythrocytes) in a vertical density gradient containing low-conductivity buffer, 1.7%-6.5% Ficoll, 6.8-5.0% sucrose, and 1% SeaPrep low-melting temperature agarose and demonstrating that, upon cooling, a gel formed in the column, and cells could be captured in the positions to which they had migrated. Two-phase extraction experiments were simulated by choosing two-polymer solutions in which phase separation occurs in normal saline at temperatures compatible with cell viability and in which one or both phases form a gel upon cooling.

TRANSPORTATION

Marine & Waterway Transportation

001,827
PB90-257676 PC A04/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD.
Strength and Creep-Rupture Properties of Adhesive-Bonded EPDM Joints Stressed in Peel. Final rept.
J. W. Martin, E. Embree, P. E. Stutzman, and J. A. Lechner. May 90, 61p NIST/BSS-169
Also available from Supt. of Docs. as SN003-003-03009-1.

TRANSPORTATION

Marine & Waterway Transportation

Keywords: *Roofing, *Creep rupture strength, *Joints(Junctions), *Adhesives, Bonding strength, Failure, Test facilities, Peel strength, Stresses, Creep properties.

The most frequently reported defect in ethylene-propylene-diene terpolymer (EPDM) single-ply roofing systems is in field-formed joints. The causes of these joint defects are largely unknown, but they tend to occur a short time after a roof is installed. The objectives of the research were (1) to determine the importance of the following material and fabrication variables in causing joint failures: adhesive thickness, cure time, mechanical load, adhesive type and surface cleanliness; (2) to rank these variables as they affect the creep-rupture life and strength of butyl-adhered EPDM joints; and (3) to determine the maximum peel stress which EPDM joints can sustain over their design life. From the results, cure time and level of cleanliness of the EPDM membrane have the greatest effect on joint strength; while the thickness of the adhesive and the magnitude of the mechanical load have the greatest effect on a joint's creep-rupture time-to-failure. Thus, the rankings of variables in creep-rupture and short-time strength experiments were different and this difference should have important implications in standards writing and in establishing performance requirements for EPDM roofing joints.

Pipeline Transportation

001,828
PB90-148776 PC A04/MF A01
National Inst. of Standards and Technology (IMSE), Gaithersburg, MD.

Assessment of the Performance and Reliability of Older ERW (Electric Resistance Welding) Pipelines.

R. J. Fields, E. N. Pugh, D. T. Read, and J. H. Smith. Jul 89, 60p NISTIR-89/4136

Keywords: *Petroleum pipelines, Reliability, Performance, Failure, Welded joints, Electric welding, Inspection, *Oil spills, *Maries County(Missouri).

On December 24, 1988, a failure occurred in the Ozark Pipeline System in Maries County, Missouri, and resulted in a spill of over 800,000 gallons of crude oil, causing serious contamination of the Gasconade and Missouri Rivers. The pipeline had been in operation since 1949 and the failure occurred in a section of steel pipe produced by electric resistance welding (ERW). A metallurgical investigation by Battelle-Columbus Laboratories concluded that the fracture originated at a defect in the ERW seam weld. At the request of Senators Bond (R-MO) and Danforth (R-MO), NIST assessed the Battelle findings and found them to be sound. NIST also addressed the issue of whether special standards should apply to the operation and inspection of older ERW pipelines. Based on a review of failure incidence data and related documents, it is concluded that, while ERW pipe manufactured prior to about 1970 is inherently susceptible to seam failures, the relatively small number of such failures does not warrant special standards except for critical risk locations. For the latter cases, measures are recommended for failure prevention and, of equal importance, for damage control in the event of isolated failure. Some of these measures are shown to have application to all pipelines.

Railroad Transportation

001,829
PB90-136920 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.

Development of a Weld Procedure to Repair Joints in a Railroad-Type Track.

Final rept.
T. A. Siewert. 1988, 7p
Sponsored by David W. Taylor Naval Ship Research and Development Center, Carderock, MD.
Pub. in Welding Jnl. 67, n8 p17-23, Aug 88.

Keywords: *Arc welding, *Railroad tracks, Welding electrodes, Hard surfacing, Welded joints, Maintenance, Steel, Welding, Joints(Junctions), Reprints.

The report describes the development of a repair procedure for a precision railroad-type track located at the David Taylor Naval Research Center in Carderock, Maryland. The report describes the electrode selection, preheat determination, and other welding parameters that must be controlled to allow a precision repair.

001,830
PB90-271636 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.

EMAT (Electromagnetic-Acoustic Transducers) Examination for Cracks in Railroad Wheel Treads.

Final rept.
R. E. Schramm, P. J. Shull, A. V. Clark, and D. V. Mitakovic. 1990, 8p
See also PB90-123894. Sponsored by Federal Railroad Administration, Washington, DC.
Pub. in Proceedings of Nondestructive Testing and Evaluation for Manufacturing and Construction Conference, Urbana, IL., August 9-12, 1988, p373-380 1990.

Keywords: *Railroad cars, *Wheels, *Cracks, *Nondestructive tests, Stresses, Electromagnetic testing, Ultrasonic tests, Inspection, Braking, Rayleigh waves, Treads, Reprints.

The authors examined the use of Rayleigh-wave electromagnetic-acoustic transducers (EMATs) in pitch-catch as a possible non-contact inspection tool for cast steel wheels with an American-style profile used on the freight cars of the U.S. railway system. The transmitter and receiver coils were a meanderline design on a flexible substrate which conformed to the tread shape for maximum electromagnetic coupling. The transducer package was the two coils stacked and backed by a large Nd-Fe-B permanent magnet. A newly designed MOSFET pulser generated a high-current, gated rf pulse at 500 kHz. The Rayleigh wave generated traveled around an unflawed wheel circumference at least 14 times (about 36 m). This technique should allow detection of critical-depth cracks in the tread of every wheel on a train as it rolls by an inspection point in a railyard.

001,831
PB91-101550 Not available NTIS
National Inst. of Standards and Technology (IMSE), Boulder, CO. Fracture and Deformation Div.

Crack Inspection of Railroad Wheel Treads by EMATs.

Final rept.
R. E. Schramm, P. J. Shull, A. V. Clark, and D. V. Mitakovic. 1989, 8p
Sponsored by Federal Railroad Administration, Washington, DC.

Pub. in Proceedings of International Symposium on Nondestructive Characterization of Materials (3rd), Saarbrücken, FRG, October 3-6, 1988, p421-428 1989.

Keywords: *Rolling stock, *Wheels, *Ultrasonic tests, *Cracks, Rail transportation, Nondestructive tests, Inspection, Treads, Rayleigh waves, Safety, Reprints.

Railroad safety depends on many factors. The integrity of the wheels on rolling stock is one that is subject to nondestructive evaluation. For some years, ultrasonic testing has been applied to the detection of cracks in wheel treads, with particular attention to automatic, in-rail, roll-by methods. We have begun constructing a system aimed at using relatively low frequency Rayleigh waves generated by electromagnetic acoustic transducers (EMATs). The current design uses a permanent magnet to maintain a compact structure and minimize the size of the pocket machined into the rail. Measurements thus far indicate a responsiveness even to small flaws. With the development of a signal processing and analysis system, field tests should soon be possible.

Road Transportation

001,832
PB90-260969 Not available NTIS
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Building Environment Div.

Color Appearance of Traffic Control Devices under Different Illuminants.

Final rept.
B. L. Collins. 1989, 10p
Sponsored by Federal Highway Administration, Washington, DC.
Pub. in Transportation Research Record 1247, p23-31 1989.

Keywords: *Traffic safety, *Vehicular traffic control, *Color codes, *Illuminating, Safety devices, Human factors engineering, Color conditioning, Brightness, Safety engineering, Traffic engineering, Reprints, *Highway signs.

Color has traditionally been used to code safety information because of its ability to attract attention and evoke a rapid response. Research on color coding, highway safety color codes, conspicuity, illuminant color shifts, and retroreflective materials has been reviewed to evaluate the effectiveness of the current chromaticity specifications for highway signs and markings. These current specifications require colors of medium lightness and saturation (except yellow), and sometimes can appear quite dark. Data from a previous study were analyzed to compare color appearance data (color name, lightness, and saturation) under seven different illuminants for a set of American National Standards Institute (ANSI) and highway colors. This analysis demonstrated that the ANSI colors, particularly safety yellow, were identified more accurately in terms of color name, lightness, saturation, and primary hue than was the corresponding highway color. A shift toward ANSI safety yellow from highway yellow is suggested.

001,833
PB90-265307 PC A09/MF A01
National Inst. of Standards and Technology (NEL), Gaithersburg, MD. Center for Fire Research.

Assessment of the Fire Performance of School Bus Interior Components.

Final rept.
E. Braun, S. Davis, J. H. Klote, B. C. Levin, and M. Paabo. Jul 90, 178p NISTIR-4347
Sponsored by National Highway Traffic Safety Administration, Washington, DC. Office of Vehicle Safety Standards.

Keywords: *Flammability testing, *Buses(Vehicles), *Seats, Burning rate, Fire tests, Toxicity, Combustion products, Smoke, Flame propagation, Furniture, Upholstery, *School buses, *Fire resistant materials, School bus safety.

Since seat assemblies represent the single largest type of combustible fuel in a school bus interior, the study is limited to currently used and state-of-the-art material assemblies. Six different seat assemblies having a range of fire performance were examined. Small-scale tests (Cone Calorimeter, LIFT, and NBS Toxicity Protocol) were performed on these materials. Large-scale tests (Furniture Calorimeter) were conducted on single seat assemblies. Full-scale tests were performed using a simulated bus enclosure measuring 2.44 m wide by 2.13 m high by 8.23 m long and three seat assemblies. The impact of ignition source size was determined by computer simulation. It was found that a 500 kW ignition source could produce untenable conditions in the simulated bus enclosure. Seat assemblies were exposed to 50 kW and 100 kW ignition sources in the large-scale tests and 100 kW ignition source in the full-scale tests. It was found that the small-scale tests were unable to provide a simple method for material selection that was consistent with the full-scale test results. At the present time, small-scale tests of materials cannot be depended upon to predict the fire behavior in the real world.

URBAN & REGIONAL TECHNOLOGY & DEVELOPMENT

Fire Services, Law Enforcement, & Criminal Justice

001,834
PB90-170457 Not available NTIS
National Bureau of Standards (ICST), Gaithersburg,
MD. Advanced Systems Div.
**Automated Fingerprint Identification Systems
Benchmark Tests of Relative Performance.**
Final rept.
R. T. Moore. 1988, 29p
Sponsored by International Association for Identifica-
tion, Alameda, CA.
Pub. in ANSI/IAI (American National Standards Insti-
tute/International Association for Identification), n1
p1-29 1988.

Keywords: *Identification systems, *Law enforcement,
Criminal investigations, Performance evaluation,
Standards, Reliability, Quality control, Reprints, *Finger-
print identification systems, Computer applications,
Benchmarks.

The standard defines benchmark tests to measure
certain aspects of the relative performance of auto-
mated fingerprint identification systems. The perform-
ance attributes include the reliability and selectivity
with which fingerprints are identified. The tests are in-
tended to help users select equipment that best meets
their requirements and to provide a reference for the
comparison of continuing system performance in sup-
port of operational quality control.

001,835
PB90-250051 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Fire Research.
Software Development Tools.
Final rept.
G. P. Forney, and W. W. Jones. Jul 90, 43p NISTIR-
4363

Keywords: *Fire growth, Mathematical models, *Soft-
ware engineering, *Software tools, *Compartment
fires, Computer software.

The paper discusses the use of software tools to air in
the development of models produced by the Center for
Fire Research (CFR). There are two types of tools de-
scribed in the paper. The first type consists of execut-
able programs that characterize the subroutine and
data structures of FORTRAN programs. A second
class of software tools are subroutines that support
various utility functions required by CFR models. The
authors will discuss how each of these tools are used
and why their development was necessary. In addition,
the authors will indicate how these tools might be im-
proved.

001,836
PB90-257601 PC A03/MF A01
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Center for Fire Research.
Exposure: An Expert System Fire Code.
R. L. Smith. Jul 90, 42p NISTIR-4373
Sponsored by Air Force Engineering and Services
Center, Tyndall AFB, FL.

Keywords: *Fire safety, Building codes, Walls, Com-
puter programs, Cost effectiveness, *Fire codes,
*Expert systems, *Building fires, Combustibles,
Spread.

The report addresses the issue of developing an
expert or knowledge-based system that deals with the
problem of preventing the spread of fire between build-
ings. A knowledge-based program, EXPOSURE, has
been developed that facilitates using more appropriate
technology, expanding the problem domain, and pro-
viding cost-effective solutions. EXPOSURE can solve
the problem of the prevention of the spread of fire be-
tween buildings for the case when the exposed build-
ing has combustible walls. The use of the expert
system EXPOSURE and NFPA 80A produce signifi-
cantly different recommended minimum separation be-
tween buildings. In some cases EXPOSURE calls for
significantly greater separation and in others signifi-
cantly less. In one case the separation required by
NFPA 80A was more than five times greater than what
EXPOSURE recommended. The program demon-
strates that significant cost savings in achieving the
desired level of fire safety and in assuring the levels of
safety can be obtained by use of expert system fire
codes.

001,837
PB90-265315 PC A08/MF A01
Worcester Polytechnic Inst., MA.
**Development of an Instructional Program for Prac-
ticing Engineers Hazard I Users.**
Final rept.
J. R. Barnett, and C. Beyler. Aug 90, 162p NIST/
GCR-90/580
Grant 60NANB9D0949
Prepared in cooperation with Fire Science Technol-
ogies, Columbia, MD. Sponsored by National Inst. of

Standards and Technology (NEL), Gaithersburg, MD.
Center for Fire Research.

