A UNITED STATES DEPARTMENT OF COMMERCE PUBLICATION

PUBLICATIONS

NBS SPECIAL PUBLICATION 260

1973 Catalog

U.S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards[1] was established by an act of Congress March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau consists of the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Center for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of a Center for Radiation Research, an Office of Measurement Services and the following divisions:

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THE INSTITUTE FOR MATERIALS RESEARCH conducts materials research leading to improved methods of measurement, standards, and data on the properties of well-characterized materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; and develops, produces, and distributes standard reference materials. The Institute consists of the Office of Standard Reference Materials and the following divisions:

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THE INSTITUTE FOR APPLIED TECHNOLOGY provides technical services to promote the use of available technology and to facilitate technological innovation in industry and Government; cooperates with public and private organizations leading to the development of technological standards (including mandatory safety standards), codes and methods of test; and provides technical advice and services to Government agencies upon request. The Institute also monitors NBS engineering standards activities and provides liaison between NBS and national and international engineering standards bodies. The Institute consists of a Center for Building Technology and the following divisions and offices:

Engineering and Product Standards—Weights and Measures—Invention and Innovation—Product Evaluation Technology—Electronic Technology—Technical Analysis—Measurement Engineering—Building Standards and Code Services[4]—Housing Technology[4]—Federal Building Technology[4]—Structures, Materials and Life Safety[4]—Building Environment[4]—Technical Evaluation and Application[4]—Fire Technology.

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Information Processing Standards—Computer Information—Computer Services —Systems Development—Information Processing Technology.

THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal Government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System; provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world, and directs the public information activities of the Bureau. The Office consists of the following organizational units:

Office of Standard Reference Data—Office of Technical Information and Publications—Library—Office of International Relations.

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[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Part of the Center for Radiation Research.
[3] Located at Boulder, Colorado 80302.
[4] Part of the Center for Building Technology.

Standard Reference Materials 1973 Catalog

Office of Standard Reference Materials
Institute for Materials Research
National Bureau of Standards
Washington, D.C. 20234

CAUTION: The values given in the following sections are listed primarily as a guide to purchaser. The values shown are nominal and may differ from those shown on the certificates. Space limitations have required that some values be omitted. For these reasons, the certificates issued with the standards should always be consulted to obtain the certified values.

U.S. DEPARTMENT OF COMMERCE, Frederick B. Dent, *Secretary*
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, *Director*

Issued April 1973

Library of Congress Catalog Card Number: 72-600291

National Bureau of Standards Special Publication 260

(Supersedes NBS Spec. Publ. 260-1970 Edition)

Nat. Bur. Stand. (U.S.), Spec. Publ. 260-1973 catalog, 96 pages (Apr. 1973)

CODEN: XNBSAV

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
(Order by SD Catalog No. C13.10:260-1973 cat.). Price: $1.25, domestic postpaid; $1.00, GPO Bookstore
Stock Number 0303-01144

CONTENTS

Standard Reference Materials

Issued by the National Bureau of Standards

This Catalog lists and describes the Standard Reference Materials (SRM's), Research Materials (RM's), and General Materials (GM's) currently distributed by the National Bureau of Standards, as well as many of the materials currently in preparation. SRM's are used to calibrate measurement systems and to provide a central basis for uniformity and accuracy of measurement. The unit and quantity, the type, and the certified characterization are listed for each SRM, as well as directions for ordering. The RM's are not certified, but are issued to meet the needs of scientists engaged in materials research. RM's are issued with a "Report of Investigation," the sole authority of which is the author of the report. The GM's are standardized by some agency other than NBS. NBS acts only as a distribution point and does not participate in the standardization of these materials. Announcements of new and renewal SRM's, RM's, and GM's are made in the semi-annual supplements to this Catalog, SRM Price and Availability List, the NBS Technical News Bulletin, and in scientific and trade journals.

Key words: Analysis; characterization; composition; properties; Standard Reference Materials; Research Materials; General Materials.

General Information

All of the Standard Reference Materials (SRM's), Research Materials (RM's), and General Materials (GM's) listed in this Catalog bear distinguishing names and numbers by which they are permanently identified. Each SRM, RM, or GM bearing a given designation is of identical characterization with every other sample bearing the same designation, within the limits required by the use for which it is intended; or if necessary, it is given a serial number and an individual calibration.

The first SRM's issued by the Bureau were a group of ores, irons, and steels certified for chemical composition, and by custom they came to be called "standard samples." At present, more than 800 SRM's are available, covering a wide range of chemical and physical properties, and the designation, Standard Reference Material, is more appropriate. As the number of SRM's has increased, so has the variety, with such new groups being established as: clinical laboratory standards, nuclear materials, glass viscosity standards, rubber and rubber compounding materials, color standards, and coating thickness standards. These groups are listed under the headings: Standards of Certified Chemical Composition, Standards of Certified Physical Properties, Engineering Type Standards, Research Materials, or General Materials. The groups of materials under these general headings are listed in the Table of Contents. An alphabetical index provides the location of a particular material, or group of similar materials. A numerical index provides the date of the current Certificate issued with these materials.

The detailed listing of materials indicates the nominal certification for which the material is issued, but the Certificate must be consulted for the actual certification. A number of SRM's are issued for which it is not feasible to supply numerical values, or for which such certification would not be useful. These SRM's provide assurance of identity among all samples with the same designation, and permit standardization of test procedures and referral of physical or chemical data on unknown materials to a common basis.

Renewal and Discontinued Standard Reference Materials

The preparation of "renewal" SRM's is intended to be completed by the time the existing supply of each kind of material is exhausted, but this is not always possible. The renewal will not usually be identical to its predecessor, but will be quite similar especially with regard to the characteristics certified, and generally the renewal can be used in place of its predecessor. As an example, when the first 0.1 percent carbon Bessemer steel was prepared in 1909, it was called Standard Sample No. 8. During the following years, a number of renewal batches, 8a, 8b, etc., were prepared; SRM 8j is now available and represents the 10th renewal batch of 0.1 percent carbon Bessemer steel. While each of these batches differ somewhat in detailed analysis from one batch to another, all retain the relatively high level of phosphorus, sulfur, and nitrogen, and low alloy metal content characteristic of this type of material. It is not possible to supply preceding numbers of a renewal series when the stock is exhausted. If little demand exists or an alternate source of supply has become available for a material, production may be discontinued permanently or until sufficient justification is obtained to warrant renewal.

New Standard Reference Materials

New SRM's are issued from time-to-time, and are announced through semi-annual supplements to this Catalog, through the NBS Technical News Bulletin, through news releases to scientific, technical, and trade publications, as well as directly to prospective users.

Catalog Supplements

SRM Price and Availability Lists are usually prepared semi-annually to keep the Catalog current. These supplements provide a complete list of the available SRM's and their prices and provide descriptions of SRM's issued since the latest Catalog was printed.

Ordering

Orders should be addressed to the Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234. Telephone (301) 921-2045. Orders should give the amount (number of units), catalog number and name of the standard requested. For example: 1 each, No. 11h, Basic-Open-Hearth Steel, 0.2 percent C. These materials are distributed only in the units listed.

Acceptance of an lorder does not imply acceptance of any provision set forth in the order contrary to the policy, practice, or regulations of the National Bureau of Standards or the U.S. Government.

Orders received for "out-of-stock" materials are cancelled if only out-of-stock items are ordered. On other orders, shipment is made of available materials and out-of-stock items are cancelled. Back-orders are not accepted for out-of-stock materials; if a renewal lot of material is available, it will be furnished automatically.

Terms

Prices are given in the SRM Price and Availability List. These prices are subject to revision and orders will be billed for prices in effect at the time of shipment. New SRM Price and Availability Lists, when issued, are sent to users who have made purchases during the preceding twelve months, and to persons or organizations who request them. No discounts are given on purchases of Standard Reference Materials.

Remittances of the purchase price need not accompany purchase orders for firms or persons in the North American continent, agents in the United States of foreign firms, or foreign firms with established credit. Payment of invoices is expected within 30 days of receipt of an invoice. Payment on foreign orders may be made by any of the following:

(a) UNESCO coupons,
(b) banker's draft against U.S.A. bank,
(c) bank to bank transfer to a U.S.A. bank,
(d) letter of credit on a U.S.A. bank, or
(e) by International Money Order.

Pro-forma invoice service will frequently require 6 to 8 weeks to process, and will be furnished only to those requiring such service, or when credit has not been established.

Domestic Shipments

Shipments of material (except for certain restricted categories, e.g., hydrocarbons, special nuclear materials, compressed gases, rubber, rubber compounding materials, and radioactive standards) intended for the United States, Mexico, and Canada are normally shipped prepaid (providing that the parcel does not exceed the weight limitations as prescribed by Postal Laws and Regulations) unless the purchaser requests a different mode of shipment, in which case the shipment will be sent collect. The Bureau does not prepay such shipping charges. Hydrocarbons, organic sulfur compounds, compressed gases, rubber, rubber compounding materials, radioactive standards, and similar materials are shipped express collect.

Foreign Shipments

Orders for small weight shipments will be shipped by prepaid International Air Parcel Post. Other shipments will be shipped prepaid International Parcel Post, except those shipments exceeding the parcel post weight limitations, which must be handled through an agent (shipping or brokerage firm) located in the U.S.A. as designated by the purchaser. Shipments handled through an agent will be packed for overseas shipment and forwarded via express collect to the U.S.A. firm designated as agent.

NOTE: Orders and inquiries submitted in English will be processed more rapidly than those requiring translations.

Introducción

Todo el Material de Referencia de Normas (Standard Reference Materials–SRM's), Material de Investigación (Research Materials–RM's), y Material General (General Materials–GM's), que figura en este Catálogo lleva nombres y números que lo identifican en forma permanente. Cada SRM, RM o GM designado en forma específica, tiene características idénticas a las de todas las demás muestras que llevan la misma designación, dentro de los límites que requiere el uso al cual está destinada; o, en caso necesario, se le asigna un número de serie y una calibración individual.

Los primeros SRM's emitidos por la Dirección fueron un grupo de minerales, hierros y aceros certificados en cuanto a su composición química, y se tomó la costumbre de llamarlos "muestras de normas" (standard samples). En la actualidad se cuenta con más de 800 SRM's que cubren una amplia gama de propiedades químicas y físicas, y la designación "Material de Referencia de Norma" (Standard Reference Material) es más apropiada. A medida que ha aumentado el número de SRM's, ha aumentado la diversidad de éstos, estableciendose nuevos grupos, tales como normas para laboratorios clínicos, materiales nucleares, normas de viscosidad de vidrio, normas para goma y compuestos para goma, normas de colores, así como normas de grosor de revestimiento. Estos grupos figuran bajo los encabezamientos: Normas de Composición Química Certificada (Standards of Certified Chemical Composition), Normas de Propiedades Físicas Certificadas (Standards of Certified Physical Properties), Normas de Tipo de Ingeniería (Engineering Type Standards), Materiales de Investigación (Research Materials), o Materiales Generales (General Materials). Los grupos de materiales que corresponden a estos títulos generales aparecen en el Índice de Materias. Un índice alfabético indica la ubicación de determinado material. Un índice numérico ofrece la fecha del Certificado vigente emitido con los materiales en cuestión.

La lista detallada de materiales indica la certificación nominal para la cual se emite el material, pero es necesario consultar el Certificado para encontrar la certificación precisa. Se emite SRM's para los cuales no es factible suministrar valores numéricos o para los cuales tal certificación no sería útil. Estos SRM's ofrecen la seguridad de que son idénticas todas las muestras que llevan la misma designación, lo cual permite normalizar los procedimientos de prueba y referir a una base común los datos físicos o químicos de materiales desconocidos.

Norma de Renovación y Descontinuación Materiales de Referencia

Se tiene el propósito de completar la preparación de SRM's "de renovación" para cuando estén agotadas las existencias de cada clase de material, pero esto no es siempre posible. Por lo general, el material de renovación no será idéntico a su predecesor, pero será bastante similar, en especial en lo que a las caracteristicas certificadas se refiere, y por lo general la renovación puede ser utilizada en lugar de su predecesor. Por ejemplo, en 1909, cuando se preparó el primer acero Bessemer con 0.1 por ciento de carbono, fué designado como "Standard Sample No. 8." Durante los años subsiguientes, fueron preparados lotes de renovación 8a, 8b, etc. En la actualidad está disponible el SRM 8j, que representa la décima renovación de acero Bessemer con 0.1 por ciento de carbono. Si bien cada uno de estos lotes difiere en algo en cuanto a análisis detallado entre lote y lote, todos ellos tienen el nivel relativamente alto de contenido de fósforo, azufre, nitrógeno y metal de baja aleación que es característico de este material. Una vez agotadas las existencias, no es posible suministrar números precedentes de una serie de renovaciones. Si existe poca demanda o se encuentra disponible una fuente alternativa de suministro de determinado material, es posible que la producción sea descontinuada en forma permanente, o hasta que se obtenga justificación suficiente para una renovación.

Nuevo Material de Referencia de Normas

De cuando en cuando se emite nuevos SRM's, los cuales son anunciados mediante suplementos semestrales de este Catálogo, por el NBS Technical News Bulletin, mediante informativos enviados a publicaciones científicas, técnicas y del ramo, así como directamente a los usuarios en potencia.

Suplementos de Catálogo.

Por lo general, las Listas de Precios y Disponibilidad de SRM's (SRM Price and Availability List) son preparadas semestralmente para mantener al día el Catálogo. Estos suplementos ofrecen una lista completa de los SRM's disponibles, así como sus precios, y dan la descripción de SRM's emitidos desde que fuera impreso el último Catálogo.

Pedidos

Los pedidos deberán ser hechos a la siguiente dirección:

Office of Standard Reference Materials
Room B311, Chemistry Building
National Bureau of Standards
Washington, D.C. 20234

El teléfono es (301) 921-2045. En los pedidos se deberá indicar el número de unidades, número y nombre del SRM. Por ejemplo: 1 muestra, No. 11h, Acero Siemens-Martin Básico, 0.2 por ciento C. Estos materiales son distribuidos solamente en las unidades que figuran en la lista.

Pedidos que se recibe por materiales "agotados" son cancelados y devueltos si se ha pedido solamente artículos agotados. En caso contrario, se remite los materiales disponibles y se cancela los materiales agotados. No se acepta pedidos retroactivos por materiales agotados; si un lote de material de renovación está disponible sera suministrado en forma automática.

Condiciones

Los precios aparecen en la Lista de Precios y Disponibilidad de SRM's (SRM Price and Availability List). Estos precios están sujetos a cambio y se facturará los pedidos a los precios que esten en vigencia en el momento en que se hace el embarque. Al ser emitidas las nuevas Listas de Precios y Disponibilidad, son enviadas a los usuarios que han hecho compras en el curso de los doce meses precedentes, y a las personas u organizaciones que las solicitan. No se hace descuentos en las compras de Materiales de Referencia de Normas.

Ordenes de compra hechas por empresas o personas en el continente norteamericano, agentes en los Estados Unidos de empresas extranjeras, o empresas extranjeras de crédito bien establecido, no necesariamente tienen que ir acompañadas del valor de la compra. Se espera que las facturas sean pagadas a los treinta días de recibidas. El pago de pedidos desde el extranjero se puede hacer mediante cualquiera de los siguientes:

(a) cupones de la UNESCO,
(b) giro bancario contra un banco estadounidense,
(c) transferencia de banco a un banco en los Estados Unidos,
(d) carta de crédito en un banco en los Estados Unidos, o
(e) Giro Internacional.

Suele requerir 8 semanas procesar facturas pro-forma, y serán suministradas solamente a aquellos que requieren de tal servicio, o cuando no ha sido establecido el crédito.

Remesas dentro del País

Los materiales (a excepción de ciertas categorías restringidas, por ejemplo hidrocarburos, materiales nucleares especiales, gases comprimidos, compuestos orgánicos de azufre y normas radioactivas) destinados a los Estados Unidos, México y el Canadá, por lo general son remesados con porte pagado (siempre y cuando que el paquete no exceda las limitaciones prescritas por las Leyes y el Reglamento Postal), a no ser que el comprador solicite una forma de embarque diferente, en cuyo caso se enviará con flete por pagar. Esta Dirección no paga por tales fletes. Hidrocarburos, compuestos orgánicos de azufre, gases comprimidos, materiales para compuestos de goma, normas radioactivas y material similar, son remitidos por expreso con flete por cobrar.

Embarques al Extranjero

Embarques de poco peso por valor de mas de $100 dólares con porte pagado serán enviados por encomienda aérea con flete pagado. Los embarques que excedan las limitaciones de encomienda postal deberán ser manejados por intermedio de un agente (empresa de transportes o corredor) ubicado en los Estados Unidos, según indicación del comprador. Tales paquetes serán embalados para embarque marítimo y remesados como expreso por cobrar a la empresa en los Estados Unidos que ha sido designada como agente.

Pedidos que no han sido pagados serán embarcados con flete pagado por Encomienda Postal Internacional, sujeto a limitaciones en cuanto a tamaño, peso y categoría de material. Cualquier otra forma de embarque solicitado por un cliente deberá ser pagada por ese cliente. (Embarques que por cualquier motivo sean excluídos de remesa por Encomienda Postal Internacional deberán ser manejados por intermedio de un agente [empresa de transporte o corredor] ubicado en los Estados Unidos, segun indicación del comprador.) Tales paquetes serán embalados para embarque marítimo y remesados como expreso por cobrar a la empresa en los Estados Unidos que ha sido designada como agente.

Nota: Pedidos y consultas presentados en idioma inglés serán tramitados en forma mas rápida que aquellos que requieren traducción.