Keywords: *Engineering, *Training, Hazard assess-
ment, Safety factors, Computer model, Instructions,
Manuals, Students, *Fire statistics, *Computer soft-
ware.

With the release of HAZARD I, a prototype hazard as-
sessment method and software, the National Institute
of Standards and Technology (NIST) has brought to
the fire protection engineering community a new gen-
eration of hazard analysis capabilities. In order to help
HAZARD I users benefit from the software, Worcester
Polytechnic Institute (WPI) has developed a five day
short course. The short course emphasizes correct
use of the software, and how to recognize misuse. The
course has been offered three times to a broad range
of students. In general, only those students with an en-
gineering background were able to learn enough about
the HAZARD I software to feel that they could continue
to learn how to use the software on their own and
eventually use it in practice. Nonetheless, virtually all
of the students benefitted from the course and found it
a worthwhile experience.

001,838
PB91-101519 Not available NTIS
National Inst. of Standards and Technology (NEL),
Gaithersburg, MD. Fire Measurement and Research
Div.

**Protecting Fire Fighters Exposed in Room Fires.
Part 2. Performance of Turnout Coat Materials
under Actual Fire Conditions.**

Final rept.
R. D. Peacock, J. F. Krasny, J. A. Rockett, and D.
Huang. 1990, 21p
See also PB88-200258.
Pub. in Fire Technology 26, n3 p202-222 Aug 90.

Keywords: *Fire tests, *Clothing, *Fire fighting, Fire
protection, Apparel fabrics, Heat resistant materials,
Safety engineering, Fire safety, Heat flux, Experimen-
tal data, Reprints.

Seven experimental fires varying in fire load were con-
ducted in a simulated townhouse. Specimens of vari-
ous current fire fighters turnout coat materials were ex-
posed in the room of fire origin. The time at which con-
ditions would become untenable for the fire fighter due
to pain, as well as the time to second degree burn,
were calculated. These times ranked the coat speci-
mens in roughly the same order as the 'Thermal Pro-
tection Performance' measured according to NFPA
1971-1986, especially if the heat in the room devel-
oped rapidly.



PERSONAL AUTHOR INDEX

SAMPLE ENTRY

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AD-A205 656/2 *000,659*

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AD-A223 579/4 *000,704*

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AD-A204 439/4 *000,659*

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AD-A204 506/0 *000,660*

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AD-A204 780/1 *000,662*

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AD-A204 928/6 *000,664*

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AD-A205 444/3 *000,666*

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AD-A206 490/5 *000,670*

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AD-A206 491/3 *000,671*

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AD-A208 303/8 *000,672*

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AD-A208 474/7 *000,674*

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AD-A208 475/4 *000,675*

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AD-A208 498/6 *000,676*

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AD-A208 513/2 *000,677*

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AD-A208 514/0 *000,678*

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AD-A208 515/7 *000,679*

Ada Compiler Validation Summary Report: Certificate Number: 880708S1.09150 SoftTech, Inc., Ada 86, Version 3.21, VAX 11/780-11/785 Host and Intel iAPX 80286P Target.
AD-A208 652/8 *000,680*

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AD-A208 830/0 *000,681*

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AD-A214 907/8 *000,683*

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AD-A215 057/1 *000,684*

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AD-A215 201/5 *000,685*

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AD-A215 202/3 *000,686*

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AD-A218 464/6 *000,688*

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AD-A219 438/9 *000,689*

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AD-A220 908/8 *000,693*

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AD-A220 944/3 *000,694*

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AD-A221 010/2 *000,695*

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AD-A223 495/3 *000,702*

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AD-A223 596/8 *000,706*

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AD-A223 597/6 *000,707*

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AD-A223 693/3 *000,708*

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PATENT-4 919 829 001,221 Not available NTIS

REPT-19
Mechanical Properties and Fracture Toughness of AAR (Association of American Railroads) TC128 Grade B Steel and a Micro-Alloyed, Control-Rolled Steel, A 8XX Grade B, from -80F to + 73F.
PB90-207796 001,216 PC A03/MF A01

REPT-20
Determination of the NDT (Nil-Ductility Transition) Temperature and Charpy V-Notch Impact Properties of AAR (American Association of Railroads) TC128 Grades B Steel and A 8XX Grade B Steel.
PB90-207804 001,217 PC A03/MF A01

SERI/STR-211-3473
Diagnostics of Glow Discharges Used to Produce Hydrogenated Amorphous Silicon Films: Annual Subcontract Report, June 15, 1987--November 30, 1988.
DE89000887 000,963 PC A03/MF A01

WHOI-89-56
Report on Sediment Transport Events on Shelf and Slope (STRESS) Field Season 1: Winter 1988-1989 Benthic Acoustic Stress Sensor (BASS) Component.
AD-A222 068/9 001,434 PC A03/MF A01



APPENDIX A

List of Depository Libraries in the United States

ALABAMA

Auburn

Auburn University Ralph Brown Draughon Library (1873)

Birmingham

Birmingham Public Library (1895)
Birmingham-Southern College Library (1932)
Jefferson State Community College James B. Allen Library (1970)
Samford University Library Harwell G. Davis Library (1884)

Enterprise

Enterprise State Junior College Learning Resources Center (1967)

Fayette

Brewer State Junior College Learning Resources Center Library (1979)

Florence

University of North Alabama Collier Library (1932)

Gadsden

Gadsden Public Library (1963)

Huntsville

University of Alabama in Huntsville Library (1964)

Jacksonville

Jacksonville State University Houston Cole Library (1929)

Mobile

Mobile Public Library (1963)
Spring Hill College Thomas Byrne Memorial Library (1937)
University of South Alabama Library (1968)

Montgomery

Alabama Public Library Service (1984)
Alabama Supreme Court and State Law Library (1884)
Auburn University at Montgomery Library (1971) REGIONAL
Air University Library Maxwell Air Force Base (1963)

Normal

Alabama Agricultural and Mechanical University J. F. Drake Memorial Learning Resources Center (1963)

Troy

Troy State University Library (1963)

Tuscaloosa

University of Alabama Amelia Gayle Gorgas Library (1860) REGIONAL
University of Alabama School of Law Library (1967)

Tuskegee

Tuskegee University Hollis Burke Frissell Library (1907)

ALASKA

Anchorage

Anchorage Law Library (1973)
Anchorage Municipal Libraries Z. J. Loussac Public Library (1978)
University of Alaska at Anchorage Library (1961)
U.S. Alaska Resources Library (1981)
U.S. District Court Law Library (1983)

Fairbanks

University of Alaska Elmer E. Rasmuson Library (1922)

Juneau

Alaska State Library (1900)
University of Alaska-Juneau Library (1981)

Ketchikan

Ketchikan College Library (1970)

AMERICAN SAMOA

Pago Pago

American Samoa Community College Learning Resources Center (1985)

ARIZONA

Coolidge

Central Arizona College Instructional Materials Center (1973)

Flagstaff

Northern Arizona University Cline Library (1937)

Glendale

Glendale Public Library (1986)

Holbrook

Northland Pioneer College Learning Resources Center (1985)

Mesa

Mesa Public Library (1983)

Phoenix

Department of Library Archives, and Public Records (unknown)
REGIONAL

Grand Canyon University Fleming Library (1978)

Phoenix Public Library (1917)

U.S. Court of Appeals 9th Circuit Library (1984)

Prescott

Yavapai College Library (1976)

Tempe

Arizona State University College of Law Library (1977)

Arizona State University Hayden Library (1944)

Tucson

Tucson Public Library (1970)

University of Arizona Library (1907) REGIONAL

Yuma

Yuma County Library (1963)

ARKANSAS

Arkadelphia

Ouachita Baptist University Riley Hickingbotham Library (1963)

Batesville

Arkansas College Library (1963)

Clarksville

University of the Ozarks Dobson Memorial Library (1925)

Conway

Hendrix College Olin C. Bailey Library (1903)

Fayetteville

University of Arkansas Mullins Library (1907)

University of Arkansas School of Law Library Robert A. Leflar (1978)

Little Rock

Arkansas State Library (1978) REGIONAL

Arkansas Supreme Court Library (1962)

Central Arkansas Library System Main Library (1953)

University of Arkansas at Little Rock Library Ottenheimer Library (1973)

University of Arkansas at Little Rock Pulaski County Law Library
(1979)

Magnolia

Southern Arkansas University Magale Library (1956)

Monticello

University of Arkansas at Monticello Library (1956)

Pine Bluff

University of Arkansas at Pine Bluff Watson Memorial Library (1976)

Russellville

Arkansas Technical University Tomlinson Library (1925)

Searcy

Harding University Brackett Library (1963)

State University

Arkansas State University Dean B. Ellis Library (1913)

Walnut Ridge

Southern Baptist College Felix Goodson Library (1967)

CALIFORNIA

Anaheim

Anaheim Public Library (1963)

Arcadia

Arcadia Public Library (1975)

Arcata

Humboldt State University Library (1963)

Bakersfield

California State University Bakersfield Library (1974)

Kern County, Beale Memorial Library (1943)

Berkeley

University of California General Library (1907)

University of California Boalt Law Library (1963)

Carson

California State University Dominguez Hills Library (1973)
Carson Regional Library (1973)

Chico

California State University, Chico Merriam Library (1962)

Claremont

Government Publications and Microforms Department Honnold Library,
Claremont College (1913)

Compton

Compton Public Library (1972)

Culver City

Culver City Public Library (1966)

Davis

University of California Shields Library (1953)
University of California at Davis Law Library (1972)

Downey

Downey City Library (1963)

Fresno

California State University, Fresno, Henry Madden Library (1962)
Government Documents Department Library (1920)

Fullerton

California State University at Fullerton Library (1963)

Garden Grove

Orange County Public Library (1963)

Gardena

County of Los Angeles Public Library (1966)

Hayward

California State University, Hayward Library (1963)

Huntington Park

Huntington Park Library (1970)

Inglewood

Inglewood Public Library (1963)

Irvine

University of California at Irvine Main Library (1963)

La Jolla

University of California at San Diego Central University Library (1963)

Lakewood

Angelo Iacoboni Public Library (1970)

Lancaster

Lancaster Library (1967)

La Verne

University of La Verne College of Law Library (1979)

Long Beach

California State University at Long Beach Library (1962)
Long Beach Public Library (1933)

Los Angeles

California State University, Los Angeles University Library (1956)
Los Angeles County Law Library (1963)
Los Angeles Public Library (1891)
Loyola Marymount University Charles Von der Ahe Library (1933)
Loyola Law School William M. Rains Law Library (1979)
Occidental College Library (1941)
Southwestern University School of Law Library (1975)
University of California, University Research Library (1932)
University of California, Los Angeles Law Library (1958)
University of Southern California Doheny Memorial Library (1933)
University of Southern California Law Library (1978)
U.S. Court of Appeals Ninth Circuit Library (1981)
Whittier College School of Law Library (1978)

Mallbu

Pepperdine University Payson Library (1963)

Menlo Park

U.S. Geological Survey Library (1962)

Montebello

Montebello Regional Library (1966)

Monterey

U.S. Naval Postgraduate School Dudley Knox Library (1963)

Monterey Park

Bruggemeyer Memorial Library (1964)

Northridge

California State University at Northridge Oviatt Library (1958)

Norwalk

Norwalk Regional Library (1973)

Oakland

Mills College Library (1966)
Oakland Public Library (1923)

Ontario

Ontario City Library (1974)

Palm Springs

Palm Springs Public Library (1980)

Pasadena

California Institute of Technology Millikan Memorial Library (1933)
Pasadena Public Library (1963)

Pleasant Hill

Contra Costa County Library (1964)

Redding

Shasta County Library (1956)

Redlands

University of Redlands Armacost Library (1933)

Redwood City

Redwood City Public Library (1966)

Reseda

West Valley Regional Branch Library (1966)

Richmond

Richmond Public Library (1943)

Riverside

Riverside City and County Public Library (1947)
University of California at Riverside Library (1963)

Sacramento

California State Library (1895) REGIONAL
California State University Sacramento Library (1963)
Sacramento County Law Library (1963)
Sacramento Public Library (1880)
University of the Pacific McGeorge School of Law Library (1978)

San Bernardino

Don A. Turner County Law Library (1984)
San Bernardino County Library (1964)

San Diego

National University Law Library (1989)
San Diego County Law Library (1973)
San Diego County Library (1973)
San Diego Public Library (1895)
San Diego State University Library (1962)
University of San Diego Legal Research Center (1967)

San Francisco

Golden Gate University School of Law Library (1979)

University of California Hastings College of Law Library (1972)
San Francisco Public Library (1889)
San Francisco State University J. Paul Leonard Library (1955)
Supreme Court of California Library (1979)
U.S. Court of Appeals Ninth Circuit Library (1971)
University of San Francisco Richard A. Gleeson Library (1963)

San Jose

San Jose State University Clark Library (1962)

San Leandro

San Leandro Community Library Center (1961)

San Luis Obispo

California Polytechnic State University Robert E. Kennedy Library (1969)

San Mateo

College of San Mateo Library (1987)

San Rafael

Marin County Free Library (1975)

Santa Ana

Orange County Law Library (1975)
Santa Ana Public Library (1959)

Santa Barbara

University of California at Santa Barbara Library (1960)

Santa Clara

Santa Clara University Orradre Library (1963)

Santa Cruz

University of California at Santa Cruz McHenry Library (1963)

Santa Rosa

Sonoma County Library (1896)

Stanford

Stanford University Libraries (1895)
Stanford University Robert Crown Law Library (1978)

Stockton

Public Library of Stockton and San Joaquin County (1884)

Thousand Oaks

California Lutheran University Pearson Library (1964)

Torrance

Torrance Public Library (1969)

Turlock

California State University, Stanislaus Library (1964)

Vallejo

Solano County Library John F. Kennedy Library (1982)

Valencia

Valencia Regional Library (1972)

Ventura

Ventura County Library Services Agency (1975)

Visalia

Tulare County Free Library (1967)

Walnut

Mount San Antonio College Library (1966)

West Covina

West Covina Regional Library (1966)

Whittier

Whittier College Wardman Library (1963)

COLORADO

Alamosa

Adams State College Library (1963)

Aurora

Aurora Public Library (1984)

Boulder

University of Colorado at Boulder Norlin Library (1879) REGIONAL
University of Colorado School of Law Library (1988)

Colorado Springs

Colorado College Tutt Library (1880)
University of Colorado at Colorado Springs Library (1974)
U.S. Air Force Academy Library (1956)

Denver

Auraria Library (1978)
Colorado Supreme Court Library (1978)
Denver Public Library (1884) REGIONAL
Department of the Interior Library (1962)
Regis College Dayton Memorial Library (1915)
U.S. Courts Library (1973)

University of Denver Penrose Library (1909)
University of Denver College of Law Westminster Law Library (1978)

Fort Collins

Colorado State University Libraries (1907)

Golden

Colorado School of Mines Arthur Lakes Library (1939)

Grand Junction

Mesa State College Tomlinson Library (1978)
Mesa County Public Library (1975)

Greeley

University of Northern Colorado James A. Michener Library (1966)

Gunnison

Western State College Leslie J. Savage Library (1932)

La Junta

Otero Junior College Wheeler Library (1963)

Lakewood

Jefferson County Public Library Lakewood Library (1968)

Pueblo

Pueblo Library District (1893)
University of Southern Colorado Library (1965)

CONNECTICUT

Bridgeport

Bridgeport Public Library (1884)
University of Bridgeport School of Law Library Wahlstrom Library (1979)

Danbury

Western Connecticut State University Ruth A. Haas Library (1967)

Danielson

Quinebaug Valley Community College Audrey P. Beck Library (1968)

Enfield

Enfield Central Library (1967)

Hartford

Connecticut State Library (unknown) REGIONAL
Hartford Public Library (1945)

Trinity College Library (1895)
University of Connecticut School of Law Library (1978)

Middletown

Wesleyan University Olin Library (1906)

Mystic

Mystic Seaport Museum, Inc., G. W. Blunt White Library (1964)

New Britain

Central Connecticut State University Elihu Burritt Library (1973)

New Haven

Southern Connecticut State University Hilton C. Buley Library (1968)
Yale Law Library (1981)
Yale University Seeley G. Mudd Library (1859)

New London

Connecticut College C. E. Shain Library (1926)
U.S. Coast Guard Academy Library (1939)

Stamford

Ferguson Library (1973)

Storrs

University of Connecticut Homer Babbidge Library (1907)

Waterbury

Post College Traurig Library and Learning Resources Center (1977)
Silas Bronson Public Library (1869)

West Haven

University of New Haven Marvin K. Peterson Library (1971)

DELAWARE

Dover

State Law Library in Kent County (unknown)

Georgetown

Delaware Technical and Community College Southern Campus Library (1968)

Newark

University of Delaware Library (1907)

Wilmington

Wideme University School of Law Library (1976)

DISTRICT OF COLUMBIA

Washington

Administrative Conference of the United States Library (1972)
Advisory Commission on Intergovernmental Relations Library (1977)
American University Washington College of Law Library (1983)
Catholic University of America Robert J. White Law Library (1979)
Comptroller of the Currency Library (1986)
Pentagon Library (1969)
Department of Commerce Library (1955)
Department of Education (1988)
Department of Health and Human Services Library and Information Center (1954)
Department of Housing and Urban Development Library (1969)
Department of the Interior Natural Resources Library (1895)
Department of Justice Main Library (1895)
Department of Labor Library (1976)
Department of the Navy Library (1895)
Department of State Library (1895)
Department of State Law Library (1966)
Department of Transportation Main Library (1982)
Department of Transportation, U.S. Coast Guard Law Library (1982)
Department of Veteran's Affairs Library (1967)
Department of the Treasury Library (1895)
District of Columbia Court of Appeals Library (1981)
District of Columbia Public Library (1943)
Equal Employment Opportunity Commission Library (1984)
Executive Office of the President, Library & Information Service Division (1965)
Federal Deposit Insurance Corporation Library (1972)
Federal Election Commission Law Library (1975)
Federal Energy Regulatory Commission Library (1983)
Federal Mine Safety & Health Review Commission Library (1979)
Federal Reserve System Board of Governors Research Library (1978)
Federal Reserve System Law Library (1976)
General Accounting Office Office of Library Services (1974)
General Services Administration Library (1975)
Georgetown University Library (1969)
Georgetown University Law Center Edward Bennett Williams Library (1978)
George Washington University Melvin Gelman Library (1983)
George Washington University National Law Center Jacob Burns Law Library (1978)
Library of Congress Congressional Research Service (1978)
Library of Congress Serial and Government Publications (1977)
Merit Systems Protection Board Library (1979)
National Defense University Library (1895)
Pension Benefit Guaranty Corporation Legal Dept. Library (1984)
U.S. Court of Appeals Judges' Library (1975)
U.S. Court of Appeals for the Federal Circuit Library (1986)
U.S. Information Agency Library (1984)
U.S. Office of Personnel Management Library (1963)
U.S. Postal Service Library (1895)
U.S. Senate Library (1979)
U.S. Supreme Court Library (1978)
University of the District of Columbia Library Learning Resources Division (1970)
Veterans' Administration Central Office Library (1967)

FLORIDA

Boca Raton

Florida Atlantic University S. E. Wimberly Library (1963)

Casselberry

Seminole County Public Library (1989)

Coral Gables

University of Miami Otto G. Richter Library (1939)

Daytona Beach

Volusia County Library Center (1963)

De Land

Stetson University duPont-Ball Library (1887)

Fort Lauderdale

Broward County Main Library (1967)
Nova University Law Library (1967)

Fort Pierce

Indian River Community College Library (1975)

Gainesville

University of Florida College of Law Library (1978)
University of Florida Libraries (1907) REGIONAL

Jacksonville

Haydon Burns Public Library (1914)
Jacksonville University Swisher Library (1962)
University of North Florida Thomas G. Carpenter Library (1972)

Key West

Florida Keys Community College Key West Campus Library (1989)

Lakeland

Lakeland Public Library (1928)

Leesburg

Lake-Sumter Community College Library (1963)

Melbourne

Florida Institute of Technology Library (1963)

Miami

Florida International University Library Tamiami Trail (1970)
Miami-Dade Public Library (1952)

North Miami

Florida International University Bay Vista Campus Library (1977)

Opa Locka

St. Thomas University Library (1977)

Orlando

University of Central Florida Library (1966)

Palatka

Saint Johns River Community College Library (1963)

Panama City

Bay County Public Library (1983)

Pensacola

University of West Florida John C. Pace Library (1966)

Port Charlotte

Charlotte-Glades Library System (1973)

Saint Petersburg

Saint Petersburg Public Library (1965)
Stetson University College of Law Charles A. Dana Law Library (1975)

Sarasota

Selby Public Library (1970)

Tallahassee

Florida Agricultural and Mechanical University Coleman Memorial Library (1936)
Florida State University Law Library (1978)
Florida State University Strozier Library (1941)
Florida Supreme Court Library (1974)
State Library of Florida (1929)

Tampa

Tampa-Hillsborough County Public Library (1965)
University of South Florida Library (1962)
University of Tampa Merl Kelce Library (1953)

Winter Park

Rollins College Olin Library (1909)

GEORGIA

Albany

Dougherty County Public Library (1964)

Americus

Georgia Southwestern College James Earl Carter Library (1966)

Athens

University of Georgia Libraries (1907) REGIONAL
University of Georgia School of Law Library (1979)

Atlanta

Atlanta-Fulton Public Library (1880)
Atlanta University Center Robert W. Woodruff Library (1962)
Emory University Law School Library (1968)
Emory University Woodruff Library (1928)
Georgia Institute of Technology Price Gilbert Memorial Library (1963)
Georgia State Law Library (unknown)
Georgia State University William Russell Pullen Library (1970)
Georgia State University College of Law Library (1983)
U.S. Court of Appeals 11th Circuit Library (1980)

Augusta

Augusta College Reese Library (1962)
Medical College of Georgia Library (1986)

Brunswick

Brunswick-Glynn County Regional Library (1965)

Carrollton

West Georgia College Irvine Sullivan Ingram Library (1962)

Columbus

Columbus College Simon Schwob Memorial Library (1975)

Dahlonega

North Georgia College Stewart Library (1939)

Dalton

Dalton College Library (1978)

Macon

Mercer University Stetson Main Library (1964)
Mercer University Walter F. George School of Law Library (1978)

Marletta

Kennesaw State College Horace W. Sturgis Library (1968)

Milledgeville

Georgia College Ina Dillard Russell Library (1950)

Rome

Berry College Memorial Library (1970)

Savannah

Chatham-Effingham Liberty Regional Library (1857)

Statesboro

Georgia Southern University Zach S. Henderson Library (1939)

Valdosta

Valdosta State College Library (1956)

GUAM

Agana

Nieves M. Flores Memorial Library (1962)

Mangllao

University of Guam Robert F. Kennedy Memorial Library (1978)

HAWAII

Hilo

University of Hawaii at Hilo Edwin H. Mookini Library (1962)

Honolulu

Hawaii Medical Library Incorporated (1968)
Hawaii State Library (1929)
Municipal Reference & Records Center (1965)
Supreme Court Law Library (1973)
University of Hawaii Hamilton Library (1907) REGIONAL
University of Hawaii William S. Richardson School of Law Library (1978)

Lale

Joseph F. Smith Library Brigham Young University Hawaii Campus (1964)

Lihue

Lihue Public Library (1967)

Pearl City

Leeward Community College Library (1967)

Walluku

Maui Public Library (1962)

IDAHO

Boise

Boise Public Library and Information Center (1929)
Boise State University Library (1966)
Idaho State Law Library (unknown)
Idaho State Library (unknown)

Caldwell

College of Idaho Terteling Library (1930)

Crawfordsville

Wabash College Lily Library

Moscow

University of Idaho College of Law Library (1978)
University of Idaho Library (1907) REGIONAL

Nampa

Northwest Nazarene College John E. Riley Library (1984)

Pocatello

Idaho State University Eli Oboler Library (1908)

Rexburg

Davis O. McKay Library (1946)

Twin Falls

College of Southern Idaho Library (1970)

ILLINOIS

Bloomington

Illinois Wesleyan University, Sheean Library (1964)

Carbondale

Southern Illinois University at Carbondale Morris Library (1932)
Southern Illinois University School of Law Library (1978)

Carlinville

Blackburn College Lumpkin Library (1954)

Carterville

Shawnee Library System (1971)

Champaign

University of Illinois Law Library (1965)

Charleston

Eastern Illinois University Booth Library (1962)

Chicago

Chicago Public Library (1876)
Chicago State University Paul and Emily Douglas Library (1954)
DePaul University Law Library (1979)
Field Museum of Natural History Library (1963)
Illinois Institute of Technology Chicago-Kent College of Law Library (1978)
Illinois Institute of Technology Paul V. Galvin Library (1982)
John Marshall Law School Library (1981)
Loyola University of Chicago E. M. Cudahy Memorial Library (1966)
Loyola University School of Law Library (1979)
Northeastern Illinois University Ronald Williams Library (1961)
Northwestern University School of Law Library (1978)
University of Chicago Law Library (1964)
University of Chicago Library (1897)

University of Illinois at Chicago Library (1957)
William J. Campbell Library of the U.S. Courts (1979)

Decatur

Decatur Public Library (1954)

De Kalb

Northern Illinois University Founders' Memorial Library (1960)
Northern Illinois University College of Law Library (1978)

Des Plaines

Government Information Center and The Northwest Municipal Conference Oakton Community College Library (1976)

Edwardsville

Southern Illinois University at Edwardsville Lovejoy Memorial Library (1959)

Elsah

Principia College Marshall Brooks Library (1957)

Evanston

Northwestern University Library (1876)

Freeport

Freeport Public Library (1905)

Galesburg

Galesburg Public Library (1896)

Jacksonville

MacMurray College Henry Pfeiffer Library (1929)

Kankakee

Olivet Nazarene University Bonner Library and Learning Center (1946)

Lake Forest

Lake Forest College Donnelley Library (1962)

Lebanon

McKendree College Holman Library (1968)

Lisle

Illinois Benedictine College Theodore F. Lownik Library (1911)

Macomb

Western Illinois University Government Publications & Legal Reference Library (1962)

Moline

Black Hawk College Learning Resources Center (1970)

Monmouth

Monmouth College Hewes Library (1860)

Mount Carmel

Wabash Valley College Bauer Media Center (1975)

Mount Prospect

Mount Prospect Public Library (1977)

Normal

Illinois State University Milner Library (1877)

Oak Park

Oak Park Public Library (1963)

Oglesby

Illinois Valley Community College Jacobs Memorial Library (1976)