Avant-Propos

Toutes les mesures étalon des matériaux classés dans la catégorie SRM, (Standard Reference Matérial) celles des matériaux de recherche ou RM (Research Material), et celles des matériaux divers ou GM (General Material) répertoriés dans ce catalogue se sont vus attribuer une désignation et un numéro de référence distincts afin de les identifier à titre permanent. Chacun des matériaux tombant dans les catégories SRM, RM ou GM est identique en ce qui concerne sa caractérisation à tout autre échantillon de même désignation, compte tenu des tolérances établies pour son usage. Si necessaire, le matériau reçoit un numéro de série et un calibrage individuel.

Les titrages des premiers SRM établis par le Service des Poids et Mesures concernaient certains minerais, du fer et des aciers qui, par la suite, devaient être désignes sous le nom de "échantillon-type" (Standard samples). A l'heure actuelle, il existe plus de 800 SRM aux propriétés chimiques et physiques très variées. Il est donc apparu plus approprié de les designer sous le nom de "Mesures étalon pour matériaus répertoriés" (Standard Reference Materials). Au fur et à mesure que le nombre de SRM augmentait il en etait de même de la diversité des nouvelles catégories de normes à établir pour, par exemple : les laboratoires médicaux, les matériaux nucléaires, la viscosité dynamique du verre, le caoutchouc et ses derivés, les produits colorants et l'épaisseur des enduits et revêtements. Des rubriques spéciales ont ete établies à cet effet: Normes de composition chimique (Standards of Certified Chemical Composition); Normes de propriétés physiques (Standards of Certified Physical Properties); Normes d'Engineering (Engineering Type Standards); Matériaux de recherche (Research Materials); ou Matériaux divers (General Materials). Les catégories de matériaux répertoriés sous ses rubriques sont indiquées à la table des matières. Il suffit de consulter l'index presenté par ordre alphabétique pour trouver la page se rapportant à un matériau particulier. Un index numérique fournit la date de délivrance du brevet correspondant aux normes éxigées pour tel ou tel matériau.

La liste detaillée des matériaux constituant une homologation à caractère purement nominal, il est nécessaire de consulter le brevet delivré pour chacun des matériaux par le Service des Poids et Mesures. Il existe cependant un certain nombre de SRM pour lesquels il est impossible de fournir des valeurs numériques ou pour lesquels une telle certification serait inutile. Ces SRM sont identiques aux autres échantillons de même désignation. Ils permettent d'une uniformisation des méthodes experimentales et dans le cas de matériaux inconnus de se baser sur des données de physique ou de chimie communes.

Mises à jour et discontinuation des normes. Matériaux repertoriés.

La mise à jour de la liste concernant les SRM doit en principe être terminée lorsque les stocks de chaque lot de matériaux sont épuisés, cela n'est toutefois pas toujours possible. Habituellement le nouveau lot n'est pas rigoureusement identique au précédent mais en est cependant très proche, ses spécifications étant les mêmes si bien qu'en règle générale il peut être utilisé en remplacement du lot precedent. Par exemple, lorsque le premier lot d'acier Bessemer a 0,1% de teneur en carbone a été preparé en 1909, il s'appelait à l'époque "Standard Sample No. 8". Les lots suivants furent désignés 8a, 8b, etc... Le SRM 8j., actuellement en stock correspond au dixième lot de lingots Bessemer fabriqués à partir d'une teneur en carbone de 0,1%. Bien que chacun de ces lots diffère quelque peu les uns des autres, si on les analyse en détail l'on constate qu'ils comportent tous une teneur relativement élevée en phosphore, souffre et azote ainsi qu'une faible proportion d'alliage, caracteristique à ce type de matériau. Pour les raisons exposées ci-dessus, il n'est donc pas possible de fournir des lingots appartenant à une série précédente épuisée. De surcroît, si la demande pour un type de matériau donné est marginale ou si une autre source d'approvisionnement est disponible pour tel ou tel matériau, la production peut alors en être suspendue à titre permanent ou jusqu'à ce qu'un renouvellement des stocks soit justifié.

Etablissement de normes pour nouveaux matériaux répertories.

Les mises à jour relatives aux SRM se font de temps à autre et sont publiées dans les supplements semestriels de ce catalogue, dans le *NBS Technical News Bulletin* ou dans des articles paraissant dans des revues scientifiques, techniques ou commerciales ou encore directement portées à la connaissance de futures personnes interessées.

Supplements du Catalogue.

Les tarifs et listes de matériaux SRM disponibles sont (SRM Price and Availability List), en règle générale, publiés semestriellement afin que le catalogue demeure à jour. Ces supplements fournissent une liste complète des SRM disponibles et des tarifs en vigueur ainsi que les spécifications des SRM repertoriés depuis la dernière publication du catalogue.

Modalités de commande.

Les lettres et bordereaux de commande doivent être adressés à : Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234. Téléphone: (301) 921-2045. Les commandes doivent spécifier la quantité desirée (nombre unitaire), le numéro de reférence du catalogue ainsi que les spécifications et titrage. Exemple: Qte. 1, Ref.: no. 11h, Acier sur sole basique à teneur de 0,2% de carbone (en anglais, de préférence).

Les bordereaux de commande reçus pour des materiaux dont les stocks sont épuisés sont annulés et renvoyes à leur expéditeur si tous les articles demandés sont hors stock. Dans ce cas, seuls les materiaux disponibles sont expediés. Les soldes de commande ne sont pas honorés pour ce qui concerne les matériaux dont les stocks sont épuisés, si un lot est renouvelé, le matériau est alors expedié automatiquement.

Conditions de paiement.

Les tarifs en vigueurs relatifs aux SRM figurent à coté de la liste des matériaux disponibles (SRM Price and Availability List). Ces tarifs sont sujets à révision et les factures sont établiés en fonction des tarifs applicables au moment de l'expedition de la commande. Les tarifs et listes de matériaux

en stock sont addressés aux clients ayant passé commande dans les douze mois ayant précedé l'établissement de ces tarifs et listes, ainsi qu'aux personnes ou organisations en sollicitant l'envoi. Aucun rabais n'est consenti sur les commandes de SRM.

Pour toute firme ou particulier, établi sur le continent nord americain, représentant aux Etats-Unis des firmes étrangères ou une société étrangère, offrant des garanties bancaires, il n'est pas necessaire de joindre le règlement au bordereau de commande. Cependant les factures doivent etre réglées dans les 30 jours suivant leur réception. les commandes passées à l'étranger peuvent etre réglées de la manière suivante:

(a) Coupons UNESCO
(b) Lettre de change à l'ordre d'une banque américaine
(c) Transfert de banque à banque dans un établissement américain.
(d) Lettre de crédit à l'ordre d'une banque américaine
(e) ou par mandat international.

L'établissement de factures pro-forma entraine fréquemment un délai de 6 à 8 semaines.Elles ne seront fournies que sur demande expresse des intéressés ou en l'absence d'une ouverture de crédit.

Expéditions à destination du continent nord-americain.

Les expéditions de matériaux (à l'exclusion toutefois de certaines catégories faisant l'objet de restrictions tels que : hydrocarbures, matériaux nucléaires spéciaux, gaz comprimés, composés de souffre organique, étalons pour matières radio-actives) à destination des Etats-Unis, du Mexique et du Canada sont en général réglées d'avance (à condition que le colis n'excède pas les limites des poids fixées aux termes des reglements postaux en vigueur) et sauf si le destinataire désire un mode d'envoi différent, auquel cas le colis est expedié contre remboursement, et en exprès.

Expéditions a l'étranger.

Les colis legers dont la valeur excède $100 et dont le contenu à été réglé d'avance seront expedies par la poste aérienne avec la mention "marchandise réglée". Les expéditions de matériaux dont le poids excède les limites fixées pour l'envoi de colis postaux doivent être faites par l'intermédiaire d'un agent maritime ou d'un transitaire ayant ses bureaux aux Etats-Unis et designé par le destinataire. Les colis seront emballés specialement pour envoi à l'étranger et expediés en exprès et contre remboursement à la firme américaine agissant en qualité de Transitaire.

L'expédition des commandes non encore réglées se fera par colis postal, régime international, et compte tenu des restrictions imposées, sur le volume, le poids et les catégories de matériaux, par le Service des Postes. Tout autre mode d'expédition sollicité par un client doit être réglé directement par ses soins. (Les expeditions ne pouvant être faites pour une raison quelconque par colis postal, régime international, devront être confiées à un agent maritime ou à un transitaire dont les bureaux sont installés aux Etats-Unis et désigné par le destinataire. Ces colis seront spécialement emballés pour expédition à l'étranger en exprès et contre remboursement à la firme américaine agissant en qualité de transitaire.

N.B. Les commandes et demandes de renseignements rédigées en anglais seront satisfaites plus rapidement que celles exigeant une traduction.

Katalog der Standard-Nachweis-Materialien

Alle Standard-Nachweis-Materialien (Standard Reference Materials oder SRM's), Forschungs-Materialien (Research Materials oder RM's) und Allgemein-Materialien (General Materials oder GM's) die in diesem Katalog aufgefuehrt sind tragen unterschiedliche Namen und Nummern durch welche sie jederzeit identifizierbar sind. Jedes SRM, RM oder GM das eine gewisse Kennzeichnung

traegt hat dieselben Eigenschaften wie jede andere Probe versehen mit derselben Kennzeichnung innerhalb der Nachweisgrenzen die fuer einen bestimmten Zweck angegeben sind; andernfalls wird einer solchen Probe zweckbedingt eine Seriennummer als auch eine individuelle Eichung zugeteilt.

Die ersten vom Normamt (National Bureau of Standards oder NBS) herausgegebenen SRM's waren eine Reihe von Erzen, verschiedene Eisen und Staehle alle bescheinigt mit Bezug auf die jeweilige chemische Zusammensetzung, so dass im Laufe der Zeit diese Materialien als "Normproben" (Standard Samples) allgemein bekannt wurden. Zur Zeit sind ueber 800 SRM's verfuegbar die ein weites Gebiet chemischer und physikalischer Eigenschaften umfassen, auf Grund dessen die Bezeichnung "Standard-Nachweis-Material" sachgemaesser ist. Ebenso wie die Anzahl der SRM's zugenommen hat so ist auch derer Vielseitigkeit angestiegen: Neue Arten von Normproben wie z.B. klinische Labornormen, Kerntechnische Materialien, Normen zur Bestimmung der Glasviskositaet, Gummi-und Gummiverarbeitungs–Materialien, Farbnormen, als auch Normen zur Oberflaechenschichte-Dichtemessung, sind inzwischen herausgebracht worden. Derartige Gruppen von Standard-Nachweis-Materialien sind hierbei unter den folgenden Ueberschriften angegeben: Proben mit amtlich bescheinigter chemischer Zusammensetzung (Standards of Certified Chemical Composition), Proben mit attestierten physikalischen Eigenschaften (Standards of Certified Physical Properties), Kontroll-Proben mit Pruefungszeugnis fuer Anwendungen in der Technik (Engineering Type Standards), Forschungs-Materialien (Research Materials) und Allgemein-Materialien (General Materials). Die Gruppen von Materialien die diesen Kategorien zugehoeren sind in dem Inhaltsverzeichnis angegeben. Ein alphabetisch angeordneter Index gibt die Stelle jedes gewissen Materials oder auch jeder Gruppe aehnlicher Materialien an. Ein Nummerindex gibt das Datum des gueltigen Beglaubigungs-Zeugnisses an das jedem dieser Materialien zugeschrieben ist.

Die ausfuehrliche Anordnung dieser Materialien gibt den nominellen Richtwert an der dem entsprechenden Material zugesprochen ist; trotzdem muss in jedem einzelnen Falle das originale Beglanbigungs-Zeugnis fuer den rechtmaessigen Richtwert in Anbetracht gezogen werden. Eine Anzahl von SRM's werden angeboten fuer die es nicht moeglich ist entweder einen Zahlenwert (Eichwert oder Richtwert) in dem Pruefungszeugnis anzugeben oder fuer die eine derartige Beglaubigung von fraglichem Vorteil ist. SRM's dieser Art gewaehrleisten die Identitaet aller Proben die mit ein und derselben Kennzeichnung versehen sind und demzufolge ermoeglichen die Normung von Versuchsverfahren als auch Bezugnahme auf eine gemeinsame Grundlage von physikalischen und chemischen Daten hinsichtlich unerforschter Materialien.

Erneuerung und Ausscheidung von Standard-Nachweis-Materialien

Die Vorbereitung von "Erneuerungs-" SRM's ist meistens dann abgeschlossen wenn bei einem gewissen Zeitpunkt der vorhandene Betrag eines jeden Materials erschoepft ist; das ist jedoch nicht immer moeglich. Im allgemeinen ist das neuere Material dem aelteren Vorlaeufer nicht unbedingt identisch; trotzdem werden sie sich beiderseits sehr aehnlich sein besonders in Bezug auf die Eigenschaften fuer die das jeweilige SRM bescheinigt ist, so dass man im allgemeinen das neuere Material an Stelle des aelteren Materials benutzen kann. Zum Beispiel: Als der erste 0,1 Prozent Kohlenstoff Bessemer Stahl im Jahre 1909 vorbereitet wurde, erhielt diese Analysen-Kontrollprobe die Kennzeichnung "Standard Sample No. 8". Im Laufe der folgenden Jahre wurde eine Anzahl von Erneuerungsproben, gekennzeichnet 8a, 8b, u.s.w., vorbereitet. SRM 8j ist inzwischen erhaeltlich und dieses Material ist daher die zehnte Erneuerungsprobe des 0,1 Prozent Kohlenstoff Bessemer Stahls. Waehrend sich jede dieser Stahlschmelzen in Anbetracht der Richtanalyse von der anderen wenn auch nur gering unterscheidet, so enthaelt jede dieser Schmelzen den relativ hohen Gehalt an Phosphor, Schwefel und Stickstoff und einen niedrigeren Prozentsatz an Legierungsmetallen der kennzeichnend fuer diese Art Material ist. Es ist nicht moeglich vorangegangene Nummern einer gewissen SRM-Erneuerungs-Serie zu liefern sobald der Vorrat eines solchen Materials aufgebraucht ist. Sofern nur geringe Nachfrage besteht, oder eine andere Lieferungsquelle fuer eine bestimmte Analysen-Kontrollprobe verfuegbar ist, so kann die Vorbereitung bei NBS eines solchen Materials entweder ganz eingestellt oder voruebergehend unterbrochen werden bis ausreichender Grund vorhanden ist, eine Erneuerung desselben zu rechtfertigen.

Neue Standard-Nachweis-Materialien

Von Zeit zu Zeit werden neue SRM's herausgegeben die durch halbjaehrige Nachtraege zu diesem Katalog bekannt gemacht werden. Neuerscheinungen dieser Art werden ebenso zur Kenntnis gebracht durch das "NBS Technical News Bulletin" als auch durch Veroeffentlichungen in verschiedenen wissenschaftlichen, technischen Fachschriften und Fachhandelsblaettern sowie Ankuendigungen direkt gerichtet an Kunden und interessierte Kaeufer.

Katalog Nachtraege

Eine SRM Preisliste mit Lieferungsverzeichnis (SRM Price and Availability List) wird gewoehnlich halbjaehrlich veroeffentlicht um den Katalog auf dem laufenden zu halten. Derartige Nachtraege bieten ein vollstaendiges Verzeichnis aller verfuegbarer SRM's und deren Preise und enthalten Beschreibungen derjenigen SRM's die nach dem Druck des letzten Katalogs herausgegeben sind.

Bestellungen

Bestellungen muessen an die

Office of Standard Reference Materials
Chemistry Building, Room B311
National Bureau of Standards
Washington, D.C. 20234

gerichtet werden. Telefon: (301) 921-2045.

Bestellungen muessen die Anzahl (Menge jeder einzelen Probe) und Bezeichnung (Nummer und Namen) des gewuenschten Standard-Nachweis-Materials angeben. Zum Beispiel: Ein, No. 11h, Siemens Martin Stahl, 0,2 Prozent C. Wir bitten, Bestellungen in Englisch zu erhalten, sofern moeglich. In diesem Falle lautet die obige Bestellung folgendermassen: "1 each, No. 11h, Basic-Open-Hearth Steel, 0.2 percent C." Diese Materialien sind nur in den beschriebenen Menge-Einheiten erhaeltlich.

Erhalt einer Bestellung bei NBS schliesst keinerlei Vereinbarung ein mit irgendwelchen Bedingungen denen in besagter Bestellung Ausdruck gegeben ist, insofern als solche Bedingungen im Gegensatz zu den Vorschriften, ueblichen Handhabungen und Regulierungen des National Bureau of Standards oder der U.S. Regierung stehen.

Bestellungen fuer Materialien die aus dem Handel gezogen sind werden als ungueltig erklaert und an den Kunden zurueck geschickt sofern nur Bestellungen fuer nicht mehr erhaeltliche Proben bei NBS in Empfang genommen werden. Bei anderen Bestellungen werden die im Lager vorhandenen Materialien geliefert und die gegebenenfalls nicht mehr vorhandenen Materialien einfach gestrichen. Gleichermassen, Nachbestellungen von Materialien nicht mehr auf Lager koennen nicht angenommen werden; sobald eine Neuausgabe eines angeforderten Materials verfuegbar ist wird dasselbe unverzueglich geliefert.

Zahlungsbedingungen

Preise sind in der SRM Preis- und Lieferungliste (SRM Price and Availability List) angegeben. Die genannten Preise werden von Zeit zu Zeit einer Beruecksichtigung unterzogen und Bestellungen werden berechnet zu den Preisen in Geltung zur Zeit des Versands. Neu veroeffentlichte SRM Preis-und Lieferungslisten werden an Kunden geschickt die in den vergangenen zwoelf Monaten ein Material angefordert haben. Diese Listen sind ebenso erhaeltlich bei Privatpersonen oder Betrieben die dafuer Antrag stellen. Wir moechten darauf hinweisen, dass wir keinen Rabatt auf Standard-Nachweis-Materialien irgend welcher Art gewaehrleisten koennen.

Zahlung braucht einer Bestellung nicht beizuliegen solange diese von Personen oder Firmen im Nordamerikanischen Kontinent kommt, oder diese von Vertretungen von auslaendischen Firmen in den Vereinigten Staaten, oder von auslaendischen Firmen mit etabliertem Kredit stammt.

Zahlung wird innerhalb von 30 Tagen nach Erhalt der Rechnung erwartet. Zahlungen fuer Bestellungen aus dem Ausland koennen wie folgt verschiedentlich gehandhabt werden:

(a) durch UNESCO Coupons,
(b) durch Bankbezug gegen eine Bank in den U.S.A.,
(c) durch Bankueberweisung an eine Bank in den U.S.A.,
(d) mittels Kreditbrief an eine Bank in den U.S.A., oder
(e) durch eine internationale Gelduebeerweisung.

Pro-forma Abrechnungsdienst nimmt gewoehnlich 6 bis 8 Wochen in Anspruch und wird nur auf Antrag geleistet oder wenn Kredit nicht vorhanden ist.

Inlandversand

Versand von Materialien (mit Ausnahme von gewissen Beschraenkungen, wie z.B. der Versand von Kohlenwasserstoffen, besonderen Materialien der Kerntechnik, verdichteten Gasen, Gummi und Gummi-Verarbeitungsmaterialien, als auch radioaktive Probematerialien) innerhalb der Vereinigten Staaten, Mexiko und Kanada geschieht normalerweise unter Vorauszahlung (solange die Lieferung nicht entsprechende Gewichtsbegrenzungen der Postvorschriften ueberschreitet). Andernfalls, sollte der Kunde eine andere Weise des Versands verlangen, dann wird die Ware so versandt dass sie bei Empfang zahlbar ist. Das Normamt leistet keine Vorauszahlungen derartiger Versandspesen. Kohlenwasserstoffe, organische Schwefelverbindungen, verdichtete Gase, Gummi-Verarbeitungsmaterialien, radioaktive Stoffe und aehnliche Materialien werden per Express geliefert, mit Versandkosten zu Lasten des Empfaengers, zahlbar bei Erhalt.

Ueberseeversand

Lieferungen von nur geringem Gewicht werden als Versandspesen-vorausbezahlte Bestellung per internationale Paket-Luftpost befoerdert. Lieferungen anderer Art werden als Versandspesen-vorausbezahlte Ware durch internationale Paketpost befoerdert. Eine Ausnahme sind Lieferungen die gewisse Paketpost-Gewichtsbestimmungen ueberschreiten; diese muessen durch eine von dem Kunden beauftragte Agentur (Versand-oder Maklerfirma), ansaessig in den U.S.A., gehandhabt werden. Solche von einem Agenten vollzogenen Bestellungen die fuer den Ueberseeversand bestimmt sind werden entsprechend verpackt und via Express an den von dem Kunden angeforderten Vertreter in den U.S.A. weitergeleitet, zahlbar durch den Agenten an Erhalt der Lieferung.

Anmerkung: Bestellungen und Anfragen koennen schneller bearbeitet werden wenn sie auf Englisch erfolgen im Vergleich zu solchen, die eine Uebersetzung erfordern.

Guide for the Submission of Requests for the Development of New or Renewal Standard Reference Materials

August 20, 1964
(June 1, 1970 - Revised)

Introduction

The National Bureau of Standards presently has available more than 800 Standard Reference Materials. It is also working on the development of about 150 new ones and has on hand requests for the preparation of many others. The requests have always far exceeded the Bureau's capacity to produce and certify these materials.

Policy

One of the functions of the National Bureau of Standards is to develop, produce, and distribute Standard Reference Materials that provide a basis for comparison of measurements on materials and aid in the control of production processes in industry. To help carry out this function, the Office of Standard Reference Materials evaluates the requirements of science, industry, and government for carefully characterized reference materials, and directs their production and distribution. Emphasis is given to providing NBS Standard Reference Materials (a) where attainment of needed accuracy of analysis or accuracy of measurement of characteristics is not economically or technically feasible elsewhere, and where such accuracy is generally important to users, (b) where industry-wide standards for commerce are needed from a neutral supplier who is not otherwise available, and (c) where continuing availability of highly characterized material from a common source is important to science, industry, or government.

The National Bureau of Standards recognized and had responded to the need for broadening the present program on reference materials to include all types of well-characterized materials that can be used to calibrate a measurement system or to produce scientific data that can be readily referred to a common base. With this broadening, however, it still remains apparent that the demand for new Standard Reference Materials will continue to greatly exceed the Bureau's capacity for development. Therefore, requests for new Standard Reference Materials that will have limited use and for which the need is not very great will have to be deferred in favor of requests clearly showing a critical need. For the purpose of determining which requests are to receive top priority, the National Bureau of Standards will need, and will rely heavily upon, the information supplied by industry, either through its own representatives or through interested committees, such as those of the American Society for Testing and Materials, the American National Standards Institute, the International Organization for Standardization, etc.

Accordingly, while the Bureau welcomes all requests for the development of new Standard Reference Materials, it will help both the Bureau, and industry as well, if requests are accompanied by such information as will permit an assessment of the urgency and importance of proposed new reference materials.

Information Needed

Those requesting the development of new Standard Reference Materials should supply as much as possible of the following information:

(1) Short title of Standard Reference Material.
(2) Purpose for which the new standard material is needed.
(3) Reasons why the new standard material is needed.
(4) Special characteristics and/or requirements for the material. Include additional requirements and reasons, if more than one standard material is necessary for standardization in this area.
(5) Your estimate of the possible present and future (10 year) demand for this new standard in your own operations and elsewhere.
(6) Whether this standard, or a similar standard, can be produced by, or obtained from a source other than the National Bureau of Standards. If so, give reasons to justify its preparation by NBS.
(7) Miscellaneous pertinent comments to aid justification for the new Standard Reference Material, such as: (a) an estimate of the range of application, monetary significance, and scientific and/or technological significance including, when feasible, estimates of the impact upon industrial productivity or growth, and (b) supporting letters from industry leaders, trade organizations, interested committees and others.

Other Services of the National Bureau of Standards

The following is a list of some of the services offered by NBS that may be of interest to SRM users. For general information see the entry on Technical Information and Publications.

Calibration and Test Services of the National Bureau of Standards

The measurement services of the National Bureau of Standards include the calibration of standards, test of instruments, and certain interlaboratory testing programs. These services are listed in NBS Special Publication 250, Calibration and Test Services of the National Bureau of Standards. [Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, as SD Catalog No. C13.10:250 (1970Edition) for $2].

All technical inquiries regarding Calibration and Test Services, except those services related to electrical standards in the radio frequency region (above 30 kHz) or to time and frequency standards, should be directed to:

Office of Measurement Services
Room B154, Metrology Building
National Bureau of Standards
Washington, D.C. 20234
Telephone: (301) 921-2807.

Technical Inquiries related to electrical standards in the radio frequency range (above 30 kHz) or to time and frequency standards, should be directed to:

Office of Measurement Services
National Bureau of Standards
Boulder, Colorado 80302
Telephone: (303) 499-3753.

National Standard Reference Data System

The National Standard Reference Data System (NSRDS) is a nationwide program established to make critically evaluated data in the physical sciences available to the technical community. It publishes compilations of critically evaluated data, critical reviews and bibliographies. A complete listing of the publications of the NSRDS is available from the Office of Standard Reference Data (OSRD). The OSRD responds in a limited way to queries within the scope of the program by providing references, referrals, documentation, or data, as available. The program's monthly newsletter is available on request. Inquiries or requests for further information should be directed to:

Information Services
Office of Standard Reference Data
Room A523, Administration Building
National Bureau of Standards
Washington, D.C. 20234
Telephone: (301) 921-2583.

Standards Information Services Engineering and Product Standards

This service maintains a reference collection of some 20,000 engineering standards issued by more than 380 U.S. technical societies, professional organizations, and trade associations; specifications of the various State purchasing offices; standards and specifications of U.S. civilian government agencies; and the specifications and standards of the major foreign national and international standardizing bodies. The collection is open to the public Monday through Friday from 8:30 a.m. to 5 p.m.

The center publishes general and specialized indexes of standards. Information services consist of searching a Key-Word-In-Context (KWIC) Index to determine whether there are any published standards, specifications, test methods, or recommended practices for a given item or product.

Inquiries are referred to the appropriate source to obtain copies of standards. The Center neither sells nor distributes standards.

Inquiries or requests for additional information should be directed to:

Standards Information Service
Room B151, Technology Building
National Bureau of Standards
Washington, D.C. 20234
Telephone: (301) 921-2587.

Technical Information and Publications

The Office of Technical Information and Publications maintains a general correspondence and inquiry service on the technical activities of the National Bureau of Standards. Inquiries of a general nature and not covered by the services listed above should be directed to:

Office of Technical Information and Publications
Room A607, Administration Building
National Bureau of Standards
Washington, D.C. 20234
Telephone: (301) 921-2318.

Standards of Certified Chemical Composition

Steels (Chip Form)

These SRM's were prepared for the steel industry primarily for use with methods involving sample solutions in checking chemical methods of analysis both for production control and for customer acceptance. These SRM's consist of nominal composition steel alloys selected to provide a wide range of analytical values for the various elements that are of vital concern to the chemist. They are furnished in chips, usually sized between 16- and 40-mesh sieves, prepared from selected portions of commercial ingots.

The Certificate of Analysis, provided with each SRM, gives the chemical composition determined at NBS. Most certificates also include values obtained by other laboratories that cooperated in the certification of the SRM's.

Plain Carbon Steels (150 gram units unless otherwise noted)

Chemical Composition (Nominal Weight Percent)

SRM	Type	C	Mn	P	S Grav	S Comb	Si
8j	Bessemer (Simulated), 0.1C	0.081	0.505	0.095	-----	0.077	0.058
10g	Bessemer, 0.2C	.240	.850	.086	0.109	.109	.020
11h	BOH, 0.2C	.200	.510	.010	-----	.026	.211
12h	BOH, 0.4C	.407	.842	.018	-----	.027	.235
13g	BOH, 0.6C	.61	.85	.006	-----	.030	$.35_5$
14e	BOH, 0.8C	.753	.404	.008	-----	.039	.177
15g	BOH, 0.1C	.097	.485	.005	-----	.026	.095
16e	BOH, 1.1C	1.09	.381	.021	-----	.029	.20
19g	AOH, 0.2C	0.223	.554	.046	.032	.033	.186
20g	AISI 1045	.462	.665	.012	-----	.028	.305
51b	Electric Furnace 1.2C	1.21	.573	.013	.014	.014	.246
65d	Basic Electric 0.3C	0.264	.730	.015	.010	.010	.370
152a	BOH, 0.5C (Tin bearing)	.486	.717	.012	-----	.030	.202
178	Basic oxygen 0.4C	.395	.824	.012	-----	.014	.163
335	BOH 0.1C (Carbon only) 300g	.092	-----	-----	-----	-----	-----
337	BOH 1.1C (Carbon only) 300g	1.07	-----	-----	-----	-----	-----

Low Alloy Steels (150 gram units unless otherwise noted)

Chemical Composition (Nominal Weight Percent)

SRM	Type	(Other Forms)	C	Mn	P	S Grav.	S Comb.	Si	Cu	Ni
30f	Cr-V (SAE 6150)	----------	0.49	0.79	0.010	-----	0.010	0.28	0.76	0.071
32e	Ni-Cr (SAE 3140)	----------	.409	.798	.008	0.022	.021	.278	.127	1.19
33d	Ni-Mo (SAE 4820)	----------	.173	.537	.006	.010	.011	.253	.123	3.58
36b	Cr2-Mo1	----------	.114	.404	.007	-----	.019	.258	.179	0.203
72f	Cr-Mo (SAE X4130)	----------	.301	.545	.014	.024	.024	.256	.062	.055
100b	Manganese (SAE T1344)	----------	.397	1.89	.023	.029	.028	.210	.064	.030
105	High-Sulfur 0.2C (Carbon only)	----------	.193	-----	-----	-----	(.60)	-----	-----	-----
106b	Cr-Mo-Al (Nitralloy G)	----------	.326	0.506	.008	.016	.017	.274	.117	.217
125b	High-Silicon	1134	.028	.278	.029	-----	.008	2.89	.071	0.038
139a	Cr-Ni-Mo (AISI 8640)	----------	.404	.780	.013	.019	.019	0.241	.096	.510
155	Cr0.5-W0.5	----------	.905	1.24	.015	.010	.011	.322	.083	.100
361	AISI 4340	661,1095,1261	.383	0.66	.014	-----	.017	.222	.042	2.00
362	AISI 94B17 (Mod)	662,1096,1262	.160	1.04	.014	-----	.038	.39	.50	0.59
363	Cr-V(Mod)	663,1097,1263	.62	1.50	.029	-----	.009	.74	.10	.30
364	High Carbon (Mod)	664,1098,1264	.87	0.25_5	$.01_8$	-----	$.02_9$	$.06_5$	$.24_9$	$.14_4$
366	Set: 1 each of 361,362,363,364, and 365, Electrolytic Iron. (SRM 365 is described on page 28.)									

SRM	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd
361	(0.0005)	(<0.0001)	0.004_2	(0.0005)	(0.0004)	(0.004)	(0.0005)	(0.005)	(0.001)	(0.001)
362	(.0025)	(.0006)	.013	(.006)	(.0009)	(.001)	(.001)	(.002)	(.0005)	(.0005)
363	(.0010)	(.0018)	(.0022)	(.0006)	(.0032)	(.0001)	(.0023)	(.002)	(.0012)	------
364	(.014)	$.01_9$	(.025)	(.002)	(.00005)	(.0003)	(.0002)	(.0005)	(.00007)	(.0002)

Plain Carbon Steels (Continued)

Cu	Ni	Cr	V	Mo	Co	Ti	Sn	Al (total)	N	Other	SRM
0.020	0.113	0.097	0.015	0.038	-----	-----	-----	------	-----	---------	8j
.008	.005	.008	.007	.002	-----	-----	-----	------	0.015	---------	10g
-----	-----	-----	-----	-----	-----	-----	-----	------	-----	---------	11h
.073	.032	.074	.003	.006	-----	-----	-----	(0.038)	.006	---------	12h
-----	-----	-----	-----	-----	-----	-----	-----	------	-----	---------	13g
.072	.053	.071	.002	.013	-----	-----	-----	.060	-----	---------	14e
-----	-----	-----	-----	-----	-----	-----	-----	------	-----	---------	15g
-----	-----	-----	-----	-----	-----	-----	-----	------	-----	---------	16e
.093	.066	.374	.012	.013	0.012	0.027	0.008	.031	-----	Nb 0.026	19g
.034	.034	.036	.002	.008	-----	-----	-----	.040	-----	---------	20g
.071	.053	.455	.002	.014	-----	-----	.008	------	.011	---------	51b
.051	.060	.049	.002	.025	-----	-----	.004	.059	.013	Al_2O_3 0.009	65d
.023	.056	.046	.001	.036	-----	-----	.032	------	-----	---------	152a
.032	.010	.016	.001	.003	-----	-----	-----	------	-----	---------	178
-----	-----	-----	-----	-----	-----	-----	-----	------	-----	---------	335
-----	-----	-----	-----	-----	-----	-----	-----	------	-----	---------	337

Low Alloy Steels (Continued)

Cr	V	Mo	W	Co	Ti	As	Sn	Al Total	Nb	Ta	Zr	N	SRM
0.95	0.18	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	30f
.678	.002	0.023	-----	-----	-----	-----	(0.011)	-----	-----	-----	-----	0.009	32e
.143	.002	.246	-----	-----	-----	-----	-----	-----	-----	-----	-----	(.011)	33d
2.18	.004	.996	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36b
0.891	.005	.184	-----	-----	-----	-----	-----	-----	-----	-----	-----	.009	72f
.063	.003	.237	-----	-----	-----	-----	-----	-----	-----	-----	-----	.004	100b
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	105
1.18	.003	.199	-----	-----	-----	-----	-----	1.07	-----	-----	-----	-----	106b
0.019	-----	.008	-----	-----	-----	-----	.003	0.329	-----	-----	-----	-----	125b
.486	.003	.183	-----	-----	-----	-----	-----	-----	-----	-----	-----	.008	139a
.485	.014	.039	0.517	-----	-----	-----	-----	-----	-----	-----	-----	-----	155
.69	.011	.19	(.011)	0.030	0.02_0	0.01_2	$.01_1$	$.02_1$	0.02_2	(0.021)	0.01_1	(.0037)	361
.30	.040	.068	(.20)	.30	(.084)	(.079)	(.016)	(.086)	(.28)	(.20)	(.21)	(.0040)	362
1.31	.31	.028	(.047)	$.04_9$	(.06)	(.011)	(.094)	(.25)	(.049)	(.04)	(.048)	(.0042)	363
0.06_3	$.10_5$	.49	(.10)	.15	(.24)	(.057)	(.005)	(.014)	(.157)	(.11)	(.070)	(.003)	364

Ca	Mg	Zn	Pr	Ge	O	H	Au	Hf	SRM
(0.0001)	(0.0002)	(0.0005)	(0.0005)	(0.006)	(0.001)	(<0.0005)	(<0.00005)	(0.0002)	361
(.0003)	(.0007)	(.001)	(.0003)	(.002)	(.001)	(<.0005)	(<.00006)	(.0040)	362
(<.0001)	(.0005)	(.0004)	(.0005)	(.010)	(.0006)	(<.0005)	(.0006)	(.0042)	363
(.00005)	(.00005)	(.0005)	(.0001)	(.003)	(.0017)	(<.0005)	(.00007)	(.005)	364