Palos Hills

Moraine Valley Community College Learning Resources Center (1972)

Peoria

Cullom-Davis Library (1963)
Peoria Public Library (1883)

River Forest

Rosary College Rebecca Crown Library (1966)

Rockford

Rockford Public Library (1895)

Romeoville

Lewis University Library (1952)

South Holland

South Suburban College Learning Resources Center

Springfield

Illinois State Library (unknown) REGIONAL

Streamwood

Poplar Creek Public Library (1980)

University Park

Governors' State University Library (1974)

Urbana

University of Illinois Documents Library (1907)

Wheaton

Wheaton College Buswell Memorial Library (1964)

Woodstock

Woodstock Public Library (1963)

INDIANA

Anderson

Anderson College Charles E. Wilson Library (1959)
Anderson Public Library (1983)

Bloomington

Indiana University Library (1881)
Indiana University Law Library (1978)

Crawfordsville

Wabash College Lilly Library (1906)

Evansville

Evansville and Vanderburgh County Public Library (1928)
University of Southern Indiana Library Services (1969)

Fort Wayne

Allen County Public Library (1896)
Indiana University-Purdue University at Fort Wayne (1965)

Franklin

Franklin College Library (1976)

Gary

Gary Public Library (1943)
Indiana University Northwest Library (1966)

Greencastle

De Pauw University Roy O. West Library (1879)

Hammond

Hammond Public Library (1964)

Hanover

Hanover College Duggan Library (1892)

Huntington

Huntington College Richlyn Library (1964)

Indianapolis

Butler University Irwin Library (1965)
Indianapolis-Marion County Public Library (1906)
Indiana State Library (unknown) REGIONAL
Indiana Supreme Court Law Library (1975)
Indiana University School of Law Library (1967)
Indiana University-Purdue University Library (1979)

Kokomo

Indiana University at Kokomo Learning Resource Center (1969)

Muncie

Ball State University Alexander M. Bracken Library (1959)
Muncie Public Library (1906)

New Albany

Indiana University Southeast Library (1965)

Notre Dame

Notre Dame Law School Kresge Law Library (1985)
University of Notre Dame Hesburgh Library (1883)

Rensselaer

Saint Joseph's College Library (1964)

Richmond

Earlham College Lilly Library (1964)
Morrison-Reeves Library (1906)

South Bend

Indiana University at South Bend Franklin D. Schurz Library (1965)

Terre Haute

Indiana State University Cunningham Memorial Library (1906)

Valparaiso

Valparaiso University Moelling Memorial Library (1930)
Valparaiso University Law Library (1978)

West Lafayette

Purdue University Libraries (1907)

IOWA

Ames

Iowa State University Parks Library (1907)

Cedar Falls

University of Northern Iowa Donald O. Rod Library (1946)

Cedar Rapids

Cedar Rapids Public Library (1986)

Council Bluffs

Free Public Library (1885)
Iowa Western Community College Herbert Hoover Library (1972)

Davenport

Davenport Public Library (1973)

Des Moines

Drake University Cowles Library (1966)
Drake University Law Library (1972)
Public Library of Des Moines (1888)
State Library of Iowa (unknown)

Dubuque

Carnegie-Stout Public Library (unknown)
Loras College Wahlert Memorial Library (1967)

Fayette

Upper Iowa University Henderson-Wilder Library (1974)

Grinnell

Grinnell College Burling Library (1874)

Iowa City

University of Iowa College of Law Library (1968)
University of Iowa Libraries (1884) REGIONAL

Lamoni

Graceland College Frederick Madison Smith Library (1927)

Mason City

North Iowa Area Community College Library (1976)

Mount Vernon

Cornell College Russell D. Cole Library (1896)

Orange City

Northwestern College Ramaker Library (1970)

Sloux City

Sioux City Public Library (1894)

KANSAS

Atchison

Benedictine College Library (1965)

Baldwin City

Baker University Collins Library (1908)

Colby

Colby Community College H. F. Davis Memorial Library (1968)

Emporia

Emporia State University William Allen White Library (1909)

Hays

Fort Hays State University Forsyth Library (1926)

Hutchinson

Hutchinson Public Library (1963)

Lawrence

University of Kansas Law Library (1971)
University of Kansas Map Library (1869) REGIONAL

Manhattan

Kansas State University Farrell Library (1907)

Pittsburg

Pittsburg State University Leonard H. Axe Library (1952)

Salina

Kansas Wesleyan University Memorial Library (1930)

Shawnee Mission

Johnson County Library (1979)

Topeka

Kansas State Historical Society Library (1877)
Kansas State Library (unknown)
Kansas Supreme Court Law Library (1975)
Washburn University of Topeka Law Library (1971)

Wichita

Wichita State University Ablah Library (1901)

KENTUCKY

Ashland

Ashland Community College Library (1946)

Barbourville

Union College Abigail E. Weeks Memorial Library (1958)

Bowling Green

Western Kentucky University Helm-Cravens Library (1934)

Columbia

Lindsey Wilson College Katie Murrell Library (1987)

Crestview Hills

Thomas More College Library (1970)

Danville

Centre College Grace Doherty Library (1884)

Frankfort

Kentucky Department of Libraries and Archives (1967)
Kentucky State Law Library (unknown)
Kentucky State University Blazer Library (1972)

Hazard

Hazard Community College Library (1988)

Highland Heights

Northern Kentucky University W. Frank Steely Library (1973)

Lexington

University of Kentucky Law Library (1968)
University of Kentucky Libraries (1907) REGIONAL

Louisville

Louisville Free Public Library (1904)
University of Louisville Ekstrom Library (1925)
University of Louisville Law Library (1975)

Morehead

Morehead State University Camden-Carroll Library (1955)

Murray

Murray State University Waterfield Library (1924)

Owensboro

Kentucky-Wesleyan College Library Learning Center (1966)

Richmond

Eastern Kentucky University John Grant Crabbe Library (1966)

Williamsburg

Cumberland College Norma Perkins Hagan (1988)

LOUISIANA

Baton Rouge

Louisiana State Library (1976)
Louisiana State University Middleton Library (1907) REGIONAL
Louisiana State University Paul M. Hebert Law Center Library (1929)
Southern University John B. Cade Library (1952)
Southern University Law School Library (1979)

Eunice

Louisiana State University at Eunice LeDoux Library (1969)

Hammond

Southeastern Louisiana University Sims Memorial Library (1966)

Lafayette

University of Southwestern Louisiana Dupre Library (1938)

Lake Charles

McNeese State University Lether E. Frazar Memorial Library (1941)

Monroe

Northeast Louisiana University Sandel Library (1963)

Natchitoches

Northwestern State University Watson Memorial Library (1887)

New Orleans

Law Library of Louisiana (unknown)
Loyola University Government Documents Library (1942)
Loyola University Law Library (1978)
New Orleans Public Library (1883)
Our Lady of Holy Cross College Library (1968)
Southern University in New Orleans Leonard S. Washington Memorial Library (1962)
Tulane University Law Library (1976)
Tulane University Howard-Tilton Memorial Library (1942)
U.S. Court of Appeals 5th Circuit Library (1973)
University of New Orleans Earl K. Long Library (1963)

Pineville

Louisiana College Richard W. Norton Memorial Library (1969)

Ruston

Louisiana Technical University Prescott Memorial Library (1896)
REGIONAL

Shreveport

Louisiana State University at Shreveport Library (1967)
Shreve Memorial Library (1923)

Thibodaux

Nicholls State University Ellender Memorial Library (1962)

MAINE

Augusta

Maine Law and Legislative Reference Library (1973)
Maine State Library (unknown)

Bangor

Bangor Public Library (1884)

Brunswick

Bowdoin College Library (1884)

Castine

Maine Maritime Academy Nutting Memorial Library (1969)

Lewiston

Bates College George and Helen Ladd Library (1883)

Orono

University of Maine Raymond H. Fogler Library (1907) REGIONAL

Portland

Portland Public Library (1884)
University of Maine School of Law Garbrecht Law Library (1964)

Presque Isle

University of Maine at Presque Isle Library/Learning Resources Center (1979)

Sanford

Louis B. Goodall Memorial Library (1984)

Waterville

Colby College Miller Library (1884)

MARYLAND

Annapolls

Maryland State Law Library (unknown)
U.S. Naval Academy Nimitz Library (1895)

Baltimore

Enoch Pratt Free Library (1887)
Johns Hopkins University Milton S. Eisenhower Library (1882)
Morgan State University Soper Library (1940)
University of Baltimore Langsdale Library (1973)
University of Baltimore Law Library (1980)
University of Maryland School of Law Marshall Law Library (1969)
U.S. Court of Appeals 4th Circuit Library (1982)

Bel Air

Harford Community College Library (1967)

Beltsville

Department of Agriculture National Agricultural Library (1895)

Bethesda

Department of Health and Human Services National Library of Medicine (1978)
Uniformed Services University of Health Sciences Learning Resource Center (1983)

Catonsville

University of Maryland, Baltimore County Albin O. Kuhn Library & Gallery (1971)

Chestertown

Washington College Clifton M. Miller Library (1891)

College Park

University of Maryland Hornbake Library (1925) REGIONAL

Cumberland

Allegheny Community College Library (1974)

Frostburg

Frostburg State University Library (1967)

Patuxent River

Patuxent River Central Library (1968)

Rockville

Montgomery County Department of Public Libraries (1951)

Salisbury

Salisbury State College Blackwell Library (1965)

Towson

Goucher College Julia Rogers Library (1966)
Towson State University Cook Library (1979)

Westminster

Western Maryland College Hoover Library (1886)

MASSACHUSETTS

Amherst

Amherst College Library (1884)
University of Massachusetts University Library (1907)

Boston

Boston Athenaeum Library (unknown)
Boston Public Library (1859) REGIONAL
Boston University School of Law (1979)
Northeastern University Snell Library (1962)
State Library of Massachusetts (unknown)
Suffolk University Law Library (1979)
Supreme Judicial Court Social Law Library (1979)
U.S. Court of Appeals First Circuit Library (1978)

Brookline

Public Library of Brookline (1925)

Cambridge

Harvard College Library (1860)
Harvard Law School Library (1981)
Massachusetts Institute of Technology Library (1946)

Chestnut Hill

Boston College Thomas P. O'Neill Jr., Library (1963)

Chicopee

College of Our Lady of the Elms Alumnae Library (1969)

Lowell

University of Lowell O'Leary Library (1952)

Medford

Tufts University Wessel Library (1899)

Milton

Curry College Levin Library (1972)

New Bedford

New Bedford Free Public Library (1858)

Newton Centre

Boston College Law School Library (1979)

North Dartmouth

Southeastern Massachusetts University Library (1965)

North Easton

Stonehill College Cushing-Martin Library (1962)

Springfield

Springfield City Library (1966)
Western New England College School of Law Library (1978)

Waltham

Brandeis University Library (1965)
Waltham Public Library (1982)

Wellesley

Wellesley College Margaret Clapp Library (1943)

Wenham

Gordon College Jenks Learning Resource Center (1963)

Williamstown

Williams College Sawyer Library (unknown)

Worcester

American Antiquarian Society Library (1814)
University of Massachusetts Medical Center Library (1972)
Worcester Public Library (1859)

MICHIGAN

Albion

Albion College Stockwell-Mudd Library (1966)

Allendale

Grand Valley State College Zumberge Library (1963)

Alma

Alma College Library (1963)

Ann Arbor

University of Michigan Harlan Hatcher Graduate Library (1884)
University of Michigan Law Library (1978)

Benton Harbor

Benton Harbor Public Library (1907)

Bloomfield Hills

Cranbrook Institute of Science Library (1940)

Dearborn

Henry Ford Centennial Library (1969)
Henry Ford Community College Library (1957)

Detroit

Detroit College of Law Library (1979)
Detroit Public Library (1868) REGIONAL
Marygrove College Library (1965)
Mercy College of Detroit Library (1965)
University of Detroit Library (1884)
University of Detroit School of Law Library (1978)
Wayne State University Purdy/Kresge Library (1937)
Wayne State University Arthur Neef Law Library (1971)

Dowagiac

Southwestern Michigan College Matthews Library (1971)

East Lansing

Michigan State University Government Documents Library (1907)

Farmington Hills

Oakland Community College Martin L. King Learning Resources Center (1968)

Flint

Flint Public Library (1967)
University of Michigan-Flint Library (1977)

Grand Rapids

Calvin College & Seminary Library (1967)
Grand Rapids Public Library (1876)

Houghton

Michigan Technological University J. Robert Van Pelt Library (1876)

Jackson

Jackson District Library (1965)

Kalamazoo

Kalamazoo Public Library (1907)
Western Michigan University Dwight B. Waldo Library (1963)

Lansing

Library of Michigan (unknown) REGIONAL
Thomas M. Cooley Law School Library (1978)

Livonia

Livonia Public Library (1987)
Schoolcraft College Library (1962)

Madison Heights

Madison Heights Public Library (1982)

Marquette

Northern Michigan University Lydia M. Olson Library (1963)

Monroe

Monroe County Library System (1974)

Mount Clemens

Macomb County Library (1968)

Mount Pleasant

Central Michigan University Charles V. Park Library (1958)

Muskegon

Hackley Public Library (1894)

Petoskey

North Central Michigan College Library (1962)

Port Huron

Saint Clair County Library (1876)

Rochester

Oakland University Kresge Library (1964)

Royal Oak

Royal Oak Public Library (1984)

Saginaw

Hoyt Public Library (1890)

Sault Ste. Marie

Lake Superior State University Kenneth Shouldice Library (1982)