High Alloy Steels (150 gram units unless otherwise noted)

Chemical Composition (Nominal Weight Percent)

SRM	Type	C	Mn	P	S		Si	Cu
					Grav	Comb		
126c	High-Nickel Steel (36% Ni)	[6] 0.026	0.47	0.004	----	0.006	0.19	0.040
131b	Low Carbon-Silicon (Carbon only) 100 grams	.0018	-----	-----	-----	-----	-----	-----
344	Cr15-Ni7-Mo2-Al1	.69	.57	.018	-----	.019	.395	.106
345	Cr16-Ni4Cu3	.048	.224	.018	0.012	.012	.610	3.44
346	Cr22-Ni4-Mn9	.541	9.15	.018	-----	.063	.239	-----
348	Ni26-Cr15 (A286)	.044	1.48	.015	-----	.002	.54	0.22

Stainless Steels (150 gram units unless otherwise noted)

Chemical Composition (Nominal Weight Percent)

SRM	Type	(Other Forms)	C	Mn	P	S		Si	Cu
						Grav	Comb		
73c	Cr13 (SAE 420)		0.310	0.330	0.018	-----	0.036	0.181	0.080
121d	Cr17-Ni11-Ti0.3 (AISI 321)	1171	.067	1.80	.019	-----	.013	.54	.121
123c	Cr17-Ni11-Nb0.6 (AISI 348)	1172	.056	1.75	.024	-----	.014	.59	.103
133a	Cr13-Mo0.3-S0.3		.120	1.03	.026	0.326	.330	.412	.118
160b	Cr19-Ni14-Mo3		.046	1.64	.020	-----	.018	.509	.172
166c	Low Carbon (AISI 3162) Carbon Only		.0078	-----	-----	-----	-----	-----	-----
339	Cr17-Ni9-Se0.2 (SAE 303Se)		.052	0.738	.129	-----	.013	.654	.199
343	Cr16-Ni2 (SAE 431)		.150	-----	-----	-----	-----	-----	-----

Tool Steels (150 gram units unless otherwise noted)

Chemical Composition (Nominal Weight Percent)

SRM	Type	C	Mn	P	S		Si	Cu
					Grav	Comb		
50c	W18-Cr4-V1	0.719	0.342	0.022	0.010	0.009	0.311	0.079
132b	Mo-W-Cr-V	.865	.349	.013	----	.005	.18	.087
134a	Mo8-W2-Cr4-V1	.808	.218	.18	.007	.007	.323	.101
153a	Co8-Mo9-W2-Cr4-V2	.902	.192	.023	.007	.007	.270	.094

Steels (Granular Form – 100 gram units)

These granular-form SRM's are prepared by a pre-alloyed powder metallurgical process, which generally includes argon atomization and hydrogen annealing. The material normally is sized between 25 and 200 mesh sieves to ensure satisfactory homogeneity.

The Certificate of Analysis, provided with each of these SRM's gives the chemical composition as determined at NBS and values obtained by other laboratories that cooperated in the certification of the SRM's.

Chemical Composition (Nominal Weight Percent)

SRM	Type	Wt/Unit (grams)	C	Mn	P	S	Si	Cu	Ni
163	Low Alloy, 1.0 Cr	100	0.933	0.897	0.007	0.027	0.488	0.087	0.081
101f	Stainless, (AISI 304L)	100	.014	.087	.008	.008	.876	.030	9.96

SRM	Cr	V	Mo	W	Co	N	As	Sb	Ga
163	0.982	-----	0.029	-----	-----	0.007	-----	-----	-----
101f	18.49	0.034	.007	(0.0002)	0.088	-----	(0.003)	(0.0009)	(0.004)

High Alloy Steels (Continued)

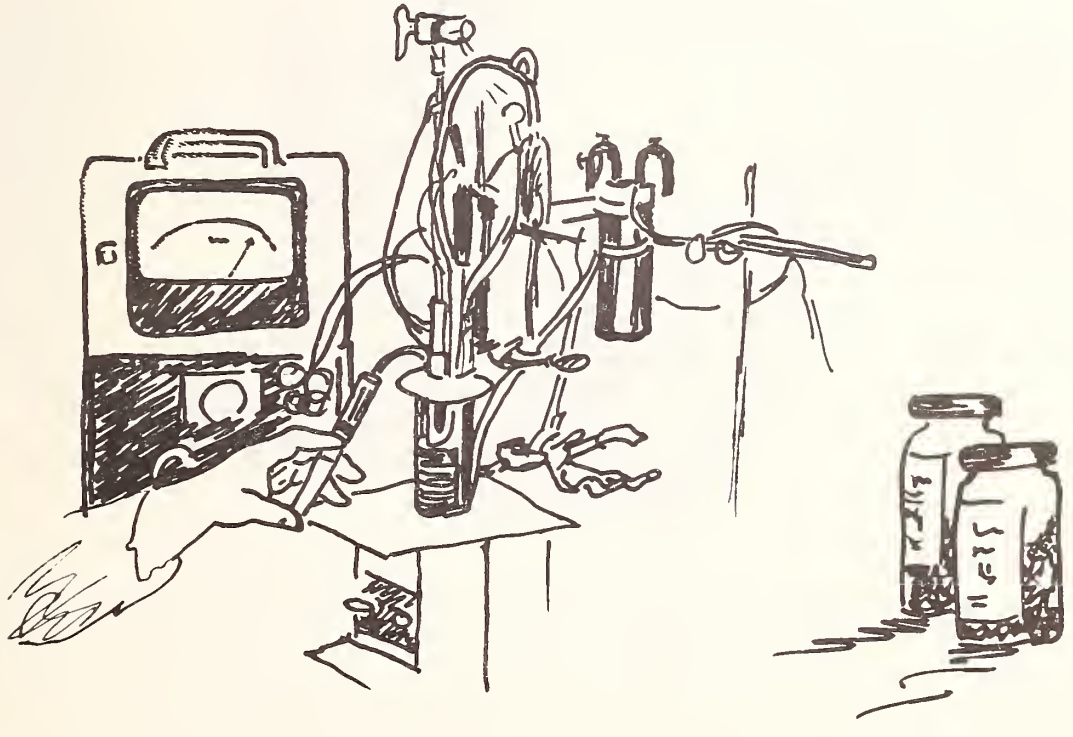
Ni	Cr	V	Mo	Co	Ti	Al Total)	Nb	Ta	B	Fe	SRM
36 .05	0.06$_4$	0.001	0.011	0 .008	----	----	----	----	-----	----	126c
-----	-----	-----	-----	-----	-----	----	-----	-----	------	----	131b
7.28	14.95	0.040	2.40	-----	0.076	1.16	-----	0.002	------	----	344
4.24	16.04	.041	0.122	.089	-----	----	0.231	-----	------	----	345
3.94	21.61	.058	-----	-----	-----	----	-----	N .441	------	----	346
25.8	14.54	.25	1.3	----	2.24	0.23	-----	-----	0.0031	53.3	348

Stainless Steels (Continued)

Ni	Cr	V	Mo	Co	Ti	Nb	Ta	Pb	Se	N	SRM
0.246	12.82	0.030	0.091	-----	-----	----	------	-----	----	0.037	73c
11.17	17.4$_3$	-----	.165	0.10	0.342	----	------	-----	-----	-----	121d
11.3$_4$	17.4$_0$	-----	.22	.12	-----	0.65	<0.001	-----	-----	-----	123c
0.241	12.89	.026	.294	-----	-----	----	------	-----	-----	.032	133a
12.2$_6$	18.4$_5$	.047	2.38	.10$_1$	-----	----	------	0.001	-----	.03$_9$	160b
------	-----	-----	-----	-----	-----	----	------	-----	-----	-----	166c
8.89	17.42	.058	0.248	.096	-----	----	------	-----	0.247	-----	339
2.14	15.76	.036	-----	-----	-----	----	------	-----	-----	.074	343

Tool Steels (Continued)

Ni	Cr	V	Mo	W	Co	Sn	As	N	SRM
0.069	4.13	1.16	0.082	18.44	----	0.018	0.022	0.012	50c
.23	4.38	1.84	4.9$_3$	6.2$_8$	0.028	----	----	----	132b
.088	3.67	1.25	8.35	2.00	----	-----	-----	-----	134a
.168	3.72	2.06	8.85	1.76	8.47	-----	-----	.024	153a

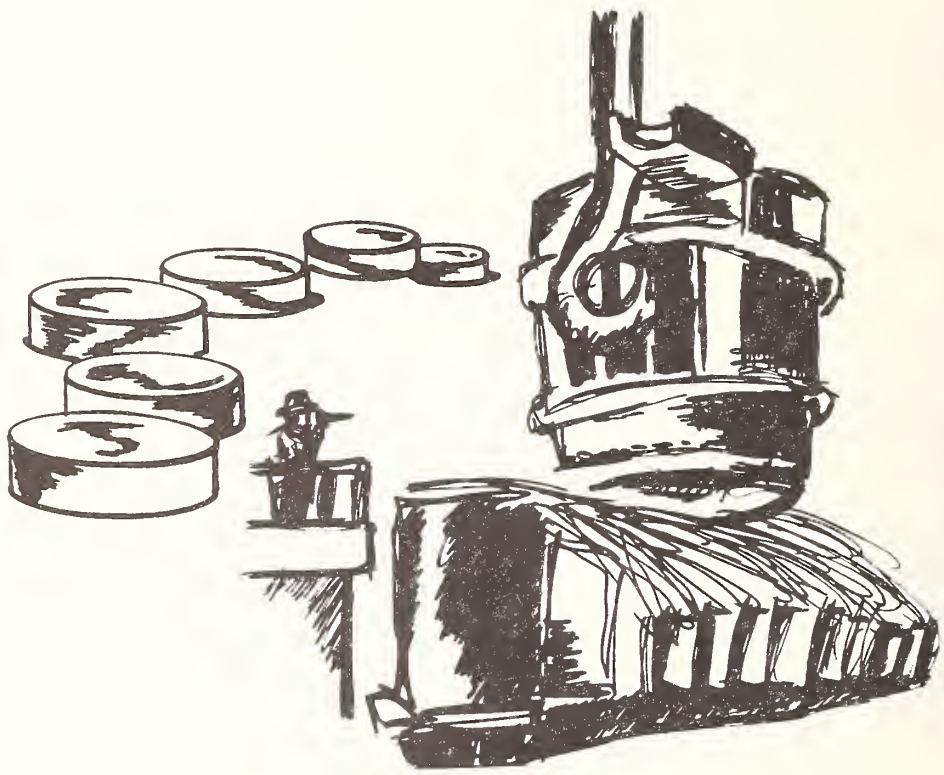


Steels (Solid Form)

Several groups of SRM's have been prepared to meet the basic needs of the steel industry for analytical control primarily by optical emission and x-ray spectroscopic methods of analysis. Both nominal composition and analytical range SRM's are provided for ingot iron, low-alloy steel, stainless steel, tool steel, and specialty steel.

These SRM's are furnished in various forms. The 400 series is intended for optical emission spectroscopic methods of analysis utilizing the "point-to-point" technique. The 600 series is intended for microchemical methods of analysis such as electron probe microanalysis, spark source mass spectrometric analysis, and laser probe analysis. The 800, 1100, and 1200 series are intended for "point-to-plane" optical emission spectroscopic methods of analysis. The D800 series, and the 1100 and 1200 series also are intended for x-ray spectroscopic methods of analysis.

Because of the special homogeneity requirements, most of these materials have been prepared by using the most modern techniques of melting, casting, fabrication, and heat treatment to ensure adequate uniformity of composition. A Certificate of Analysis, which gives the chemical composition as determined at the NBS, is furnished for each SRM; many certificates also include values obtained by outside laboratories which cooperated in the certification of the SRM's. (Values in parentheses are not certified as they are based on the results from a single laboratory. Values in brackets are not certified but are nominal values obtained from heat analyses. These values are given for additional information on the chemical composition.)



Ingot Iron and Low-Alloy Steels

The preparation of these original spectroscopic SRM's began in about 1944 when the cores remaining after lathe cutting the materials for chip form standards were tested for homogeneity. Those found satisfactory were fabricated to the final shapes and sizes. To meet the urgent need in the mid-1950's for calibration standards for x-ray spectroscopic methods of analysis, portions of the material from five of these SRM's were converted to the applicable disk form. Although entirely satisfactory for conventional spectroscopic methods of analysis, these SRM's generally do not meet the stringent requirements for homogeneity necessary for use with the newer microchemical methods of analysis. These standards will be discontinued when the supply is exhausted.

SRM				Chemical Composition (Nominal Weight Percent)				
7/32 in D × 4 in Long	1/2 in D × 2 in Long	1 1/4 in D × 1/4 in Disk	Type	Mn	Si	Cu	Ni	Cr
----	803a	D803a	Acid Open Hearth, 0.6C	1.04	0.34	0.096	0.190	0.101
404a	804a	----	Basic Electric	0.88	.44	.050	.040	.025
405a	805a	D805a	Medium Manganese	1.90	.27	.032	.065	.037
407a	807a	D807a	Chromium-Vanadium	0.76	.29	.132	.169	.92
408a	808a	----	Chromium-Nickel	.76	.28	.10	1.20	.655
409b	809b	D809b	Nickel	.46	.27	.104	3.29	.072
----	810a	----	Cr2-Mo1	----	.36	.11	0.24	2.39
413	----	----	Acid Open Hearth, 0.4C	.67	.22	.25	.18	0.055
414	----	----	Cr-Mo (SAE 4140)	.67	.26	.11	.080	.99
417a	817a	----	Basic Open Hearth, 0.4C	.78	----	.13	.062	.050
418	----	----	Cr-Mo (SAE X4130)	.52	.28	----	.11	.96
418a	----	----	Cr-Mo (SAE X4130)	.52	.27	.040	.125	1.02
420a	820a	D820a	Ingot Iron	.017	----	.027	.0092	0.0032
----	821	----	Cr-W, 0.9C	1.24	----	.080	.10	.49
427	827	----	Cr-Mo (SAE 4150) (B only)	----	----	----	-----	-----

SRM			Chemical Composition (Nominal Weight Percent)						
7/32 in D × 4 in Long	1/2 in D × 22 in Long	1 1/4 in D × 1/4 in Disk	V	Mo	W	Co	Sn	Al Total	B
----	803a	D803a	0.005	0.033	----	-----	------	-----	------
404a	804a	----	.002	.007	----	-----	------	-----	------
405a	805a	D805a	-----	.005	----	-----	------	0.056	------
407a	807a	D807a	.146	-----	----	-----	------	-----	------
408a	808a	----	.002	.065	----	-----	------	-----	------
409a	809a	D809a	.002	.009	----	0.025	0.012	-----	------
----	810a	----	-----	.91	----	-----	------	-----	------
413	----	----	.007	.006	----	-----	------	-----	------
414	----	----	.003	.32	----	-----	.014	.020	------
417a	817a	----	-----	.013	----	-----	.036	-----	------
418	----	----	-----	.22	----	-----	------	-----	------
418a	----	----	-----	.21	----	-----	------	-----	------
420a	820a	D820a	-----	.0013	----	.006	.0017	.003	------
----	821	----	.012	.040	0.52	-----	------	-----	------
427	827	----	-----	-----	----	-----	------	-----	0.0027

Special Ingot Irons and Low-Alloy Steels

The planning of the 1100 series SRM's began in late 1952 to meet critical requirements of calibration in the iron and steel industry. Steel for these SRM's was prepared by the most modern melting, casting, and fabrication techniques to provide large quantities of material of the highest possible homogeneity. The materials were fully characterized and included investigations by means of electron probe microanalysis and quantitative metallographic techniques. It was concluded that, for example, SRM's 461 and 463 are sufficiently homogeneous that any present microanalytical technique can be carried out with little chance of inaccuracy caused by inhomogeneity. Details of the metallographic and homogeneity characterization are given in NBS Miscellaneous Publication 260-3 and 260-10, respectively (see inside back cover for ordering instructions).

These SRM's were first issued in 1957 and they have been in great demand ever since. Several years ago it became apparent that supplies of some of the 1100 series would be exhausted. To remedy this situation, the new 1200 series (SRM's 1261-1265) was prepared.

The 1200 Series consists of four low alloy steels and an electrolytic iron containing a graded series of 40 elements. Material from the same melts are available in three other forms: chip form, 361-365, for chemical methods of analysis, (pages 16 and 28); rods, 661-665, 3.2 mm (1/8 in) in diameter and 51 mm (2 in) long for microchemical methods of analysis such as electron probe microanalysis, spark source mass spectrometric analysis, and laser probe analysis (see below); and rods (1095-1099), 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long for determining gases in metals by vacuum fusion and neutron activation methods of analysis (page 27).