Traverse City

Northwestern Michigan College Mark and Helen Osterlin Library (1964)

University Center

Delta College Library (1963)

Warren

Warren Public Library Arthur J. Miller Branch (1973)

Ypsilanti

Eastern Michigan University Library (1965)

MICRONESIA

East Caroline Islands

Community College of Micronesia Library (1982)

MINNESOTA

Bemidji

Bemidji State University A.C. Clark Library (1963)

Blaine

Anoka County Library (1971)

Collegeville

Saint John's University Alcuin Library (1954)

Cottage Grove

Washington County Library-Park Grove Branch (1983)

Duluth

Duluth Public Library (1909)
University of Minnesota Duluth Library (1984)

Eagan

Dakota County Library—Westcott Branch (1983)

Edina

Southdale-Hennepin Area Library (1971)

Mankato

Mankato State University Memorial Library (1962)

Marshall

Southwest State University Library (1986)

Minneapolis

Minneapolis Public Library (1893)
University of Minnesota Law School Library (1978)
University of Minnesota Wilson Library (1907) REGIONAL

Moorhead

Moorhead State University Livingston Lord Library (1956)

Morris

University of Minnesota, Morris, Rodney A. Briggs Library (1963)

Northfield

Carleton College Library (1930)
Saint Olaf College Rolvaag Memorial Library (1930)

Saint Cloud

Saint Cloud State University, Learning Resources Center (1962)

Saint Paul

Hamline University School of Law Library (1978)
Minnesota Historical Society Library (1867)
Minnesota State Law Library (unknown)
Saint Paul Public Library (1914)
University of Minnesota Saint Paul Campus Library (1974)
William Mitchell College of Law Library (1979)

Saint Peter

Gustavus Adolphus College Fake Bernadette Memorial Library (1941)

Winona

Winona State University Maxwell Library (1969)

MISSISSIPPI

Cleveland

Delta State University W. B. Roberts Library (1975)

Columbus

Mississippi University for Women John Clayton Fant Memorial Library (1929)

Hattiesburg

University of Southern Mississippi Joseph A. Cook Memorial Library (1935)

Jackson

Jackson State University Henry Thomas Sampson Library (1968)
Millsaps College Millsaps-Wilson Library (1963)
Mississippi College School of Law Library (1977)
Mississippi Library Commission (1947)
Mississippi State Law Library (unknown)

Lorman

Alcorn State University J. D. Boyd Library (1970)

Mississippi State

Mississippi State University Mitchell Memorial Library (1907)

University

University of Mississippi J. D. Williams Library (1883) REGIONAL
University of Mississippi James O. Eastland Law Library (1967)

MISSOURI

Cape Girardeau

Southeast Missouri State University Kent Library (1916)

Columbia

University of Missouri at Columbia Ellis Library (1862) REGIONAL
University of Missouri-Columbia Law Library (1978)

Fulton

Westminster College Reeves Library (1875)

Hillsboro

Jefferson College Library (1984)

Jefferson City

Lincoln University Inman E. Page Library (1944)
Missouri State Library (1963)
Missouri Supreme Court Library (unknown)

Joplin

Missouri Southern State College George A. Spiva Library (1966)

Kansas City

Kansas City Missouri Public Library (1881)
Rockhurst College Greenlease Library (1917)
University of Missouri at Kansas City General Library (1938)
University of Missouri Kansas City Leon E. Bloch Law Library (1978)

Kirksville

Northeast Missouri State University Pickler Memorial Library (1966)

Liberty

William Jewell College Charles F. Curry Library (1900)

Maryville

Northwest Missouri State University B. D. Owens Library (1982)

Rolla

University of Missouri-Rolla Curtis Laws Wilson Library (1907)

Saint Charles

Kisker Road Branch Library
Lindenwood College Margaret Leggat Butler Library (1973)

Saint Joseph

River Bluffs Regional Public Library (1891)

Saint Louis

Maryville College Library (1976)
Saint Louis County Library (1970)
Saint Louis Public Library (1866)
Saint Louis University Law Library (1967)
Saint Louis University Pius XII Memorial Library (1866)
U.S. Court of Appeals Eighth Circuit Library (1972)
University of Missouri at Saint Louis Thomas Jefferson Library (1966)
Washington University John M. Olin Library (1906)
Washington University Law Library (1978)

Springfield

Drury College, Walker Library (1874)
Southwest Missouri State University Duane G. Meyer Library (1963)

Warrensburg

Central Missouri State University Ward Edwards Library (1914)

MONTANA

Billings

Eastern Montana College Library (1958)

Bozeman

Montana State University Libraries (1907)

Butte

Montana College of Mineral Science and Technology Library (1901)

Havre

Northern Montana College Vande Bogart Library (1980)

Helena

Carroll College Corrette Library (1974)
Montana State Library (1966)
State Law Library of Montana (1977)

Missoula

University of Montana Maurene & Mike Mansfield Library (1909)
REGIONAL

NEBRASKA

Blair

C. A. Dana College Dana-LIFE Library (1924)

Crete

Doane College Perkins Library (1944)

Fremont

Midland Lutheran College Luther Library (1924)

Kearney

Keamey State College Calvin T. Ryan Library (1962)

Lincoln

Nebraska Library Commission (1972)
Nebraska State Library (unknown)
University of Nebraska-Lincoln College of Law Library (1981)
University of Nebraska-Lincoln D. L. Love Memorial Library (1907)
REGIONAL

Omaha

Creighton University Reinert/Alumni Library (1964)
Creighton University School of Law Library (1979)
Omaha Public Library W. Dale Clark Library (1880)
University of Nebraska at Omaha University Library (1939)

Scottsbluff

Scottsbluff Public Library (1925)

Wayne

Wayne State College U.S. Conn Library (1970)

NEVADA

Carson City

Nevada State Library and Archives (unknown)
Nevada Supreme Court Library (1973)

Las Vegas

Clark County Law Library (1988)
Las Vegas-Clark County Library (1974)
University of Nevada at Las Vegas James Dickinson Library (1959)

Reno

National Judicial College Law Library (1979)
Nevada Historical Society Library (1974)
University of Nevada-Reno Library (1907) REGIONAL
Washoe County Library (1980)

NEW HAMPSHIRE

Concord

Franklin Pierce Law Center Library (1973)
New Hampshire State Library (unknown)

Durham

University of New Hampshire Library (1907)

Hanover

Dartmouth College Library (1884)

Henniker

New England College Danforth Library (1966)

Manchester

Manchester City Library (1884)
New Hampshire College H. A. B. Shapiro Memorial Library (1976)
Saint Anselm College Geisel Library (1963)

Nashua

Nashua Public Library (1971)

NEW JERSEY

Bayonne

Bayonne Free Public Library (1909)

Bloomfield

Bloomfield Public Library (1965)

Bridgeton

Cumberland County Library (1966)

Camden

Rutgers University Camden Library (1966)
Rutgers University School of Law Library (1979)

Convent Station

College of Saint Elizabeth Mahoney Library (1938)

East Brunswick

East Brunswick Public Library (1977)

East Orange

East Orange Public Library (1966)

Elizabeth

Free Public Library of Elizabeth (1895)

Glassboro

Glassboro State College Savitz Library (1963)

Hackensack

Johnson Free Public Library (1966)

Irvington

Irvington Public Library (1966)

Jersey City

Jersey City Public Library (1879)
Jersey City State College Forrest A. Irwin Library (1963)

Lawrenceville

Rider College Franklin F. Moore Library (1975)

Madison

Drew University Library (1939)

Mahwah

Ramapo College Library (1971)

Mount Holly

Burlington County Library (1966)

New Brunswick

Rutgers University Alexander Library (1907)

Newark

Newark Public Library (1906) REGIONAL
Rutgers University John Cotton Dana Library (1966)
Rutgers University Law Library (1979)
Seton Hall University Law Library (1979)

Newton

Sussex County Library (1986)

Passaic

Passaic Public Library (1964)

Phillipsburg

Phillipsburg Free Public Library (1976)

Plainfield

Plainfield Public Library (1971)

Pomona

Stockton State College Library (1972)

Princeton

Princeton University Firestone Library (1884)

Randolph

County College of Morris Sherman H. Masten Learning Resource Center (1975)

Rutherford

Fairleigh Dickinson University Messler Library (1953)

Shrewsbury

Monmouth County Library (1968)

South Orange

Seton Hall University Library (1947)

Teaneck

Fairleigh Dickinson University Weiner Library (1963)

Toms River

Ocean County College Learning Resources Center (1966)

Trenton

New Jersey State Library (unknown)
Trenton Free Public Library (1902)

Union

Kean College of New Jersey Nancy Thompson Library (1971)

Upper Montclair

Montclair State College Harry A. Sprague Library (1967)

Wayne

Wayne Public Library (1972)

West Long Branch

Monmouth College Guggenheim Memorial Library (1963)

Woodbridge

Woodbridge Public Library (1965)

NEW MEXICO

Albuquerque

University of New Mexico Medical Center Library (1973)
University of New Mexico School of Law Library (1973)
University of New Mexico General Library (1896) REGIONAL

Hobbs

New Mexico Junior College Pannell Library (1969)

Las Cruces

New Mexico State University Library (1907)

Las Vegas

New Mexico Highlands University Donnelly Library (1913)

Portales

Eastern New Mexico University Golden Library (1962)

Santa Fe

New Mexico State Library (1960) REGIONAL
New Mexico Supreme Court Law Library (unknown)

Silver City

Western New Mexico University Miller Library (1972)

Socorro

New Mexico Institute of Mining & Technology Martin Speare Memorial Library (1984)

NEW YORK

Albany

Albany Law School Schaffer Law Library (1979)
New York State Library (unknown) REGIONAL
State University of New York at Albany University Library (1964)

Auburn

Seymour Library (1972)

Bellport

East Islip Public Library (1973)

Binghamton

State University of New York at Binghamton Glenn G. Bartle Library (1962)

Brockport

State University of New York at Brockport Drake Memorial Library (1967)

Bronx

Fordham University Library (1937)
Lehman College Library (1967)
New York Public Library (1973)
State University of New York Maritime College Stephen B. Luce Library (1947)

Bronxville

Sarah Lawrence College Esther Raushenbush Library (1969)

Brooklyn

Brooklyn College Library (1936)
Brooklyn Law School Library (1974)
Brooklyn Public Library Business Library (1984)
Brooklyn Public Library (1908)
Pratt Institute Library (1891)
State University of New York Health Center at Brooklyn Library (1958)

Buffalo

Buffalo and Erie County Public Library (1895)
State University of New York at Buffalo Charles B. Sears Law Library (1978)
State University of New York at Buffalo Lockwood Memorial Library (1963)

Canton

Saint Lawrence University Owen D. Young Library (1920)

Corning

Corning Community College Arthur A. Houghton Jr. Library (1963)

Cortland

State University of New York at Cortland Memorial Library (1964)

Delhi

State University College of Technology Resnick Library (1970)

Elmira

Elmira College Gannett Tripp Learning Center (1956)

Farmingdale

State University of New York at Farmingdale Greenley Library (1917)

Flushing

CUNY Law School at Queens College CUNY Law Library (1983)
Queens College Benjamin S. Rosenthal Library (1939)

Garden City

Adelphi University Swirbul Library (1966)

Geneseo

State University of New York at Geneseo Milne Library (1967)

Greenvale

Long Island University B. Davis Schwartz Memorial Library (1964)

Hamilton

Colgate University, Everett Needham Case Library (1902)

Hempstead

Hofstra University Library (1964)
Hofstra University School of Law Library (1979)

Huntington

Touro College Jacob D. Fuchsberg Law Center Library (1985)

Ithaca

Cornell University Library (1907)
Cornell Law Library (1978)
Cornell University Albert R. Mann Library (1943)

Jamalca

Queens Borough Public Library (1926)
Saint John's University Library (1956)
Saint John's University School of Law Library (1978)

Kings Point

U.S. Merchant Marine Academy Schuyler Otis Bland Library (1962)

Long Island City

Fiorello H. LaGuardia Community College Library (1981)

Middletown

Thrall Library (1986)

Mount Vernon

Mount Vernon Public Library (1962)

New Paltz

State University College at New Paltz Sojourner Truth Library (1965)

New York City

City College of City University of New York Cohen Library (1884)
College of Insurance Library (1965)
Columbia University Libraries (1882)
Columbia University School of Law Library (1981)
Cooper Union for the Advancement of Science and Arts Library (1930)
Fordham Law School Library (1987)
Medical Library Center of New York (1976)
New York Law Institute Library (1909)
New York Law School Library (1979)
New York Public Library Astor Branch (1907)
New York Public Library Lenox Branch (1884)
New York University Law Library (1974)
New York University Elmer Holmes Bobst Library (1967)
U.S. Court of Appeals Second Circuit Library (1976)
Yeshiva University Chutick Law Library Cardozo School of Law (1979)
Yeshiva University Pollack Library (1979)

Newburgh

Newburgh Free Library (1909)

Niagara Falls

Niagara Falls Public Library (1976)

Oakdale

Dowling College Library (1965)

Oneonta

State University College at Oneonta James M. Milne Library (1966)

Oswego

State University of New York at Oswego Penfield Library (1966)

Plattsburgh

State University College at Plattsburgh Benjamin F. Feinberg Library (1967)

Potsdam

Clarkson University Harriet Call Burnap Memorial Library (1938)
State University College of New York at Potsdam Frederick W. Crumb
Memorial Library (1964)

Poughkeepsie

Vassar College Library (1943)

Purchase

State University of New York at Purchase Library (1969)