SPECIAL INGOT IRONS AND LOW ALLOY STEELS

Chemical Composition (Nominal Weight Percent)

Sizes: 400 Series – 7/32 in D × 4 in long
600 Series – 3.2 mm D × 51 mm long
1100 Series – 1 1/4 in D × 3/4 in thick
1200 Series – 31 mm D × 19 mm thick

Sets: 666 Set of 2: 661 and 665
667 Set of 2: 662 and 663
668 Set of 5: 661, 662, 663, 664, and 665
1266 Set of 5: 1261, 1262, 1263, 1264, and 1265

SRM		Type	(Other Forms)	C	Mn	P	S	Si	Cu	Ni	Cr
	1134	High Silicon	125b	0.026	0.277	0.028	0.009	2.89	0.070	0.038	0.019
	1135	High Silicon	(179)	.027	.094	.006	.026	3.19	.056	.050	.022
461		Low Alloy A		.15	.36	.053	(.02)	0.047	.34	1.73	.13
462		Low Alloy B		.40	.94	.045	(.02)	.28	.20	0.70	.74
463		Low Alloy C		.19	1.15	.031	(.02)	.41	.47	.39	.26
464		Low Alloy D		.54	1.32	.017	(.02)	.48	.094	$.13_5$	.078
465	1165	Ingot Iron E		.037	0.032	.008	(.01)	.029	.019	.026	.004
466	1166	Ingot Iron F		.065	$.11_3$	.012	(.01)	.025	.033	.051	.011
467	1167	Low Alloy G		.11	$.27_5$	.033	(.01)	.26	.067	.088	.036
468		Low Alloy H		.26	.47	.023	(.02)	.075	.26	1.03	.54
661	1261	AISI 4340	361,1095	$.38_2$	.66	.015	.017	.223	.042	1.99	.69
662	1262	AISI 94B17 (Mod)	362,1096	$.16_0$	1.04	.042	.038	.39	.50	0.59	.30
663	1263	Cr-V (Mod)	363,1097	.62	1.50	$.02_9$	.008	.74	$.09_8$	.32	1.31
664	1264	High Carbon (Mod)	364,(1098)	$.87_0$	0.25_5	$.01_8$	.028	.067	$.24_9$	$.14_2$	0.06_5
665	1265	Electrolytic Iron	365,1099	.0067	.0057	$.002_5$	.0059	$.008_0$	.0058	.041	$.007_2$

SRM		B	Pb	Ag	Ge	O	N	H
	1134	------	-------	-------	--------	----------	----------	---------
	1135	------	-------	-------	--------	----------	----------	---------
461		0.000_2	(0.003)	(0.001_5)	(0.001_5)	(0.02_0)	(0.00_6)	---------
462		$.000_5$	.006	(<.0002)	$(.003_0)$	(.006)	$(.00_8)$	---------
463		.0012	.012	(<.0002)	$(.002_5)$	(.007)	$(.00_6)$	---------
464		.005	.020	$(.003_2)$	$(.001_5)$	(.006)	$(.00_7)$	---------
465	1165	$.000_1$	(<.0005)	$(.0002_5)$	$(.003_5)$	(.003)	$(.00_5)$	---------
466	1166	$(.000_2)$	$(.001_3)$	$(.0004_5)$	$(.003_0)$	(.005)	$(.00_6)$	---------
467	1167	$(.000_2)$	$.000_6$	$(.004_0)$	$(.003_0)$	(.004)	$(.00_4)$	---------
468		.009	(<.0005)	(<.0005)	$(.001_0)$	(.004)	$(.00_6)$	---------
661	1261	.0005	$.00002_5$	.0004	[.006]	(.0009)†	(.0037)†	[<0.0005]†
662	1262	.0025	$.0004_3$	(.0010)	[.002]	(.0011)†	(.0041)†	[<.0005]†
663	1263	$.0009_1$	.0022	(.0038)	[.010]	(.007)†	(.0041)†	[<.0005]†
664	1264	.011	.024	(.00002)	[.003]	[.0017]†	[.003]†	[<.0005]†
665	1265	.00013	$.00001_5$	(∼.000002)	(∼.0014)	(∼.0063)†	(∼.0011)†	(∼.0001)†

SRM		Sb	Bi	Ca	Mg	Se	Te
661	1261	0.004_2	0.0004	(<0.0001)	(0.0001)	0.004	0.0006
662	1262	.012	(.002)	(.0002)	(.0006)	[.001]	(.0005)
663	1263	$.001_6$	(.0008)	(<.0001)	(.0005)	[.0001]	(.0022)
664	1264	(.035)	(.0009)	(<.0001)	(.0001)	[.0003]	[.0002]
665	1265	–(<.00005)	–(<.00001)	–(<.00001)	–(<.00002)	–(<.00001)	–(<.00001)

SRM		Zn	Au	Ce	Hf	La	Nd	Pr	Fe
661	1261	(0.0001)	(<.0.00005)	0.001_3	[0.0002]	0.0004	0.0003	(0.00014)	(95.6)
662	1262	0.0005)	(<.00005)	(.0011)	[.006]	.0004	(.0005)	(.00012)	(95.3)
663	1263	(.0004)	.0005	(.0016)	[.0015]	.0006	(.0007)	(.00018)	(94.4)
664	1264	/.001	-.0001	(.00025)	[.005]	.00007	(.00012)	(.00003)	(96.7)
665	1265	(<.0001)	–(<.000002)	–(<.000005)	–(<.00002)	–(<.000005)	–(<.000005)	–(<.000005)	(99.9)

(Continued)

V	Mo	W	Co	Ti	As	Sn	Al Total	Nb	Ta	Zr		
-----	0.008	------	------	------	-----	0.003	0.329	-------	-------	--------		1134
<0.01	.014	------	------	------	-----	.004	.0028	-------	-------	-------		1135
.024	.30	0.012	0.26	(0.01)	0.028	.022	.005	0.011	0.002	(<0.005)	461	
.058	.080	.053	.11	.037	.046	.066	$.02_3$	.096	.036	.063	462	
.10	.12	$.10_5$	$.01_3$	.010	.10	.013	$.02_7$	$.19_5$	.15	.20	463	
$.29_5$	.029	.022	$.02_8$	.004	.018	.043	.005	.037	.069	.010	464	
.002	.005	(.001)	.008	.20	.010	.001	.19	(.001)	.001	(.002)	465	1165
.007	.011	(.006)	$.04_6$	.057	.014	.005	$.01^5$	.005	.002	(<.005)	466	1166
.041	.021	.20	$.07_4$	.26	.14	.10	.16	.29	.23	.094	467	1167
.17	.20	.077	.16	.011	.008	.009	$.04_2$	.006	.005	(<.005)	468	
.011	.19	$.01_5$	.030	.020	.017	$.01_1$	$.02_1$	.022	.020	.009	661	1261
$.04_1$	$.06_8$	.21	.30	.084	$.09_2$	.016	$.09_5$	.29	.20	.19	662	1262
.31	.030	$.04_5$	.048	.050	.010	(.095)	.24	.049	(.053)	.049	663	1263
$.10_5$	.49	.10	.15	.24	$.05_2$	[.005]	(.008)	$.15_7$	.11	.068	664	1264
.0006	.0050	(∿.00004)	$.007_0$	.0006	(.0002)	(∿.0002)	(.0007)	(<.00001)	–(<.00005)	–(<.00001)	665	1265

NOTE: Values in parentheses not certified, based on a single analytical method.
Values in brackets not certified, approximate values from the heat analyses.
†From Gasometric Certificates: SRM's 1095 through 1099.
–Not detected, value given is conservative "Upper Limit" of detection by specific methods of analysis.

Stainless Steels

Three groups of stainless steel SRM's designed primarily for calibration in spectroscopic methods of analysis are available.

Group I, SRM 442 through 444, consists of three SRM's of the 18 Cr - 8 Ni type stainless steel available only in rod form for use with the "point-to-point" technique in emission spectroscopy.

Group II is comprised of six standards, each available in three different physical forms; the 400, the 800, and the D800 series.

Both Group I and Group II standards have been extensively tested for homogeneity and found satisfactory for application in conventional spectroscopic methods of analysis. Neither group, however, has been tested for microanalytical methods and their use in these applications is not recommended.

Group III consists of six stainless steels available only in disk form and two in both chip and disk form for the "point-to-plane" technique of emission spectroscopy and for x-ray spectroscopy. They were prepared by melting, casting, and fabrication techniques known to produce material of high homogeneity.

(Values in parentheses are not certified, but are given for additional information only).

GROUP I

SRM 7/32 in D × 4 in Long	Name	Chemical Composition (Nominal Weight Percent) Mn	Si	Cu	Ni	Cr	V	Mo	W	Co
442	Cr16-Ni10	2.88	(0.09)	0.11	9.9	16.1	0.032	0.12	(0.08)	0.13
443	Cr18.5-Ni9.5	3.38	(.15)	.14	9.4	18.5	.064	.12	(.09)	.12
444	Cr20.5-Ni10	4.62	(.65)	.24	10.1	20.5	.12	.23	(.17)	.22

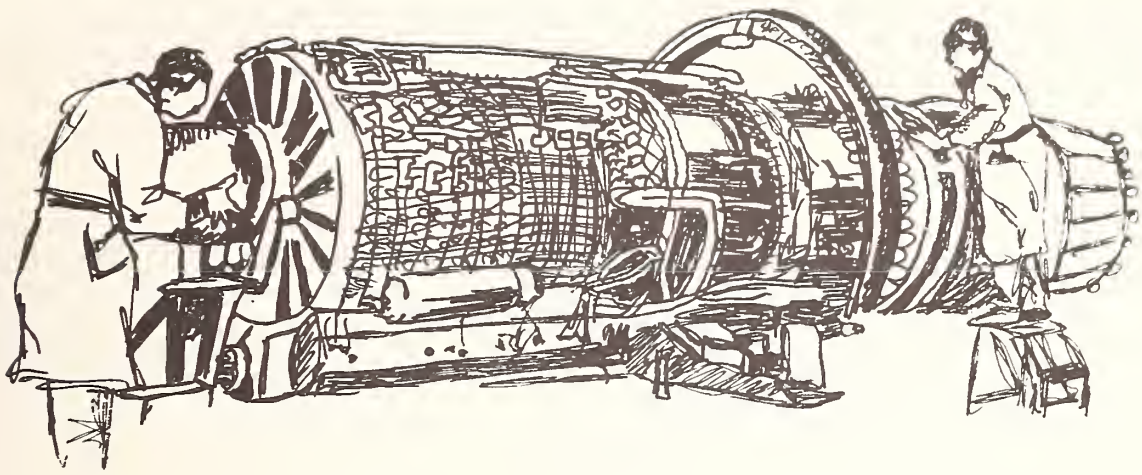
GROUP II

SRM 7/32 in D × 4 in Long	SRM 1/2 in D × 2 in Long	SRM 1 1/4 in D × 1/4 in Disks	Name	Chemical Composition (Nominal Weight Percent) Mn	Si	Cu	Ni	Cr	V
445	845	D845	Cr13-Mo0.9 (Mod. AISI 410)	0.77	0.52	0.065	0.28	13.31	(0.05)
446	846	D846	Cr18-Ni9 (Mod. AISI 321)	.53	1.19	.19	9.11	18.35	(.03)
447	847	D847	Cr24-Ni13 (Mod. AISI 309)	.23	0.37	.19	13.26	23.72	(.03)
448	----	D848	Cr9-Mo0.3 (Mod. AISI 403)	2.13	1.25	.16	.52	9.09	(.02)
449	849	D849	Cr5.5-Ni6.5	1.63	0.68	.21	6.62	5.48	(.01)
450	850	D850	Cr3-Ni25	----	.12	.36	24.8	2.99	(.006)

GROUP III

Chemical Composition (Nominal Weight Percent)

SRM	Type	(Other Forms)	C	Mn	P	S	Si	Cu	Ni	Cr
1152	Cr18-Ni10	----	0.163	1.19	0.017	0.017	0.654	0.497	10.21	18.49
1154	Cr19-Ni10	----	.094	1.74	.038	.033	1.09	.560	10.25	19.58
1155	Cr18-Ni12-Mo2 (AISI 316)	----	.046	1.63	.020	.018	0.50	.169	12.18	18.45
1185	Cr17-Ni13-Mo2 (AISI 316)	----	.11	1.22	.019	.016	.40	.067	13.18	17.09
1171	Cr17-Ni11-Ti0.3	121d	.067	1.8_0	.018	$.01_3$	.54	.121	11.2	17.4
1172	Cr17-Ni11-Nb0.6	123c	.056	1.7_6	.025	$.01_4$	.59	$.10_5$	11.3_5	17.4_0



GROUP I (Continued)

Chemical Composition (Nominal Weight Percent)								SRM
Ti	Sn	Nb	Ta	B	Pb	Zr	Zn	7/32 in D × 4 in Long
0.002	0.0035	0.032	(0.0006)	0.0005	0.0017	(0.004)	(.003)	442
.003	.006	.056	(.0008)	.0012	.0025	------	(.005)	443
.019	.014	.20	(.004)	.0033	.0037	(.011)	(.004)	444

GROUP II (Continued)

Chemical Composition (Nominal Weight Percent)						SRM		
Mo	W	Ti	Sn	Nb	Ta	7/32 in D × 4 in Long	1/2 in D × 2 in Long	1 1/4 in D × 1/4 in Disks
0.92	(0.42)	(0.03)	----	0.11	(0.002)	445	845	D845
.43	(.04)	(.34)	(0.02)	.60	(.030)	446	846	D846
.059	(.06)	(.02)	----	.03	(.002)	447	847	D847
.33	(.14)	(.23)	(.05)	.49	(.026)	448	----	D848
.15	(.19)	(.11)	(.07)	.31	(.021)	449	849	D849
----	(.21)	(.05)	(.09)	.05	(.002)	450	850	D850

GROUP III (Continued)

V	Mo	Co	Ti	As	Sn	Al	Nb	Ta	B	Pb	Zr	SRM
0.044	0.366	(0.095)	(0.12)	(0.01)	(0.004)	(0.003)	(0.20)	(0.085)	(0.005)	(0.001)	(0.03)	1152
.061	.463	(.12)	(.48)	(.03)	(.023)	(.035)	(.26)	(.045)	(.0006)	(.012)	(.022)	1154
.047	2.38	.101	------	------	-------	-------	------	-------	-------	.001	------	1155
-----	2.01	-------	<.001	------	-------	-------	<.001	<.001	-------	-------	------	1185
-----	0.16_5	.10	.34	------	-------	-------	------	-------	-------	-------	------	1171
-----	.22	.12	------	------	-------	-------	0.65	<.001	-------	-------	------	1172

Tool Steels

A group of six high-speed tool steel SRM's is available in three different physical forms. A wide concentration range is covered by combining the concentration ranges of three American Iron and Steel Institute (AISI) designations with three other tool steels of tailored composition.

SRM				Chemical Compositions (Nominal Weight Percent)							
7/32 in D× 4 in Long	1/2 in D× 2 in Long	1 1/4 in D× 1/4 in Disk	Type	Mn	Si	Cu	Cr	V	Mo	W	Co
436		D836	Special (Cr6-Mo3-W10)	0.21	0.32	0.075	6.02	0.63	2.80	9.7	----
437	837	D837	Special (Cr8-Mo2-W3-Co3)	.48	.53	-----	7.79	3.04	1.50	2.8	2.9
438	838	D838	Mo High Speed (AISI-SAE-M30)	.20	.17	.17	4.66	1.17	8.26	1.7	4.9
439	839	D839	Mo High Speed (AISI-SAE-M36)	.18	.21	.12	2.72	1.50	4.61	5.7	7.8
440	840	D840	Special W High Speed (Cr2-W13-Col 12)	.15	.14	.059	2.12	2.11	0.070	13.0	11.8
441	841	D841	W High Speed (AISI-SAE-TI)	.27	.16	.072	4.20	1.13	.84	18.5	----

Maraging Steel

This alloy derives its name from the formation of martensite on age hardening. They attain remarkable metallurgical properties by a simple heat treatment. Extensive use of these alloys is expected, particularly in submarines, missiles, and aircraft. This Maraging Steel, SRM No. 1156, of the 19 percent nickel type, is designed primarily for calibration in optical emission and x-ray spectroscopic methods of analysis.

SRM		Chemical Compositions (Nominal Weight Percent)						
1 1/4 in D× 3/4 in Disk	Type	C	Mn	P	S	Si	Cu	
1156	Maraging, (Ni 19)	0.023	0.21	0.011	0.012	0.184	0.025	

	Ni	Cr	Mo	Co	Ti	Al	Zr	B	Ca
1156	19.0	0.20	3.1	7.3	0.21	0.047	0.004	0.003	<0.001

High-Temperature Alloys (Solid Form)

High-temperature alloy SRM's were prepared to meet the critical needs of industry, particularly the aerospace industry, and government agencies. These SRM's are useful in instrument calibration, primarily for x-ray and optical emission spectroscopic methods of analysis.

Chemical Composition (Nominal Weight Percent)

SRM	Type	C	Mn	P	S	Si	Cu
1206-2	Rene-41	0.21_7	0.030	(0.004)	0.006	0.21_6	0.040
1207-1	Waspaloy(1)	.043	.34	.005	.009	$.47_2$	.026
1207-2	Waspaloy(2)	.083	$.29_5$	.005	.009	$.61_5$	.033
1208-1	Inco 718(1)	.046	$.38_5$	.003	$.01_1$	$.43_4$	$.14_7$
1208-2	Inco 718(2)	.022	$.23_0$	.003	.007	$.08_3$	.077

1209 Set, 1 each: 1206-2, 1207-1, 1207-2, 1208-1, and 1208-2

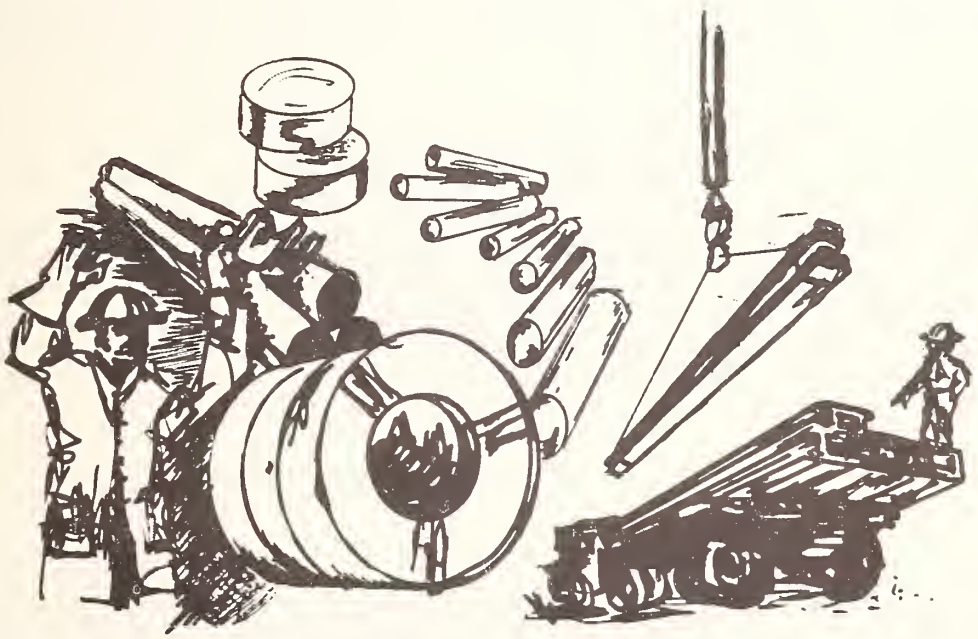
SRM	Ni	Cr	Mo	Co	Ti	Al	Nb	Ta	Fe
1206-2	53.3	19.7	10.3_0	11.5_5	2.9_4	1.7_4	----	------	0.46
1207-1	56.1	18.88	4.50	13.0_5	3.09	1.26	----	------	2.22
1207-2	55.7	19.4_4	4.34	13.5_0	2.54	1.3_2	----	------	2.09
1208-1	51.9	17.5^{*}	3.2_2	0.82	0.46	(0.15)	5.3_8	(0.012)	19.2
1208-2	51.5	17.4	3.13	0.76	(0.8_5)	(0.8_5)	4.9_8	(0.012)	19.8

Oxygen Standards

These SRM's are issued for the determination of oxygen and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods. SRM's 1095-1099 were prepared from the same melt as the 1200 series (1261-1265), page 22.

(Values in parentheses are not certified, but are given for information only.)

SRM	Type	Unit	Oxygen (ppm)	Nitrogen (ppm)
1090	Ingot iron	Rods 1/4 in D × 4 in Long	491	(60)
1091	Stainless Steel (AISI 431)	Rods 5/16 in D × 4 in Long	131	(945)
1092	Vacuum-melted steel	Rods 1/4 in D × 4 in Long	28	(4)
1093	Valve steel	Rods 1/4 in D × 4 in Long	60	(4807)
1094	Maraging steel	Rods 1/4 in D ×4 in Long	4.5	(71)
1095	AISI 4340 Steel	Rods 6.4 mm in D × 102 mm Long	9	(37)
1096	AISI 94B17 (Mod) Steel	Rods 6.4 mm in D × 102 mm Long	10.7	40.4
1097	Cr-V (Mod) Steel	Rods 6.4 mm in D × 102 mm Long	6.6	(41)
1098	High Carbon (Mod) Steel	Rods 6.4 mm in D × 102 mm Long	(17)	(30)
1099	Electrolytic Iron	Rods 6.4 mm in D × 102 mm Long	61	(13)
1089	Set of 5: 1095, 1096, 1097, 1098, and 1099			



Cast Irons (Chip Form – 150 gram units, unless otherwise noted)

This group of cast iron SRM's is similar to the chip-form steels and was prepared for use in checking chemical methods in the cast iron industry. These SRM's are in the form of chips, usually sized between 16- and 25-mesh sieves. They are prepared by lathe cutting of chips with a multiple-tooth cutting tool from thin-wall cylindrical castings especially made for the purpose. Supplied with each SRM is a Certificate of Analysis listing the chemical composition determined at NBS and other laboratories that cooperated in the certification of the SRM's. For SRM 365, Electrolytic Iron, the Certificate provides information on these additional elements: W, Nb, Ag, Zn, Ge, O, H, Ta, Nd, Zr, Sb, Bi, Ca, Mg, Se, Te, Ce, La, Pr, Au, Hf, and Fe.

(Values in parentheses are not certified, but are given for information only.)

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)							
			C				S			
			Total	Graphitic	Mn	P	Grav.	Comb.	Si	Cu
3b	White	110	2.44	----	0.353	0.086	-----	0.088	1.04	0.050
4j	Cast	150	2.99	2.38	.79	.17	-----	.062	1.31	.24
5L	Cast	150	2.59	1.99	.68	.280	-----	.123	1.83	1.01
6g	Cast	150	2.84	2.00	1.06	.56	-----	.123	1.06	0.50
7g	Cast (High Phosphorus)	150	2.69	2.59	0.612	.794	0.061	.060	2.41	.128
55e	Ingot	150	0.0112	----	.035	.003	.012	.011	0.001	.065
82b	Cast (Ni-Cr)	150	2.85	2.37	.745	.025	-----	.007	2.10	.038
107b	Cast (Ni-Cr-Mo)	150	2.75	1.87	.510	.058	.067	.067	1.35	.235
115a	Cast (Cu-Ni-Cr)	150	2.62	1.96	1.00	.086	.064	.065	2.13	5.52
122e	Cast (Car Wheel)	150	3.51	2.78	0.528	.349	-----	.074	0.510	0.033
341	Ductile	150	1.81	1.23	.92	.024	.007	.007	2.44	.152
342	Nodular	150	2.45	2.14	.369	.020	.014	.014	2.85	.14
342a	Nodular	150	1.86	1.38	.275	.018	-----	.006	2.73	.14
365	Electrolytic Iron	150	0.0070		.0057	.003		.006	0.007_6	.0058

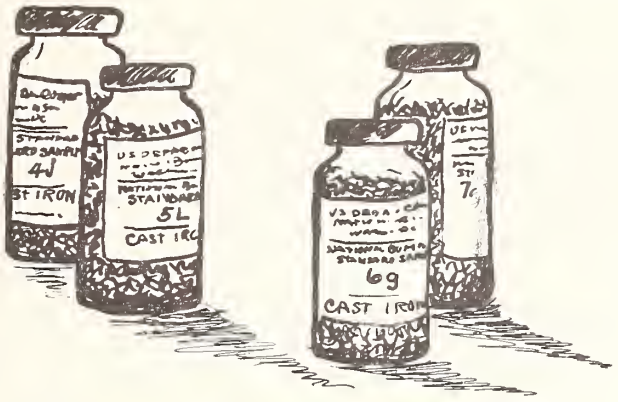
Cast Steels, White Cast Irons, Ductile Irons and Blast Furnace Irons (Solid Form)

These chill-cast SRM's were prepared for use in analytical control of cast steels and cast irons by rapid instrumental methods. Although employed in x-ray spectroscopic analysis, they are particularly useful for calibrating vacuum optical emission spectrometers because they permit the determination of carbon, phosphorus, and sulfur in addition to the metallic elements.

These SRM's are chill-cast sections. Details of the preparation and intended use of the SRM's are given in the NBS Miscellaneous Publication 260-1. (See inside back cover for ordering instructions.)

(Values in parentheses are not certified, but are given for information only.)

SRM 1 1/4 in × 1 1/4 in × 1/2 in	Type	Chemical Composition (Nominal Weight Percent)									
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo
1147	White (4i)	3.60	0.78	.160	.059	1.31	0.23	0.070	0.093	.032	0.078
1148	White (5L)	2.89	.66	.300	(.11)	1.82	.99	.091	.146	.036	.022
1149	White (6g)	3.28	1.05	.564	.127	1.04	.49	.138	.363	.055	.036
1140	Ductile (No. 1)	3.18	0.725	.0070	.010	1.92	.10	.028	.030	.030	.090
1141	Ductile (No. 2)	3.64	.480	.072	.020	1.11	.21	.54	.145	.0090	.05
1142	Ductile (No. 3)	2.94	.18	.20	.015	3.33	1.02	1.65	.053	.006	.022
1138	Cast Steel (No. 1)	0.120	.43	.053	.053	0.34	0.09	0.10	.12	.020	.05
1139	Cast Steel (No. 2)	.792	.98	.011	.013	.85	.40	.93	1.96	.24	.51
1143	Blast Furnace (No. 1)	3.91	.414	.158	.028	1.68	.144	.115	0.145	.008	(.005)
1144	Blast Furnace (No. 2)	4.27	1.33	.112	.021	0.276	.090	.021	.019	.004	.007



(Continued)

Chemical Composition (Nominal Weight Percent)

Ni	Cr	V	Mo	Co	Ti	As	Sn	Al (Total)	Mg	N	SRM
0.010	0.052	0.006	0.002	-----	------	------	-----	-----	-----	-----	3b
.068	.09	.03	.080	-----	0.05	0.03	-----	-----	-----	-----	4j
.086	.15	.036	.020	-----	.05	<.005	-----	-----	-----	0.006	5L
.136	.37	.06	.035	-----	.06	.04	-----	-----	-----	.006	6g
.120	.048	.010	.012	-----	.044	.014	-----	-----	-----	.004	7g
.038	.006	<001	.011	0.007	------	.007	0.007	0.002	-----	.004	55e
1.22	.333	.027	.002	-----	.027	------	-----	-----	-----	-----	82b
2.12	.560	.008	.750	-----	.016	------	-----	-----	-----	(.008)	107b
14.49	1.98	.014	.050	-----	.020	------	-----	-----	-----	-----	115a
0.080	(0.038)	(.032)	(.001)	-----	(.026)	(.018)	-----	-----	-----	(.009)	122e
20.32	1.98	.012	.010	-----	.018	------	-----	-----	0.068	-----	341
0.023	0.032	.005	.009	-----	.019	------	-----	-----	.053	-----	342
.06	.034	------	-----	-----	.020	------	-----	-----	.069	-----	342a
.041	.0072	.0006	.0050	.0070	.0006	.0002	(.0002)	(.0007)	N 0.001	Pb 0.00002	365

(Continued)

Chemical Composition (Nominal Weight Percent)

Co	Ti	As	Sb	Sn	Al	Te	Zr	B	Bi	Ce	Y	Pb	Mg	SRM 1 1/4 in × 1 1/4 in × 1/2 in
0.009	0.011	0.024	0.17	0.23	(0.001)	0.072	(0.02)	0.040	(0.008)	------	-------	(0.01)	-----	1174a
.11	.35	.19	.022	.025	(.03)	.009	(.03)	.005	(.017)	------	-------	.006	-----	1175a
-----	.049	.022	-----	-----	------	.016	-----	-----	------	------	-------	-----	-----	1147
-----	.050	(.022)	-----	-----	------	.015	-----	-----	------	------	-------	-----	-----	1148
-----	.062	.036	-----	-----	------	.013	-----	-----	------	------	-------	-----	-----	1149
-----	.10	(.07)	-----	-----	(.01)	-----	-----	-----	-------	(0.09)	(<0.002)	-----	0.019	1140
-----	.013	(.04)	-----	-----	(.005)	-----	-----	-----	-------	(.05)	.040	-----	.044	1141
-----	.008	(.015)	-----	-----	(.09)	-----	-----	-----	-------	(.015)	.01	-----	.10	1142
-----	-----	------	-----	-----	------	-----	-----	-----	------	------	-------	-----	-----	1138
-----	-----	------	-----	-----	------	-----	-----	-----	------	------	-------	-----	-----	1139
-----	.17	(.004)	-----	-----	------	.020	-----	-----	------	------	-------	-----	-----	1143
-----	.44	(.004)	-----	-----	------	.020	-----	-----	------	------	-------	-----	-----	1144

Steelmaking Alloys

These SRM's provide standards of known chemical composition primarily for checking chemical methods of analysis for the major constituents and for selected minor elements covered by ASTM specifications. They are furnished as fine powders, sized to about 100 mesh or finer.

These SRM's are finding increasing application in x-ray and optical emission spectroscopic methods of analysis when procedures are used in which the samples to be analyzed are in the same form or can be converted to the same form; that is, to pellets, solutions, or powders.

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) C	Mn	P	S	Si	Cu	Ni
57	Refined Silicon	60	0.087	0.034	0.008	0.005	96.80	0.02	0.002
58a	Ferrosilicon (75%)	IN PREP							
59a	Ferrosilicon (50%)	50	.04	.76	.016	-----	48.2	.05	.03
195	Ferrosilicon (75%)	IN PREP							
64b	Ferrochromium (HC)	100	4.30	.208	.012	.062	1.42	----	----
196	Ferrochromium(LC)	100	0.035	.28	-----	-----	.38	----	----
71	Calcium Molybdate	60	-----	-----	-----	-----	-----	----	----
90	Ferrophosphorus	75	-----	-----	26.2	-----	-----	----	----
340	Ferroniobium	100	.060	1.71	.035	-----	4.39	----	----

SRM	Cr	V	Mo	Ti	Al	Nb	Zr	Ca	Mg	Fe	B	N
57	0.025	----	----	0.10	0.67	-----	0.025	0.73	0.01	0.65	----	-----
58a	-----	----	----	----	----	-----	-------	----	----	-----	----	-----
59a	.08	----	----	----	.35	-----	----	.04	----	50.0	0.06	-----
195	-----	----	----	----	----	-----	-------	----	----	-----	----	-----
64b	68.03	0.15	----	----	----	-----	-------	----	----	-----	----	0.033
196	70.87	.12	----	----	----	-----	-------	----	----	-----	----	-----
71	-----	----	35.3	.06	----	-----	-------	----	----	1.92	----	-----
90	-----	----	----	----	----	-----	-------	----	----	-----	----	-----
340	-----	----	----	.89	----	57.51	Ta 3.73	----	----	-----	----	-----

Nonferrous Alloys (Chip Form)

These SRM's provide materials of known composition for checking the performance of chemical methods of analysis both for production control and for customer acceptance. The aluminum-, magnesium-, and zinc-base alloys are furnished as approximately 14- to 40-mesh chips prepared by cutting thin wall castings or wrought bar stock. Certificates of Analysis provided with these standards give the composition as determined at NBS, and most give values obtained by industrial and other outside laboratories cooperating in certification of the standards.

Aluminum-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)												
			Mn	Si	Cu	Ni	Cr	V	Ti	Sn	Ga	Fe	Pb	Mg	Zn
85b	Wrought	75	0.61	0.18	3.99	0.084	0.211	0.006	0.022	----	0.019	0.24	0.021	1.49	0.030
86c	Casting	75	.041	.68	7.92	.030	.029	-----	.035	----	-----	.90	.031	0.002	1.50
87a	Al-Si	75	.26	6.24	0.30	.57	.11	<.01	.18	0.05	.02	.61	.10	.37	0.16

Cobalt-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)					
			Co	Ni	Cr	Mo	W	Nb
168	Co41-Mo4-Nb3-Tal-W4	150	41.20	20.25	20.33	3.95	3.95	2.95

SRM	Ta	Fe	Mn	C	P	S	Si	Cu	V	Ti
168	0.95	3.43	1.50	0.37	0.008	0.005	0.80	0.035	0.03	0.06

Copper-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)					
			Mn	P	S	Si	Cu	Ni
37e	Brass, Sheet	150	-----	-----	-----	----	69.61	0.53
124d	Bronze, Ounce Metal ..	150	-----	.02	.093	----	83.60	.99
157a	Nickel Silver	135	0.174	.009	-----	----	58.61	11.82
158a	Bronze, Silicon	150	1.11	.026	-----	3.03	90.93	0.001
184	Bronze, Leaded Tin ...	150	-----	.009	-----	----	88.96	.50

SRM	Co	As	Sn	Fe	Al	Pb	Sb	Ag	Zn
37e	-----	----	1.00	0.004	----	1.00	----	----	27.85
124e	-----	0.02	4.56	.18	----	5.20	0.17	0.02	5.06
157a	0.022	----	0.021	.174	----	0.034	----	----	29.09
158a	-----	----	.96	1.23	0.46	.097	----	----	2.08
184	-----	----	6.38	0.005	----	1.44	----	----	2.69

Lead-Base Alloys

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent) Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
53e	Bearing Metal (84Pb-10Sb-6Sn)	1132	0.054	0.003	0.057	5.84	10.26	0.052	----	<0.001
127b	Solder (40Sn-60Pb)	1131	.011	.012	.01	39.3	0.43	.06	0.01	-------

Magnesium-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) Mn	Si	Cu	Ni	Al	Pb	Fe	Zn
171	Alloy	100	0.45	0.0118	0.0112	0.0009	2.98	0.0033	0.0018	1.05

Nickel-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) C	Mn	P	S	Si	Cu	Ni	Cr
162a	Monel-type (Ni64-Cu31) . . .	150	0.079	1.60	-----	0.007	0.93	30.61	63.95	0.042
349	Ni57-Cr20	150	.08	0.43	0.002	-----	.29	0.006	57.15	19.50

SRM	V	Mo	W	Co	Ti	Al	B	Ca	Fe	Nb	Ta	Zr
162a	-----	----	-----	0.076	0.005	0.50	------	0.013	2.19	-----	-----	-----
349	0.081	4.04	<0.01	13.95	3.05	1.23	0.0046	-----	0.13	<0.01	<0.01	0.081

Nickel Oxide

The nickel oxide SRM's are available primarily for application in the electronics industry to the analysis of cathode grade nickel. The "Standard Method for Spectrochemical Analysis of Thermionic Nickel Alloys by the Powder-D-C Arc Technique," ASTM Designation E129 is based on calibration with these standards. The values given are for the percentage of the element in nickel oxide.

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) Mn	Si	Cu	Cr	Co	Ti	Al	Fe	Mg
671	Oxide 1	25	0.13	0.047	0.20	0.025	0.31	0.024	0.009	0.39	0.030
672	Oxide 2	25	.095	.11	.018	.003	.55	.009	.004	.079	.020
673	Oxide 3	25	.0037	.006	.002	.0003	.016	.003	.001	.029	.003

Selenium Base

This SRM is intended to bridge the gap between commercial materials available in bulk and selenium available in primary or purer grades. It should prove useful to the small research laboratory, or to the individual engaged in purification, as a characterized starting material. It should be useful also as a homogeneous material in analytical procedures when a high-purity primary grade is neither necessary nor available.