Rochester

Rochester Public Library (1963)
University of Rochester Rush Rhees Library (1880)

Saint Bonaventure

Saint Bonaventure University Friedsam Memorial Library (1938)

Saratoga Springs

Skidmore College Library (1964)

Schenectady

Union College Schaffer Library (1901)

Southampton

Long Island University Southampton Campus Library (1973)

Sparkill

St. Thomas Aquinas College Loughheed Library (1984)

Staten Island

Wagner College Hormann Library (1953)

Stony Brook

State University of New York at Stony Brook Main Library (1963)

Syracuse

Onondaga County Public Library (1978)
Syracuse University Library (1878)
Syracuse University College of Law H. Douglas Barclay Law Library
(1978)

Troy

Troy Public Library (1869)

Unlondale

Nassau Library System (1965)

Utica

Utica Public Library (1885)
SUNY Institute of Technology Library (1977)

West Point

U.S. Military Academy Library (unknown)

White Plains

Pace University Law Library (1978)

Yonkers

Yonkers Public Library Getty Square Branch (1910)

Yorktown Heights

Mercy College Library (1976)

NORTH CAROLINA

Asheville

University of North Carolina at Asheville D. Hiden Ramsey Library
(1965)

Bolling Springs

Gardner-Webb College Dover Memorial Library (1974)

Boone

Appalachian State University Carol Grotnes Belk Library (1963)

Bules Creek

Campbell University Carrie Rich Memorial Library (1965)

Chapel Hill

University of North Carolina at Chapel Hill Davis Library (1884)
REGIONAL
University of North Carolina at Chapel Hill Law Library (1978)

Charlotte

Public Library of Charlotte and Mecklenburg County (1964)
Queens College Everett Library (1927)
University of North Carolina at Charlotte Atkins Library (1964)

Cullowhee

Western Carolina University Hunter Library (1953)

Davidson

Davidson College Library (1893)

Durham

Duke University School of Law Library (1978)
Duke University William R. Perkins Library (1890)
North Carolina Central University Law School Library (1979)
North Carolina Central University James E. Shepard Memorial Library (1973)

Elon College

Elon College Iris Holt McEwen Library (1971)

Fayetteville

Fayetteville State University Charles W. Chesnut Library (1971)

Greensboro

North Carolina Agricultural and Technical State University F. D. Bluford Library (1937)
University of North Carolina at Greensboro Walter Clinton Jackson Library (1963)

Greenville

East Carolina University J. Y. Joyner Library (1951)

Laurinburg

Saint Andrews Presbyterian College DeTamble Library (1969)

Lexington

Davidson County Public Library (1971)

Mount Olive

Mount Olive College Moye Library (1971)

Pembroke

Pembroke State University Mary H. Livermore Library (1956)

Raleigh

Department of Cultural Resources Division of State Library (unknown)
North Carolina State University D. H. Hill Library (1923)
North Carolina Supreme Court Library (1972)

Rocky Mount

North Carolina Wesleyan College Library (1969)

Salisbury

Catawba College Library (1925)

Wilmington

University of North Carolina at Wilmington William M. Randall Library (1965)

Wilson

Barton College Hackney Library (1930)

Winston-Salem

Forsyth County Public Library (1954)
Wake Forest University School of Law Library (1902)

NORTH DAKOTA

Bismarck

North Dakota State Library (1971)
North Dakota Supreme Court Law Library (unknown)
State Historical Society of North Dakota State Archives & Historical Research Library (1907)
Veterans' Memorial Public Library (1967)

Dickinson

Dickinson State University Stoxen Library (1968)

Fargo

Fargo Public Library (1964)
North Dakota State University Library (1907) REGIONAL

Grand Forks

University of North Dakota Chester Fritz Library (1890)

Minot

Minot State University Memorial Library (1925)

Valley City

Valley City State University Allen Memorial Library (1913)

NORTHERN MARIANA ISLANDS

Salpan

Northern Marianas College Olympio T. Borja Memorial Library (1988)

OHIO

Ada

Ohio Northern University J. P. Taggart Law Library (1965)

Akron

Akron-Summit County Public Library (1952)
University of Akron Bierce Library (1963)
University of Akron School of Law Library (1978)

Alliance

Mount Union College Library (1888)

Ashland

Ashland University Library (1938)

Athens

Ohio University Alden Library (1886)

Batavia

University of Cincinnati Clermont College Library (1973)

Bluffton

Bluffton College Musselman Library (1951)

Bowling Green

Bowling Green State University Jerome Library (1933)

Canton

Malone College Everett L. Cattel Library (1970)

Chardon

Chardon Public Library (1971)

Cincinnati

Public Library of Cincinnati and Hamilton County (1884)
University of Cincinnati Langsam Library (1929)
University of Cincinnati College of Law Marx Law Library (1978)
U.S. Court of Appeals 6th Circuit Library (1986)

Cleveland

Case Western Reserve University Freiburger Library (1913)
Case Western Reserve University School of Law Library (1979)
Cleveland Public Library (1886)
Cleveland State University Cleveland-Marshall College of Law,
Joseph W. Bartunek III Law Library (1978)
Cleveland State University Library (1966)
Municipal Reference Library (1970)

Cleveland Heights

Cleveland Heights-University Heights Public Library (1970)

Columbus

Capital University Law School Library (1980)
Capital University Library (1968)
Columbus Metropolitan Library (1885)
Ohio State University College of Law Library (1984)
Ohio State University Libraries (1907)
Ohio Supreme Court Law Library (1973)
State Library of Ohio (unknown) REGIONAL

Dayton

Dayton and Montgomery County Public Library (1909)
University of Dayton Roesch Library (1969)
Wright State University Library (1965)

Delaware

Ohio Wesleyan University L. A. Beeghly Library (1845)

Elyria

Elyria Public Library (1966)

Findlay

Findlay University of Shafer Library (1969)

Gambler

Kenyon College Library (1873)

Granville

Denison University Libraries William H. Doane Library (1884)

Hiram

Hiram College Teachout-Price Memorial Library (1874)

Kent

Kent State University Libraries (1962)

Marletta

Marletta College Dawes Memorial Library (1884)

Marion

Marion Public Library (1979)

Middletown

Miami University Middletown Gardner-Harvey Library (1970)

New Concord

Muskingum College Library (1966)

Oberlin

Oberlin College Library (1858)

Oxford

Miami University Libraries King Library (1909)

Portsmouth

Shawnee State University Library (1987)

Rio Grande

University of Rio Grande Jeanette Albiez Davis Library (1966)

Springfield

Clark County Public Library (1884)

Steubenville

Franciscan University of Steubenville John Paul II Library (1971)
Public Library of Steubenville and Jefferson County (1950)

Tiffin

Heidelberg College Beeghly Library (1964)

Toledo

Toledo-Lucas County Public Library (1884)
University of Toledo College of Law Library (1981)
University of Toledo Library (1963)

University Heights

John Carroll University Grasselli Library (1963)

Westerville

Otterbein College Courtright Memorial Library (1967)

Wilmington

Wilmington College S. Arthur Watson Library (1986)

Wooster

College of Wooster Andrews Library (1966)

Worthington

Worthington Public Library (1984)

Youngstown

Public Library of Youngstown and Mahoning County (1923)
Youngstown State University William F. Maag Library (1971)

OKLAHOMA

Ada

East Central Oklahoma State University Linscheid Library (1914)

Alva

Northwestern Oklahoma State University J. W. Martin Library (1907)

Bethany

Southern Nazarene University R. T. Williams Learning Resources Center (1971)

Durant

Southeastern Oklahoma State University Henry G. Bennett Memorial Library (1929)

Edmond

Central State University Library (1934)

Enid

Public Library of Enid and Garfield County (1908)

Langston

Langston University G. Lamar Harrison Library (1941)

Lawton

Lawton Public Library (1987)

Norman

University of Oklahoma Libraries Bizzell Memorial Library (1893)
University of Oklahoma Law Library (1978)

Oklahoma City

Metropolitan Library System Main Library (1974)
Oklahoma City University Dulaney Browne Library (1963)
Oklahoma Department of Libraries (1893) REGIONAL

Shawnee

Oklahoma Baptist University Library (1933)

Stillwater

Oklahoma State University Edmon Low Library (1907) REGIONAL

Tahlequah

Northeastern Oklahoma State University John Vaughan Library (1923)

Tulsa

Tulsa City-County Library System (1963)
University of Tulsa College of Law Library (1979)
University of Tulsa McFarlin Library (1929)

Weatherford

Southwestern Oklahoma State University Al Harris Library (1958)

OREGON

Ashland

Southern Oregon State College Library (1953)

Bend

Central Oregon Community College Library/Media Service (1985)

Corvallis

Oregon State University Library (1907)

Eugene

University of Oregon Law Library (1979)
University of Oregon Library (1883)

Forest Grove

Pacific University Harvey W. Scott Memorial Library (1897)

Klamath Falls

Oregon Institute of Technology Library (1982)

La Grande

Eastern Oregon State College Walter M. Pierce Library (1954)

McMinnville

Linfield College Northup Library (1965)

Monmouth

Western Oregon State College Library (1967)

Pendleton

Blue Mountain Community College Library (1983)

Portland

Lewis and Clark College Aubrey R. Watzek Library (1967)
Multnomah County Portland (1884)
Northwestern School of Law Lewis and Clark College Paul L. Boley
Law Library (1979)
Portland State University Millar Library (1963) REGIONAL
Reed College Library (1912)
U.S Department of Energy Bonneville Power Administration Library
(1962)

Salem

Oregon State Library (unknown)
Oregon Supreme Court Law Library (1974)
Willamette University College of Law Library (1979)
Willamette University Main Library (1969)

PANAMA

Balboa Heights

Panama Canal Commission Technical Resources Center

PENNSYLVANIA

Allentown

Muhlenberg College Trexler Library (1939)

Altoona

Altoona Area Public Library (1969)

Bethel Park

Bethel Park Public Library (1980)

Bethlehem

Lehigh University Libraries Linderman Library (1876)

Blue Bell

Montgomery County Community College Learning Resources Center
(1975)

Bradford

University of Pittsburgh at Bradford T. Edwards & Tullah Hanley Library
(1979)

Broomall

Marple Public Library (1988)

California

California University of Pennsylvania Louis L. Manderino Library (1986)

Carlisle

Dickinson College Boyd Lee Spahr Library (1947)
Dickinson School of Law Sheeley-Lee Law Library (1978)

Cheyney

Cheyney University Leslie Pinckney Hill Library (1967)

Collegeville

Ursinus College Myrin Library (1963)

Coraopolis

Robert Morris College Library (1978)

Doylestown

Bucks County Free Library (1970)

East Stroudsburg

East Stroudsburg University Kemp Library (1966)

Erie

Erie County Library System (1897)

Greenville

Thiel College Langenheim Memorial Library (1963)

Harrisburg

State Library of Pennsylvania (unknown) REGIONAL
Widener University Harrisburg Campus School of Law Library

Haverford

Haverford College Magill Library (1897)

Hazleton

Hazleton Area Public Library (1964)

Indiana

Indiana University of Pennsylvania Stapleton Library (1962)

Johnstown

Cambria County Library System Glosser Memorial Library Building
(1965)

Lancaster

Bucknell University Ellen Clarke Bertrand Library
Franklin and Marshall College Shadek-Fackenthal Library (1895)

Lewislburg

Bucknell University Ellen Clarke Bertrand Library (1963)

Mansfield

Mansfield University Library (1968)

Meadville

Allegheny College Lawrence Lee Pelletier Library (1907)

Millersville

Millersville University Helen A. Ganser Library (1966)

Monessen

Monessen Public Library (1969)

New Castle

New Castle Public Library (1963)

Newton

Bucks County Community College Library (1968)

Norristown

Montgomery County-Norristown Public Library (1969)

Philadelphia

Drexel University W. W. Hagerty Library (1963)
Free Library of Philadelphia (1897)

Saint Joseph's University Drexel Library (1974)
Temple University Paley Library (1947)
Temple University Law Library (1979)
U.S. Court of Appeals Third Circuit Library (1973)
University of Pennsylvania Biddle Law Library (1974)
University of Pennsylvania Library (1886)

Pittsburgh

Allegheny County Law Library (1977)
Carnegie Library of Pittsburgh Allegheny Regional Branch (1924)
Carnegie Library of Pittsburgh (1895)
Duquesne University Law Library (1978)
La Roche College John J. Wright Library (1974)
U.S. Bureau of Mines Library (1962)
University of Pittsburgh Hillman Library (1910)
University of Pittsburgh Barco Law Library (1979)

Pottsville

Pottsville Free Public Library (1967)

Reading

Reading Public Library (1901)

Scranton

Scranton Public Library (1895)

Shippensburg

Shippensburg University Ezra Lehman Memorial Library (1973)

Silperry Rock

Bailey Library (1965)

Swarthmore

Swarthmore College McCabe Library (1923)

University Park

Pennsylvania State University Libraries Pattee Library (1907)

Villanova

Villanova University Law School Pulling Law Library (1964)

Warren

Warren Library Association Warren Public Library (1885)

Waynesburg

Waynesburg College Library (1964)

West Chester

West Chester University Francis Harvey Green Library (1967)

Wilkes-Barre

King's College D. Leonard Corgan Library (1949)

Williamsport

Lycoming College Library (1970)

York

York College of Pennsylvania Schmidt Library (1963)

Youngwood

Westmoreland County Community College Learning Resources Center (1972)

PUERTO RICO

Mayaguez

University of Puerto Rico Mayaguez Campus Library (1928)