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Parts Per Million)									
			Mn	S	Cu	Ni	Cr	V	Mo	Co	As	Sn
726	Selenium, Intermediate Purity	450	<0.3	12 ± 3	<1	<0.5	<1	N.D.	<0.3	N.D.	<2	<1

SRM	Al	B	Pb	Bi	Ag	Ca	Mg	Te	Fe	Cl	Tl	Be	Cd	In
726	<1	<1	<1	N.D.	<1	<1	<1	0.3 ± 0.1	1	<0.5	<0.5	N.D.	N.D.	N.D.

N.D. = Not detected at limits of detection of <0.5 ppm.

Tin-Base Alloys

SRM	Type	Chemical Composition (Nominal Weight Percent)								
		Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	Bearing metal	0.62	88.57	7.04	0.044	3.62	0.027	0.088	0.0032	0.0027

Titanium-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)									
			C	Mn	Si	Cu	V	Mo	Sn	Al	Fe	N
173a	6Al-4V	100	0.025	------	0.037	0.002	4.06	0.005	----	6.47	0.15	0.018
174	4Al-4Mn	100	-----	4.57	.015	-----	----	------	----	4.27	.175	.012
176	5Al-2.5Sn	100	.015	0.0008	-----	.003	----	.0003	2.47	5.16	.070	.010

Zinc-Base

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)										
			Mn	Cu	Ni	Sn	Al	Cd	Fe	Pb	Ag	Mg	Ti
94c	Die Casting Alloy	150	0.014	1.01	0.006	0.006	4.13	0.002	0.018	0.006	-------	0.042	--------
728	Zinc	450	-----	0.00057	-----	(.000002)	----	.00012	.00027	.00111	0.00011	-----	--------

Zirconium-Base

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Parts Per Million)										
			C	Mn	Si	Cu	Ni	Cr	Ti	Sn (Wt %)	Fe	N	U
360a	Zircaloy-2	100	136	3	51	140	554	1060	27	1.42	1441	43	0.15

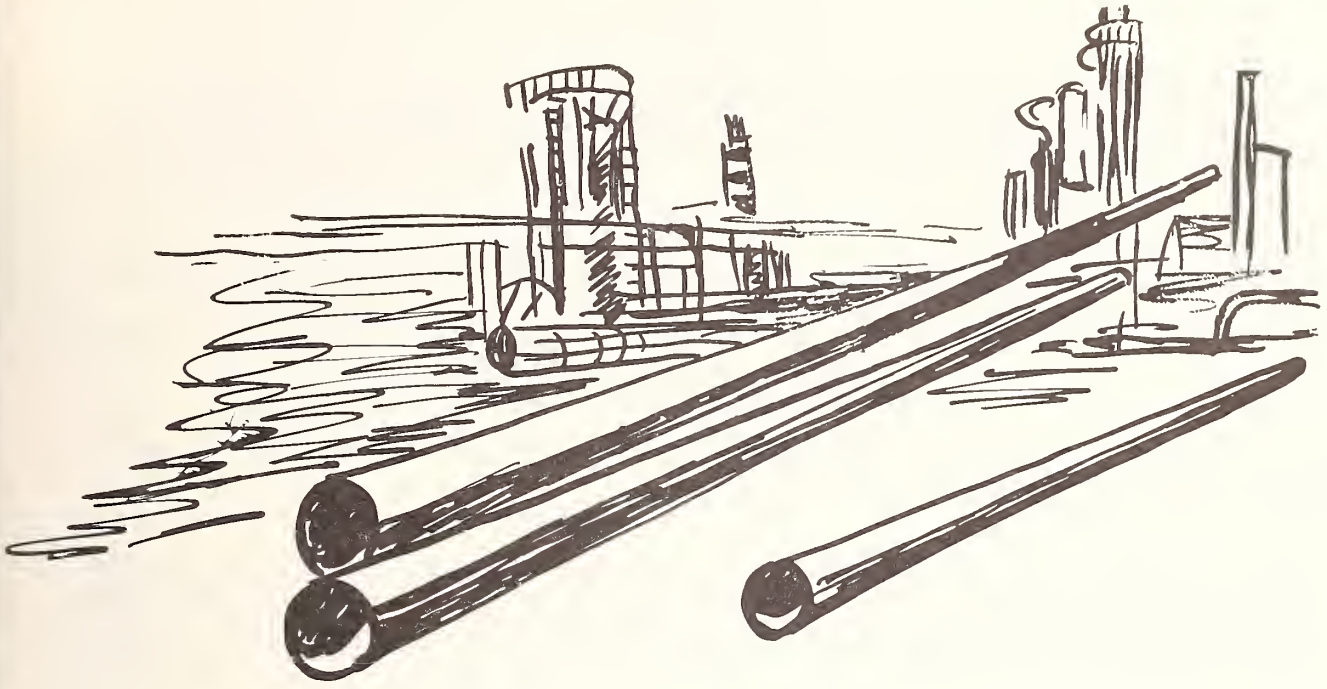
Nonferrous Alloys (Solid Form)

These SRM's are designed to fill the basic needs of the nonferrous primary and secondary metals industries for analytical control, primarily with optical emission and x-ray spectroscopic methods. Both nominal chemical composition and analytical range SRM's have been prepared for many of the commercially important nonferrous alloy systems.

Copper-Base Alloys

Eight groups of copper-base alloy SRM's have been prepared to provide for analytical control by rapid instrumental methods in the copper industry. These SRM's are intended primarily for calibration of optical emission and x-ray spectroscopic equipment. These SRM's have been prepared in two forms: chill-cast form (with "C" prefix) for the producer (1 1/4 X 1 1/4 in blocks), and wrought form for the consumer (disks, 1 1/4 in in diameter and 3/4 in thick). Both forms have nearly identical chemical compositions. Each of the eight principal copper-base alloys are covered by three SRM's comprised of a "nominal-composition" together with a low- and a high-composition standard. To make the cartridge-brass SRM's more widely applicable, a number of trace elements were purposely added to and certified for these SRM's. (The low-composition cartridge-brass A, C1100, is no longer available.) The beryllium copper SRM's are representative of the nominal chemical composition of three Copper and Brass Research Association (CABRA) alloy designations.
(Values in parentheses are not certified, but are given for information only.)

SRM		Type	Chemical Composition (Nominal Weight Percent)								
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb	As
1101	C1101	Cartridge Brass B	69.50	30.30	.05	.037	.016	.013	.0006	.012	.009
1102		Cartridge Brass C	72.85	27.10	.020	.011	.006	.005	.0007	.005	.004
1103	C1103	Free-Cutting Brass A	59.23	35.7	3.73	.26	.88	.16	-----	------	------
1104	C1104	Free-Cutting Brass B	61.33	35.3	2.77	.088	.43	.070	------	------	------
1105	C1105	Free-Cutting Brass C	63.7	34.0	2.0	.044	.21	.043	------	------	------
1106	C1106	Naval Brass A	59.08	40.08	0.032	.004	.74	.025	------	------	------
1107	C1107	Naval Brass B	61.21	37.34	.18	.037	1.04	.098	------	------	------
1108	C1108	Naval Brass C	64.95	34.42	.063	.050	0.39	.033	------	------	------
1109	C1109	Red Brass A	82.2	17.4	.075	.053	.10	.10	------	------	------
1110	C1110	Red Brass B	84.59	15.20	.033	.033	.051	.053	------	------	------
1111	C1111	Red Brass C	87.14	12.81	.013	.010	.019	.022	------	------	------
1112	C1112	Gilding Metal A	93.38	6.30	.057	.070	.12	.100	------	------	------
1113	C1113	Gilding Metal B	95.03	4.80	.026	.043	.064	.057	------	------	------
1114	C1114	Gilding Metal C	96.45	3.47	.012	.017	.027	.021	------	------	------
1115	C1115	Commercial Bronze A	87.96	11.73	.013	.13	.10	.074	------	------	------
1116	C1116	Commercial Bronze B	90.37	9.44	.042	.046	.044	.048	------	------	------
1117	C1117	Commercial Bronze C	93.01	6.87	.069	.014	.021	.020	------	------	------
1118	C1118	Aluminum Brass A	75.1	21.9	.025	.065	------	------	2.80	.010	.007
1119	C1119	Aluminum Brass B	.77.1	20.5	.050	.030	------	------	2.14	.050	.040
1120	C1120	Aluminum Brass C	.80.1	18.1	.105	.015	------	------	1.46	.100	.090
1121	C1121	Beryllium Copper CA-172	.97.49	(0.01)	(.002)	.085	.01	.012	0.07	------	------
1122	C1122	Beryllium Copper CA-170	.97.45	(.01)	(.003)	.16	(.01)	(.01)	.17	------	------
1123	C1123	Beryllium Copper CA-175	97.10	(.01	(.001)	.04	(.01)	(.01)	.02	------	------



(Continued)

Chemical Composition (Nominal Weight Percent)

Be	Bi	Cd	Mn	P	Si	Ag	Te	Co	Cr	SRM	
.00055	.0004	.0055	.0055	.0020	(.005)	.003	.0015	------	------	1101	C1101
.00003	.0005	.0045	.0045	.0048	(.002)	.0010	.0003	------	------	1102	
------	------	------	------	.003	------	------	------	------	-- ---	1103	C1103
------	------	------	------	.005	------	------	------	------	------	1104	C1104
------	------	------	------	.003	------	------	------	------	------	1105	C1105
------	------	------	.005	------	------	------	------	------	------	1106	C1106
------	------	------	------	------	------	------	------	------	------	1107	C1107
------	------	------	.025	------	------	------	------	------	------	1108	C1108
------	------	------	------	.006	------	------	------	------	------	1109	C1109
------	------	------	------	------	------	------	------	------	------	1110	C1110
------	------	------	------	------	------	------	------	------	------	1111	C1111
------	------	------	------	.009	------	------	------	------	------	1112	C1112
------	------	------	------	.008	------	------	------	-----	-------	1113	C1113
------	------	------	------	.009	------	------	------	------	------	1114	C1114
------	------	------	------	.005	------	------	------	------	------	1115	C1115
------	------	------	------	.008	------	------	------	------	------	1116	C1116
------	------	------	------	.002	------	------	------	------	------	1117	C1117
------	------	------	------	.13	.0021	------	------	------	------	1118	C1118
------	------	------	------	.070	.0015	------	------	------	------	1119	C1119
------	------	------	------	.018	.0011	------	------	------	------	1120	C1120
1.90	------	------	(.004)	(.005)	.11	(.005)	------	0.295	(0.002)	1121	C1121
1.75	------	------	(.004)	(.004)	.17	(.005)	------	.220	(.002)	1122	C1122
0.46	------	------	(.002)	(.002)	.03	(.009)	------	2.35	(.002)	1123	C1123

Lead-Base Alloy

These SRM's are designed primarily for the calibration of optical emission and x-ray spectrometric methods of analysis. SRM 1131, Solder, and SRM 1132, Bearing Metal, are available in chip form as: 53e (1132) and 127b (1131), see Lead-base Alloys, page **32** .

SRM	Type	Other Forms	Size	Chemical Composition (Nominal Weight Percent) Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
1131	Solder Pb60-Sn40	127b	31.4 mm D X 19 mm thick	0.011	0.012	0.01	39.3	0.43	0.06	0.01	-----
1132	Bearing Metal	53e	31.4 mm D X 19 mm thick	.054	.003	.057	5.84	10.2	.052	---	<0.001

Nickel-Base Alloys

These SRM's are designed primarily for calibration in optical emission and x-ray spectroscopic methods of analysis. They are issued in disk form.

SRM	Type	Unit Size	Chemical Composition (Nominal Weight Percent) C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Co	Fe
1159	Ni48, balance Fe	1 1/4 in D × 3/4 in thick	0.007	0.305	0.003	0.003	0.32	0.038	48.2	0.06	0.010	0.022	51.0
1160	Ni80, Mo4, balance Fe ...	1 1/4 in D × 3/4 in thick	.019	.550	.003	.001	.37	.021	80.3	.05	4.35	.054	14.3

Tin-Base Alloys

These tin metal SRM's have been prepared primarily for the tin-plate industry; they are useful for the calibration of optical emission spectroscopic equipment by the "point-to-point" technique. They are furnished in the form of rods, 1/4 in in diameter and 4 in long.

SRM	Type	Chemical Composition (Nominal Weight Percent) Cu	Ni	Co	As	Pb	Sb	Bi	Ag	Zn	Cd
431	Tin A	0.19	0.038	0.021	0.16	0.19	0.19	0.020	0.015	0.041	0.020
432	Tin B	.097	.020	.011	.075	.094	.095	.0098	.0095	.020	.0095
433	Tin C	.055	.0095	.0045	.047	.055	.050	.0052	.0055	.0095	.0053
434	Tin D	.019	.0044	.0020	.019	.022	.019	.0020	.0018	.0046	.0020
435	Tin E	.0077	.0024	.0011	.0090	.015	.010	.0011	.0010	.0020	.0011

Titanium-Base Alloys

These SRM's are issued primarily for the aerospace industries for analytical control and equipment calibration purposes. These SRM's are in disk form intended as calibration materials for optical emission and x-ray spectroscopic methods of analysis of similar materials.

SRM	Type	Unit Size	Chemical Composition (Nominal Weight Percent) Mn	Cr	Fe	Mo	Al	V
641	8Mn (A)	1 1/4 in D × 3/4 in Disks	6.68	----	----	----	----	----
642	8Mn (B)	1 1/4 in D × 3/4 in Disks	9.08	----	----	----	----	----
643	8Mn (C)	1 1/4 in D × 3/4 in Disks	11.68	----	----	----	----	----
644	2Cr-2Fe-2Mo (A) ...	1 1/4 in D × 3/4 in Disks	-----	1.03	1.36	3.61	----	----
645	2Cr-2Fe-2Mo (B) ...	1 1/4 in D × 3/4 in Disks	-----	1.96	2.07	2.38	----	----
646	2Cr-2Fe-2Mo (C) ...	1 1/4 in D × 3/4 in Disks	-----	3.43	2.14	1.11	----	----
654a	6Al-4V (B)	1 1/4 in D × 1/4 in Disks	(<0.1)	(0.20)	(0.20)	(<0.05)	6.3_4	3.9_5

Titanium-Base Alloys – Oxygen and Hydrogen Only

SRM's intended for determination of hydrogen and oxygen in titanium-base alloys are available in sheet and rod form. These were designed primarily for calibration of vacuum fusion or inert gas fusion equipment.

A group of iron-base alloys certified for oxygen also are available. See Oxygen Standards, page 27.

SRM	Type	Unit Size	Wt/Unit (grams)	Oxygen (ppm)	Hydrogen (Wt %)
352	Unalloyed titanium for hydrogen	1/4 in square × 0.05 in thick	20	----	0.0032
353	Unalloyed titanium for hydrogen	1/4 in square × 0.05 in thick	20	----	.0098
354	Unalloyed titanium for hydrogen	1/4 in square × 0.05 in thick	20	----	.0215
355	Unalloyed	Rod-1/2 in D × 2 in long	-----	3031	------
356	Alloy, 6Al-4V	Rod-.425 in D × 1 3/4 in long	-----	1332	------

Zinc-Base Alloys

Zinc-base alloy SRM's are available ranging from very high-purity zinc to commercial materials such as spelter and die-casting alloy compositions. They are supplied as bar segments (disks) intended for calibrating and checking optical emission and x-ray spectroscopic techniques. The certificate of analysis supplied with each gives the chemical composition determined at NBS and values determined by other laboratories that have cooperated in the certification of the SRM's. For high-purity Zinc, see High-Purity Metals, page 40.

Die Casting Alloys and Spelter

Zinc-base die casting alloys and a spelter SRM are available. They were designed for calibration of optical emission spectroscopic techniques primarily for analysis of such alloys as ASTM Designations AG 40A and AC 41A. The SRM's were prepared by a continuous chill-casting process into square bars which then were cut into segments. The certified portion of each segment is that part included between 3/16 inch and 11/16 inch from each side. The center core, 3/16 inch square, and the outer rim, 3/16 inch from the outer surface, are parts which may differ in chemical composition for some elements from the certified portion, and should not be used.

(Values in parentheses are not certified, but are given for information only.)

SRM	Type	Unit Size	Chemical Composition (Nominal Weight Percent)					
			Cu	Al	Mg	Fe	Pb	Cd
625	Zinc-base A-ASTM AG 40A ..	1 3/4 in square × 3/4 in thick	0.034	3.06	0.070	0.036	0.0014	0.0007
626	Zinc-base B-ASTM AG 40A ..	1 3/4 in square × 3/4 in thick	.056	3.56	.020	.103	.0022	.0016
627	Zinc-base C-ASTM AG 40A ..	1 3/4 in square × 3/4 in thick	.132	3.88	.030	.023	.0082	.0051
628	Zinc-base D-ASTM AC 41A ..	1 3/4 in square × 3/4 in thick	.611	4.59	.0094	.066	.0045	.0040
629	Zinc-base E-ASTM AC 41A ..	1 3/4 in square × 3/4 in thick	1.50	5.15	.094	.017	.0135	.0155
630	Zinc-base F-ASTM AC 41A ..	1 3/4 in square × 3/4 in thick	0.976	4.30	.030	.023	.0083	.0048
631	Zinc spelter (modified)	1 3/4 in square × 3/4 in thick	.0013	0.50	(<.001)	.005	(.001)	.0002

SRM	Chemical Composition (Nominal Weight Percent)									
	Sn	Cr	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
625	0.0006	0.0128	0.031	0.0184	0.017	-------	------	------	--------	-------
626	.0012	.0395	.048	.047	.042	-------	------	------	--------	-------
627	.0042	.0038	.014	.0029	.021	-------	------	------	--------	-------
628	.0017	.0087	.0091	.030	.009	-------	------	------	--------	-------
629	.012	.0008	.0017	.0075	.078	-------	------	------	--------	-------
630	.0040	.0031	.0106	.0027	.022	-------	------	------	--------	-------
631	.0001	.0001	.0015	(<.0005)	<.002	(0.0023)	(0.002)	<0.001	(<0.0005)	(0.0002)

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Zirconium-Base Alloys

A zirconium metal SRM certified at the parts-per-million level, is available in the form of a wrought disk for checking and calibrating of optical emission and x-ray spectroscopic instruments used in the analytical control of trace level constituents of zirconium for use in nuclear power applications.