Ponce

Catholic University of Puerto Rico Encarnacion Valdes Library (1966)
Catholic University of Puerto Rico School of Law Library (1978)

Rio Piedras

University of Puerto Rico J. M. Lazaro Library (1928)

RHODE ISLAND

Barrington

Barrington Public Library (1986)

Kingston

University of Rhode Island Library (1907)

Newport

U.S. Naval War College Library (1963)

Providence

Brown University John D. Rockefeller Jr. Library (unknown)
Providence College Phillips Memorial Library (1969)
Providence Public Library (1884)
Rhode Island College James P. Adams Library (1965)
Rhode Island State Law Library (1979)
Rhode Island State Library (1895)

Warwick

Warwick Public Library (1966)

Westerly

Westerly Public Library (1909)

Woonsocket

Woonsocket Harris Public Library (1977)

SOUTH CAROLINA

Alken

University of South Carolina-Aiken Gregg-Graniteville Library (1989)

Charleston

Baptist College at Charleston L. Mendel Rivers Library (1967)
The Citadel Military College Daniel Library (1962)
College of Charleston Robert Scott Small Library (1869)

Clemson

Clemson University Cooper Library (1893)

Columbia

Benedict College Library Payton Learning Resources Center (1969)
South Carolina State Library (1895)
University of South Carolina Coleman Karesh Law Library (1983)
University of South Carolina Thomas Cooper Library (1884)

Conway

University of South Carolina Coastal Carolina College Kimbel Library (1974)

Due West

Erskine College McCain Library (1968)

Florence

Florence County Library (1967)
Francis Marion College James A. Rogers Library (1970)

Greenville

Furman University Library (1962)
Greenville County Library (1966)

Greenwood

Lander College Jackson Library (1967)

Lancaster

University of South Carolina-Lancaster Medford Library

Orangeburg

South Carolina State College Miller F. Whittaker Library (1953)

Rock Hill

Winthrop College Dacus Library (1896)

Spartanburg

Spartanburg County Public Library (1967)

SOUTH DAKOTA

Aberdeen

Northern State College Beulah Williams Library (1963)

Brookings

South Dakota State University H. M. Briggs Library (1889)

Pierre

South Dakota State Library (1973)
South Dakota Supreme Court Library (1978)

Rapid City

Rapid City Public Library (1963)
South Dakota School of Mines and Technology Devereaux Library (1963)

Sioux Falls

Augustana College Mikkelsen Library (1969)
Sioux Falls Public Library (1903)

Spearfish

Black Hills State University Library E. Y. Berry (1942)

Vermillion

University of South Dakota I. D. Weeks Library (1889)

TENNESSEE

Bristol

King College E. W. King Library (1970)

Chattanooga

Chattanooga-Hamilton County Bicentennial Library (1908)
U.S. Tennessee Valley Authority Technical Library (1976)

Clarksville

Austin Peay State University Felix G. Woodward Library (1945)

Cleveland

Cleveland State Community College Library (1973)

Columbia

Columbia State Community College John W. Finney Memorial Library (1973)

Cookeville

Tennessee Technological University Library (1969)

Jackson

Lambuth College Luther L. Gobbel Library (1967)

Jefferson City

Carson-Newman College Stephens-Burnett Library (1964)

Johnson City

East Tennessee State University Sherrod Library (1942)

Knoxville

Knoxville County Public Library System Lawson McGhee Library (1973)
University of Tennessee at Knoxville John C. Hodges Library (1907)
University of Tennessee Law Library (1971)

Martin

University of Tennessee at Martin Paul Meek Library (1957)

Memphis

Memphis-Shelby County Public Library and Information Center (1896)
Memphis State University Cecil C. Humphreys School of Law Library (1979)
Memphis State University Libraries (1966)

Murfreesboro

Middle Tennessee State University Todd Library (1912)

Nashville

Fisk University Library (1965)
Public Library of Nashville and Davidson County (1884)
Tennessee State Library and Archives (unknown)
Tennessee State University Brown-Daniel Library (1972)
Vanderbilt University Alynne Queener Massey Law Library (1976)
Vanderbilt University Library (1884)

Sewanee

University of the South Jessie Ball duPont Library (1873)

TEXAS

Ablene

Abilene Christian University Margaret and Herman Brown Library (1978)
Hardin-Simmons University Rupert and Pauline Richardson Library (1940)

Arlington

Arlington Public Library (1970)
University of Texas at Arlington Library (1963)

Austin

Texas State Law Library (1972)
Texas State Library (unknown) REGIONAL
University of Texas at Austin Perry-Castaneda Library (1884)
University of Texas at Austin Edie and Lew Wasserman Public Affairs
Library (1966)
University of Texas at Austin Tarlton Law Library (1965)

Baytown

Lee College Library (1970)

Beaumont

Lamar University Mary and John Gray Library (1957)

Brownwood

Howard Payne University Walker Memorial Library (1964)

Canyon

West Texas State University Comette Library (1928)

College Station

Texas Agricultural and Mechanical University Sterling G. Evans Library
(1907)

Commerce

East Texas State University James Gilliam Gee Library (1937)

Corpus Christi

Corpus Christi State University Library (1976)

Corsicana

Navarro College Learning Resource Center (1965)

Dallas

Dallas Baptist University Vance Memorial Library (1967)
Dallas Public Library (1900)
Southern Methodist University Fondren Library (1925)
University of Texas Southwestern Medical Center Library (1975)

Denton

North Texas State University Library (1948)

Edinburg

University of Texas-Pan American Library (1959)

El Paso

El Paso Public Library (1906)
University of Texas at El Paso Library (1966)

Fort Worth

Fort Worth Public Library (1905)
Texas Christian University Mary Coats Burnett Library (1916)

Galveston

Rosenberg Library (1909)

Garland

Nicholson Memorial Library System (1990)

Houston

Houston Public Library (1884)
North Harris County College (1974)
Rice University Fondren Library (1967)
South Texas College of Law Library (1981)
Texas Southern University Thurgood Marshall School of Law Library
(1982)
University of Houston-Clear Lake Alfred R. Neumann Library (1980)
University of Houston M. D. Anderson Library (1957)
University of Houston School of Law Library (1979)

Huntsville

Sam Houston State University Newton Gresham Library (1949)

Irving

Irving Public Library System (1974)

Kingsville

Texas Arts and Industries University Jemigan Library (1944)

Laredo

Laredo Junior College Harold R. Yeary Library (1970)

Longview

Longview Public Library (1961)

Lubbock

Texas Technical University Library (1935) REGIONAL
Texas Technical University School of Law Library (1978)

Nacogdoches

Stephen F. Austin State University Steen Library (1965)

Richardson

University of Texas at Dallas McDermott Library (1972)

San Angelo

Angelo State University Port Henderson Library (1964)

San Antonio

Palo Alto College Learning Resources Center
Saint Mary's University Academic Library (1964)
Saint Mary's University Santa Kenedy East Law Library (1982)
San Antonio College Library (1972)
San Antonio Public Library (1899)
Trinity University Elizabeth Coates Maddux Library (1964)
University of Texas at San Antonio Library (1973)

San Marcos

Southwest Texas State University Library (1955)

Seguin

Texas Lutheran College Blumberg Memorial Library (1970)

Sherman

Austin College Abell Library (1963)

Texarkana

Texarkana College Palmer Memorial Library (1963)

Victoria

Victoria College/University of Houston Victoria Library (1973)

Waco

Baylor University Caston Law Library (1982)
Baylor University Moody Memorial Library (1905)

Wichita Falls

Midwestern State University Moffett Library (1963)

UTAH

Cedar City

Southern Utah State College Library (1964)

Ephraim

Snow College Lucy A. Phillips Library (1963)

Logan

Utah State University Merrill Library and Learning Resources Center
(1907) REGIONAL

Ogden

Weber State College Stewart Library (1962)

Provo

Brigham Young University Harold B. Lee Library (1908)
Brigham Young University Law Library (1972)

Salt Lake City

University of Utah Eccles Health Sciences Library (1970)
University of Utah Law Library (1966)
University of Utah Marriott Library (1893)
Utah State Library (unknown)
Utah State Supreme Court Law Library (1975)

VERMONT

Burlington

University of Vermont Bailey/Howe Library (1907)

Castleton

Castleton State College Calvin Coolidge Library (1969)

Johnson

Johnson State College John Dewey Library (1955)

Lyndonville

Lyndon State College Samuel Reed Hall Library (1969)

Middlebury

Middlebury College Egbert Starr Library (1884)

Montpelier

Vermont Department of Libraries (1845)

Northfield

Norwich University Chaplin Library (1908)

South Royalton

Vermont Law School Library (1978)

VIRGIN ISLANDS

Saint Croix

Florence Williams Public Library (1968)

Saint Thomas

University of the Virgin Islands Ralph M. Paiwonsky Library (1973)

VIRGINIA

Alexandria

Dept. of the Navy Office of Judge Advocate General Law Library (1963)

Arlington

George Mason University School of Law Library (1981)
U.S. Patent & Trademark Office Scientific and Technical Information
Center (1986)

Blacksburg

Virginia Polytechnic Institute and State University Carol M. Newman Library (1907)

Bridgewater

Bridgewater College Alexander Mack Memorial Library (1902)

Charlottesville

University of Virginia Alderman Library (1910) REGIONAL
University of Virginia Arthur J. Morris Law Library (1964)

Chesapeake

Chesapeake Public Library (1970)

Danville

Danville Community College Learning Resources Center (1969)

Emory

Emory and Henry College Kelly Library (1884)

Fairfax

George Mason University Fenwick Library (1960)

Fredericksburg

Mary Washington College Library (1940)

Hampden-Sydney

Hampden-Sydney College Eggleston Library (1891)

Hampton

Hampton University Huntington Memorial Library (1977)

Harrisonburg

James Madison University Carrier Library (1973)

Lexington

Virginia Military Institute Preston Library (1874)
Washington and Lee University University Library (1910)
Washington and Lee University Wilbur C. Hall Law Library (1978)

Martinsville

Patrick Henry Community College Learning Resource Center (1971)

Norfolk

Norfolk Public Library (1895)
Old Dominion University Library (1963)
U.S. Armed Forces Staff College Library (1963)

Petersburg

Virginia State University Johnston Memorial Library (1907)

Quantico

Federal Bureau of Investigation Academy Library (1970)
Marine Corps Education Center MCCDC James Carson Breckinridge Library (1967)

Reston

Department of the Interior Geological Survey Library (1963)

Richmond

U.S. Court of Appeals Fourth Circuit Library (1973)
University of Richmond Boatwright Memorial Library (1900)
University of Richmond Law School Library (1982)
Virginia Commonwealth University Library Services (1971)
Virginia State Law Library (1973)
Virginia State Library & Archives (unknown)

Roanoke

Hollins College Fisburn Library (1967)

Salem

Roanoke College Library (1886)

Williamsburg

College of William and Mary Marshall-Wythe Law Library (1978)
College of William and Mary Swem Library (1936)

Wise

Clinch Valley College John Cook Wyllie Library (1971)

WASHINGTON

Bellevue

Bellevue Public Library (1990)

Bellingham

Western Washington University Mable Zoe Wilson Library (1963)

Cheney

Eastern Washington University JFK Library (1966)

Des Moines

Highline Community College Library (1983)

Ellensburg

Central Washington University Library (1962)

Everett

Everett Public Library (1914)

Olympia

Evergreen State College Daniel J. Evans Library (1972)
Washington State Law Library (1979)
Washington State Library (unknown) REGIONAL

Port Angeles

North Olympic Library System (1965)

Pullman

Washington State University Holland Library (unknown)

Seattle

Seattle Public Library (1908)
University of Washington Suzzallo Library (1890)
University of Washington Marian Gould Gallagher Law Library (1969)
U.S. Court of Appeals 9th Circuit Library (1981)

Spokane

Gonzaga University School of Law Library (1979)
Spokane Public Library (1910)

Tacoma

Tacoma Public Library (1894)
University of Puget Sound Collins Memorial Library (1938)
University of Puget Sound School of Law Library (1978)

Vancouver

Fort Vancouver Regional Library (1962)

Walla Walla

Whitman College Penrose Memorial Library (1890)

WEST VIRGINIA

Athens

Concord College J. Frank Marsh Library (1924)

Bluefield

Bluefield State College Hardway Library (1972)

Charleston

Kanawha County Public Library (1952)
West Virginia Library Commission (1975)
West Virginia Supreme Court Law Library (1977)

Elkins

Davis and Elkins College Library (1913)

Fairmont

Fairmont State College Library (1884)

Huntington

Marshall University James E. Morrow Library (1925)

Institute

West Virginia State College Drain-Jordon Library (1907)

Montgomery

West Virginia Institute of Technology Vining Library (1985)

Morgantown

West Virginia University Library (1907) REGIONAL

Salem

Salem-Tokyo University Benedum Library (1921)

Shepherdstown

Shepherd College Scarborough Library (1971)

Weirton

Mary H. Weir Public Library (1963)

WISCONSIN

Appleton

Lawrence University Seeley G. Mudd Library (1869)

Beloit

Beloit College Col. Robert H. Morse Library (1888)

Eau Claire

University of Wisconsin-Eau Claire William D. McIntyre Library (1951)

Fond du Lac

Fond du Lac Public Library (1966)

Green Bay

University of Wisconsin-Green Bay Library Learning Center (1968)

La Crosse

La Crosse Public Library (1883)
University of Wisconsin-La Crosse Murphy Library (1965)

Madison

Madison Public Library (1965)
State Historical Society of Wisconsin Library (1870) REGIONAL
University of Wisconsin-Madison Memorial Library (1939)
University of Wisconsin-Madison Law Library (1981)
Wisconsin State Law Library (unknown)

Milwaukee

Alverno College Library/Media Center (1971)
Marquette University Law Library (1987)
Medical College of Wisconsin, Inc. Todd Wehr Library (1980)
Milwaukee County Law and Reference Library (1934)
Milwaukee Public Library (1861) REGIONAL
Mount Mary College Haggerty Library (1964)
University of Wisconsin-Milwaukee Golda Meir Library (1960)

Oshkosh

University of Wisconsin-Oshkosh Forrest R. Polk Library (1956)

Platteville

University of Wisconsin-Platteville Karmann Library (1964)

Racine

Racine Public Library (1898)

Ripon

Ripon College Library (1982)

River Falls

University of Wisconsin-River Falls Chalmer Davee Library (1962)

Sheboygan

Mead Public Library (1983)

Stevens Point

University of Wisconsin-Stevens Point Library (1951)

Superior

Superior Public Library (1908)
University of Wisconsin-Superior Jim Dan Hill Library (1935)

Waukesha

Waukesha Public Library (1966)

Wausau

Marathon County Public Library (1971)

Whitewater

University of Wisconsin-Whitewater Library and Learning Resources
(1963)

WYOMING

Casper

Natrona County Public Library (1929)

Cheyenne

Wyoming State Law Library (1977)
Wyoming State Library (unknown) REGIONAL

Gillette

Campbell County Public Library (1980)

Laramie

University of Wyoming, Coe Library (1907)
University of Wyoming Law Library (1978)

Powell

Northwest Community College John Taggart Hinckley Library (1967)

Riverton

Central Wyoming College Learning Resources Center (1969)

Rock Springs

Western Wyoming Community College Library (1969)

Sheridan

Sheridan College Griffith Memorial Library (1963)

APPENDIX B

List of District Offices of the U.S. Department of Commerce

ALABAMA

Birmingham—2015 2nd Avenue North, 3rd Floor, Berry Building, 35203, Area Code 205 Tel 731-1331, FTS 8 229-1331

ALASKA

Anchorage—222 W. 7th Avenue, P.O. Box 32, 99513-7591, Area Code 907 Tel 271-5041, FTS 8 271-5041

ARIZONA

Phoenix—Federal Building & U.S. Courthouse, 230 N. 1st Avenue, Room 3412, 85025, Area Code 602 Tel 261-3285, FTS 8 261-3285

ARKANSAS

Little Rock—Suite 811, 320 W. Capitol Avenue, 72201, Area Code 501 Tel 378-5794, FTS 8 740-5794

CALIFORNIA

Los Angeles—Room 800, 11000 Wilshire Blvd., 90049, Area Code 213 Tel 209-7104, FTS 8 793-7104

•San Diego—6363 Greenwich Drive, Suite 145, 92122, Area Code 619 Tel 557-5395, FTS 8 895-5395

San Francisco—Federal Building, Box 6013, 450 Golden Gate Avenue, 94102, Area Code 415 Tel 556-5860, FTS 8 556-5868

Santa Ana—116 W. 4th Street, Suite #1, 92701, Area Code 714 Tel 836-2461, FTS 8 799-2461

COLORADO

Denver—Room 119, U.S. Customhouse, 721 19th Street, 80202, Area Code 303 Tel 844-3246, FTS 8 564-3246

CONNECTICUT

Hartford—Room 610-B, Federal Office Building, 450 Main Street, 06103, Area Code 203 Tel 240-3530, FTS 8 244-3530

DISTRICT OF COLUMBIA

Room 1066, HCHB, Department of Commerce, 14th Street & Constitution Avenue, N.W., 20230, Area Code 202 Tel 377-3181, FTS 8 377-3181

FLORIDA

•Clearwater—128 North Osceola Avenue, 34615, Area Code 813 Tel 461-0011, FTS 8 826-3738

Miami—Suite 224, Federal Building, 51 S.W. First Avenue, 33130, Area Code 305 Tel 536-5267, FTS 8 350-5267

•Orlando—Room 346, University of Central Florida, 32802, Area Code 407 Tel 648-1608, FTS 8 820-6235

•Tallahassee—Collins Building, Room 401, 107 W. Gaines Street, 32304, Area Code 904 Tel 488-6469, FTS 8 965-7194

GEORGIA

Atlanta—Suite 310, 4380 Chamblee-Dunwoody Road, 30341, Area Code 404 Tel 452-9102

Savannah—120 Barnard Street, A-107, 31401, Area Code 912 Tel 944-4204, FTS 8 248-4204

HAWAII

Honolulu—4106 Federal Building, P.O. Box 50026, 300 Ala Moana Blvd., 96850, Area Code 808 Tel 541-1782, FTS 8 551-1785

IDAHO

Boise (Denver, Colorado District)—700 W. State Street, 83720, Area Code 208 Tel 334-3867, FTS 8 554-9254

ILLINOIS

Chicago—1406 Mid Continental Plaza Building, 55 E. Monroe Street, 60603, Area Code 312 Tel 353-4450, FTS 8 353-4450

•Palatine—W. R. Harper College, Algonquin & Rodelle Road, 60067, Area Code 312 Tel 397-3000, x2532

•Rockford—515 N. Court Street, P.O. Box 1747, 61110-0247, Area Code 815 Tel 987-8123, FTS 8 363-4347

INDIANA

Indianapolis—One N. Capitol, Suite 520, 46204, Area Code 317 Tel 269-6214, FTS 8 331-6139

IOWA

Cedar Rapids—424 First Avenue, N.E., 52407, Area Code 319 Tel 398-4317

Des Moines—817 Federal Building, 210 Walnut Street, 50309, Area Code 515 Tel 284-4222, FTS 8 862-4222

KANSAS

•Wichita (Kansas City, Missouri District)—151 North Volusia, 67214-4695, Area Code 316 Tel 269-6160, FTS 8 752-6160

KENTUCKY

Louisville—Room 6368, 601 W. Broadway, 40202, Area Code 502 Tel 582-5066, FTS 8 352-5066

LOUISIANA

New Orleans—432 World Trade Center, No. 2 Canal Street, 70130, Area Code 504 Tel 589-6546, FTS 8 682-6546

•Denotes trade specialist at post or duty station

MAINE

•**Augusta (Boston, Massachusetts District)**—77 Sewell Street, 04330, Area Code 207 Tel 622-8249, FTS 8 833-6249

MARYLAND

Baltimore—415 U.S. Customhouse, 40 South Gay Streets, 21202, Area Code 301 Tel 962-3560, FTS 8 922-3560

MASSACHUSETTS

Boston—World Trade Center, Suite 307, Commonwealth Pier Area, 02210, Area Code 617 Tel 565-8563, FTS 8 835-8563

MICHIGAN

Detroit—1140 McNamara Building, 477 Michigan Avenue, 48226, Area Code 313 Tel 226-3650, FTS 8 226-3650

•**Grand Rapids**—300 Monroe N.W., Room 409, 49503, Area Code 616 Tel 456-2411, FTS 8 372-2411

MINNESOTA

Minneapolis—108 Federal Building, 110 S. 4th St., 55401, Area Code 612 Tel 349-1638, FTS 8 777-1638

MISSISSIPPI

Jackson—328 Jackson Mall Office Center, 300 Woodrow Wilson Blvd., 39213, Area Code 601 Tel 965-4388, FTS 8 490-4388

MISSOURI

Kansas City—Room 635, 601 E. 12th Street, 64106, Area Code 816 Tel 426-3141, FTS 8 867-3141

St. Louis—7911 Forsyth Blvd., Suite 610, 63105, Area Code 314 Tel 425-3302-4, FTS 8 279-3302

NEBRASKA

Omaha—1133 O Street, 68137, Area Code 402 Tel 221-3664, FTS 8 864-3664

NEVADA

Reno—1755 E. Plumb Lane, Room 152, 89502, Area Code 702 Tel 784-5203, FTS 8 470-5203

NEW JERSEY

Trenton—3131 Princeton Pike Building, Suite 100, 08648, Area Code 609 Tel 989-2100, FTS 8 423-2100

NEW MEXICO

Albuquerque—5000 Marble Avenue, N.E., Suite 320, 87110, Area Code 505 Tel 262-6024, FTS 8 474-2386

NEW YORK

Buffalo—1312 Federal Building, 111 W. Huron Street, 14202, Area Code 716 Tel 846-4191, FTS 8 437-4191

New York—Federal Office Building, 26 Federal Plaza, Foley Square, 10278, Area Code 212 Tel 264-0634, FTS 8 264-0634

•**Rochester**—111 E. Avenue, Suite 220, 14604, Area Code 716 Tel 263-6480, FTS 8 963-6480

NORTH CAROLINA

Greensboro—203 Federal Building, 324 W. Market Street, P.O. Box 1950, 27402, Area Code 919 Tel 333-5345, FTS 8 699-5345

OHIO

Cincinnati—9504 Federal Office Building, 550 Main Street, 45202, Area Code 513 Tel 684-2944, FTS 8 684-2944

Cleveland—Room 600, 668 Euclid Avenue, 44114, Area Code 216 Tel 522-4750, FTS 8 942-4750

OKLAHOMA

Oklahoma City—5 Broadway Executive Park, Suite 200, 6601 Broadway Extension, 73116, Area Code 405 Tel 231-5302, FTS 8 736-5302

•**Tulsa**—440 S. Houston Street, 74127, Area Code 918 Tel 581-7650, FTS 8 745-7650

OREGON

Portland—Room 618, 1220 S.W. 3rd Avenue, 97204, Area Code 503 Tel 221-3001, FTS 8 423-3001

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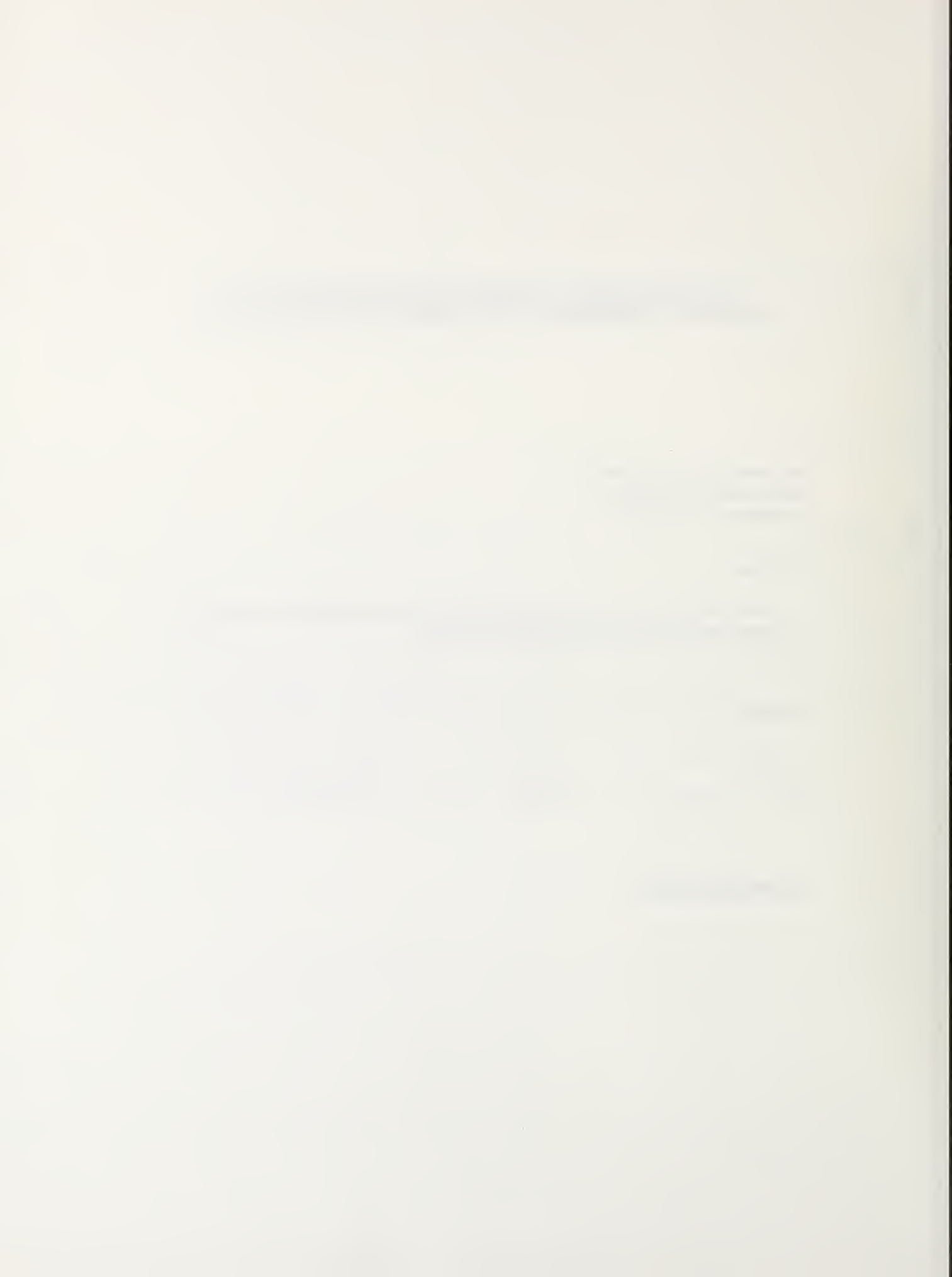
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