(Values in parentheses are not certified, but are given for information only.)

SRM	Type	Unit Size	Chemical Composition (Nominal Parts Per Million)										
			Mn	Si	Cu	Ni	Cr	W	Ti	Al	B	U	Fe
1210	Zirconium A	1 1/4 in D × 3/4 in thick	(5)	(30)	10	8	95	(4)	26	(60)	(<0.25)	1.8	2500

Gases in Metals

Values in parentheses are not certified but are given for additional information on composition.

Certified for Nitrogen

Steels, (Chip Form)

SRM	Type	Nitrogen (Wt %)
10g	Bessemer	0.015
12h	Basic Open Hearth, 0.4C	.006
32e	Ni-Cr (SAE 3140)	.009
33d	Ni-Mo (SAE 4820)	(.011)
50c	W18-Cr4-V1	.012
51b	Electric Furnace, 1.2C	.011
65d	Basic Electric Furnace, 0.3C .	.013
72f	Cr-Mo (SAE X4130)	.009
73c	Stainless (Cr13) (SAE 420) ..	.037
100b	Manganese (SAE T1340)	.004
133a	Stainless (Cr13-Mo0.3-S0.3) .	.032
139a	Cr-Ni-Mo (AISI 8640)	.008
153a	Co8-Mo9-W2-Cr4-V2 (Tool) .	.024
160b	Stainless (AISI 316)	.039
343	Stainless (SAE 431)	.074
346	Valve (Cr22-Ni4-Mn9)	.441

Steel, (Granular Form)

SRM	Type	Nitrogen (Wt %)
163	Low alloy, Cr1	0.007

Cast Irons (Chip Form)

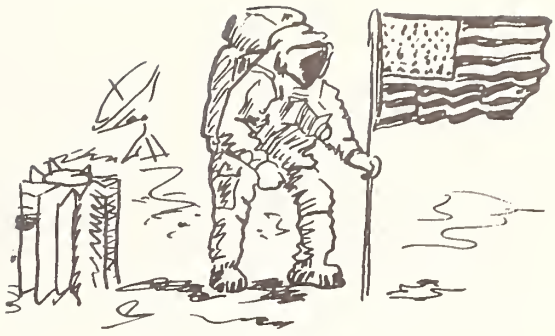
SRM	Type	Nitrogen (Wt %)
5L	Cast iron	0.006
6g	Cast iron	.006
7g	Cast iron (high phosphorus) .	.004
55e	Ingot iron	.004
107b	Cast iron (Ni-Cr-Mo)	(.008)

Titanium Base (Chip Form)

SRM	Type	Nitrogen (Wt %)
173a	6Al-4V.....	0.018
174	4Al-4Mn	.012
176	5Al-2.5Sn	.010

Zirconium Base Alloys, (Chip Form)

SRM	Type	Nitrogen (Wt %)
360a	Zircaloy-2	0.0043



Certified for Oxygen and Nitrogen

Steels (solid form)

SRM	Type	Oxygen (ppm)	Nitrogen (ppm)
1090	Ingot iron	491	(60)
1091	Stainless steel (AISI 431)	131	(945)
1092	Vacuum melted steel	28	(3.6)
1093	Valve steel	60	(4807)
1094	Maraging steel	4.5	(71)
1095	AISI 4340 Steel	9	(37)
1096	AISI 94B17 (Mod) Steel	10.7	40.4
1097	Cr-V (Mod) Steel	6.6	(41)
1098	High Carbon (Mod) Steel	(17)	30
1099	Electrolytic Iron	61	(13)

Certified for Hydrogen or Oxygen

Titanium Base (solid form)

SRM	Type	Hydrogen (Wt %)	Oxygen (ppm)
352	Unalloyed	0.0032	----
353	Unalloyed	.0098	----
354	Unalloyed	.0215	----
355	Unalloyed	------	3031
356	6Al-4V Alloy	------	1332

High-Purity Metals

Very high-purity metal SRM's are being made available to fill the needs of analysts determining impurity elements in high-purity metal materials. They are intended to serve as bench marks in calibration of methods and equipment; also, they are expected to be valuable in the development of new or improved methods and techniques for extending the sensitivity of detection in the determination of trace constituents in various materials by chemical, optical emission, solid mass spectroscopy, activation, and resistivity methods of analysis.

The certificate of analysis supplied with each high-purity SRM gives the state-of-the-art information on chemical composition in the cooperating laboratories for the various trace determinations reported.

High-purity gold is available in both wire and rod form. The wire form (W), is intended for applications such as in spark source mass spectroscopic techniques. The low levels of impurities make it important for evaluating instrument and system blanks. The rod form (R), is intended for application in other methods of characterization.

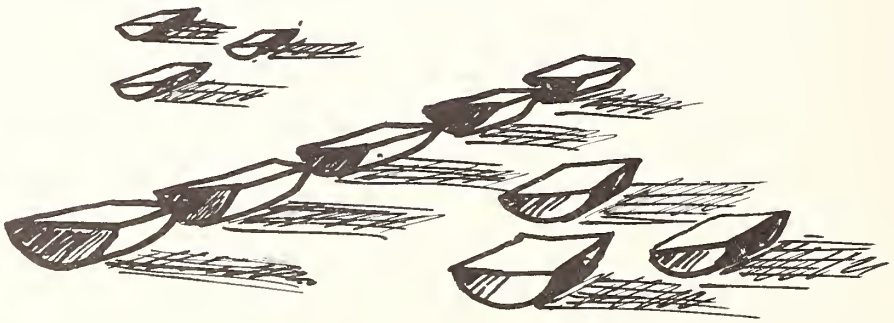
Platinum is available in wire form as a high-purity material and as a doped composition material.

Zinc is available in a high-purity and in a less pure version. Both were prepared from the same starting material. The high-purity material is the result of further purification by vacuum distillation, zone refining, and degasification. The zinc is supplied in the form of semicircular bar segments.

SRM	Type	Unit Size	Chemical Compositions (Nominal Parts Per Million by Weight) Cu	Ni	Sn	Pb	Zr
685W*	High-Purity Gold (Wire)	1.4mm D × 102mm long	0.1	----	----	----	----
685R*	High-Purity Gold (Rod)	5.9mm D × 25mm long	.1	----	----	----	----
680L1	High-Purity Platinum (Wire)	0.51mm D × 102mm long	.1	<1	----	<1	<0.1
680L2	High-Purity Platinum (Wire)	0.51mm D × 1.0m long					
681L1	Doped-Platinum (Wire)	0.51mm D × 102mm long	5.1	0.5	----	12	11
681L2	Doped-Platinum (Wire)	0.51mm D × 1.0m long					
682*	High-Purity Zinc	Semi circular segments 57mm D × 19mm long	0.042	----	(0.02)	----	----
683*	Zinc Metal	Semi circular segments 57mm D × 19mm long	5.9	----	(.02)	11.1	----

SRM	Chemical Compositions (Nominal Parts Per Million by Weight) Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Tl
685W*	[0.1]	---	0.007	0.3	[2]	---	---	----	-----	----	----
685R*	[.1]	---	.007	.2	[<2]	---	---	----	-----	----	----
680L1	.1	<1	-----	.7	4	0.2	<1	<0.2	<0.01	----	----
680L2											
681L1	2.0	12	-----	5	7	6	9	9	11	----	----
681L2											
682*	(0.02)	---	-----	(0.1)	----	---	---	----	-----	(0.1)	----
683*	1.3	---	-----	2.2	----	---	---	----	-----	1.1	(0.2)

*Certificate gives upper limits for other elements found to be present.



These SRM's provide a highly homogeneous material at about the micrometer of spatial resolution. They are intended primarily for use in calibration of quantitative electron microprobe analytical techniques.

Fe-Cr-Ni Alloy

The Fe-Cr-Ni alloy, SRM 479, is a wafer (4.6 mm in diameter and 1 mm thick) and is characterized for chemical homogeneity of iron, chromium, and nickel at the micrometer level of spatial resolution. It is satisfactory for use as a homogeneous material for electron probe microanalysis.

Tungsten – 20% Molybdenum

The tungsten-20% molybdenum alloy, SRM 480, consists of a core of tungsten-20% molybdenum wire embedded in pure molybdenum onto which pure tungsten has been deposited by electroplating to provide a composite. The Certificate supplied with this SRM gives the values for tungsten and molybdenum as determined by analysis and a summary of homogeneity testing results from approximately 1500 determinations for tungsten and molybdenum by electron probe microanalysis. Additional details on homogeneity characterization are given in NBS Spec. Publ. 260-16. (See inside back cover for ordering instructions.)

Gold-Silver

Six color-coded wires comprise this set, SRM 481. The wires consist of a high-purity gold and a high-purity silver wire and four wires with nominal chemical composition differences in steps of 20%. The Certificate of Analysis supplied with each SRM gives the results of a cooperative program of analysis and a summary of the extensive homogeneity testing performed in certifing the wires.

Although designed for quantitative elemental microprobe analysis, the wires should be equally useful for other microtechniques.

Gold-Copper

This set of color-coded wires, SRM 482, is similar to the gold-silver set. In both sets special precautions were taken to achieve homogeneity on a microscopic scale.

Iron – 3% Silicon

The iron-3% silicon microprobe, SRM 483, is a platelet (3 mm × 3 mm × 0.28 mm), and is characterized for chemical homogeneity of iron and silicon at the micrometer level of spatial resolution. It is satisfactory for use as a homogeneous material for electron probe microanalysis.

SRM	Type	Unit Size	Chemical Composition (Nominal Weight Percent)								
			Au	Cu	Ag	W	Mo	Si	Fe (by difference)	Cr	Ni
479	Fe-Cr-Ni Alloy	Wafer-4.6 mm D × 1 mm thick	------	------	------	----	----		71.0	18.3	10.7
480	Tungsten-20 Mo Alloy	Wafer-1 mm D × 1 mm thick	------	------	------	78.5	21.5	----	---------	----	----
481	Au100A	Wire-0.5mm D × 50 mm long	100.00	------	------	----	----	----	---------	----	----
	Au80-Ag20B	Wire-0.5mm D × 50 mm long	80.05	------	19.96	----	----	----	---------	----	----
	Au60-Ag40C	Wire-0.5mm D × 50 mm long	60.05	------	39.92	----	----	----	---------	----	----
	Au40-Ag60D	Wire-0.5mm D × 50 mm long	40.00	------	59.90	----	----	----	---------	----	----
	Au20-Ag80E	Wire-0.5mm D × 50 mm long	22.43	------	77.58	----	----	----	---------	----	
	Ag100F	Wire-0.5mm D × 50 mm long	------	------	100.00	----	----	----	---------	----	
482	Au100A	Wire-0.5mm D × 50 mm long	100.00	------	------	----	----	----	---------	----	----
	Au80-Cu20B	Wire-0.5mm D × 50 mm long	80.15	19.83	------	----	----	----	---------	----	----
	Au60-Cu40C	Wire-0.5mm D × 50 mm long	60.36	39.64	------	----	----	----	---------	----	----
	Au40-Cu60D	Wire-0.5mm D × 50 mm long	40.10	59.92	------	----	----	----	---------	----	----
	Au20-Cu80E	Wire-0.5mm D × 50 mm long	20.12	79.85	------	----	----	----	---------	----	----
	Cu100F	Wire-0.5mm D × 50 mm long	------	100.00	------	----	----	----	---------	----	----
483	Iron-3% Silicon	Wafer-3mm × 3mm × 0.28m	------	------	------	----	----	3.22	96.7-96.8	----	----

Primary, Working, and Secondary Standard Chemicals

These SRM's are high-purity chemicals defined as primary, working, and secondary standards in accordance with recommendations of the Analytical Chemistry Section of the International Union of Pure and Applied Chemistry [Ref. Analyst **90**, 251 (1965)]. These definitions are as follows:

Primary Standard:
a commercially available substance of purity 100 ± 0.02 percent (Purity 99.98+ percent).
Working Standard:
a commercially available substance of purity 100 ± 0.05 percent (Purity 99.95+ percent).
Secondary Standard:
a substance of lower purity which can be standardized against a primary grade standard.

SRM	Type	Wt/Unit (grams)	Certified Use	Purity Stoichiometric
17	Sucrose	60	Polarimetric Value	[a]
40h	Sodium Oxalate	60	Reductometric Value	99.95
41a	Dextrose (D-glucose)	70	Reductometric Value	[b]
83c	Arsenic trioxide	75	Reductometric Value	99.99
84h	Acid potassium phthalate	60	Acidimetric Value	99.99
136c	Potassium dichromate	60	Oxidimetric Value	99.98
350	Benzoic Acid	30	Acidimetric Value	99.98
723	Tris(hydroxymethyl)aminomethane	50	Basimetric Value	99.97
944	Plutonium Sulfate Tetrahydrate	0.5	Assay	100
949d	Plutonium Metal	0.5	Assay	99.99
950a	Uranium oxide (U_3O_8)	25	Uranium Oxide Standard Value	99.94
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00
960	Uranium Metal	26	Assay	99.975
984	Rubidium Chloride	1	Assay and Isotopic	99.90
987	Strontium Carbonate	1	Assay and Isotopic	99.98
988	Strontium-84 Spike	0.010	Assay and Isotopic	99.9
999	Potassium Chloride	60	Assay Standard for Potassium Chloride	99.98 99.99

[a]Sucrose - Moisture <0.01 percent, Reducing Substances <0.02 percent, Ash 0.003 percent.

[b]Dextrose - Moisture <0.2 percent, Ash <0.01 percent.

Microchemical Standards

These SRM's are furnished as fine crystals of suitable homogeneity for use as standards for conventional microchemical methods of analysis employing samples of approximately 5 mg. See also Microprobe Standards, page 41 .

SRM	Type	Wt/Unit (grams)	Elements Certified
140b	Benzoic acid	2	C,H
141b	Acetanilide	2	N,C,H
142	Anisic acid	2	Methoxyl(CH_3O-)
143b	Cystine	2	S,C,H,N
147	Triphenyl phosphate	2	P
148	Nicotinic acid	2	N,C,H
2141	Urea	2	N
2142	o-Bromobenzoic Acid	2	Br
2143	p-Fluorobenzoic Acid	2	F(IN PREP)
2144	m-Chlorobenzoic Acid	2	Cl(IN PREP)

Clinical Laboratory Standards

These SRM's are intended for use in the calibration of apparatus and checking methods of analysis used in clinical and pathological laboratories, and to assist manufacturers of clinical products in meeting the chemical and physical specifications required for clinical chemicals. (For details on SRM's 930 and 931, see Spectrophotometric Filters, page 65.)

SRM	Type	Purity %	Wt/Unit
911	Cholesterol	99.4	0.5g
912	Urea	99.7	25g
913	Uric Acid	99.7	10g
914	Creatinine	99.8	10g
915	Calcium Carbonate*	99.9	20g
916	Bilirubin	99.0	100mg
917	D-Glucose	99.9	25g
918	Potassium Chloride	99.9	30g
919	Sodium Chloride	99.9	30g
920	D-Mannitol	99.8	50g
921	Cortisol	IN PREP	
922	Tris(hydroxymethyl)aminomethane	99.9	25g
923	Tris(hydroxymethyl)aminomethane HCl	99.7	35g
924	Lithium Carbonate	100.5	30g
925	VMA (4-hydroxy-3-methoxymandelic acid)	IN PREP	
930a	Glass Filters for Spectrophotometry		Set of 3
931	Liquid Filters for Spectrophotometry		3 Sets of 4

*SRM 915, Calcium Carbonate, was used to develop the first referee method of analysis in clinical chemistry. This work is described in NBS Special Publication 260-36, A Referee Method for the Determination of Calcium in Serum. (See inside of back cover for ordering instructions.)

Biological Standards

These SRM's are intended for use in the calibration of apparatus and methods used in the analysis of biological materials for major, minor, and for trace elements.

(Values in parentheses are not certified, but are given for information only.)

Content in μg/g (or where noted, wt %)

SRM	Type	Wt/Unit (grams)	As	Bi	B	Br	Cd	Ca	Cl
1571	Orchard Leaves	75	14	(0.1)	33	(10)	0.11	2.09%	(700)
1573	Tomato Leaves	IN PREP							
1577	Liver, Bovine	50	(0.055)	---	--	---	.27	(123)	(2600)

SRM	Co	Cu	Cr	F	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni
1571	(0.2)	12	(2.3)	(4)	300	45	(14)	0.62%	91	0.155	-----	1.3
1573												
1577	(.18)	193	-----	---	270	0.34	----	(605)	10.3	.016	(3.2)	---

SRM	N	P	K	Rb	Se	Ag	Na	Sr	S	Tl	U	Zn
1571	2.76%	0.21%	1.47%	12	0.08	------	82	(37)	(2300)	------	0.029	25
1573												
1577	10.6%	-----	0.97%	18.3	1.1	(0.06)	0.243%	(0.14)	------	(0.05)	(.0008)	130

Metallo-organic Compounds

These SRM's are intended for the preparation of solutions in oils of known and reproducible concentrations of metals. Because "matrix" effects occur, it is desirable to prepare the standard solutions in oil identical or similar to the oil being studied. Possession of an adequate collection of these metallo-organic SRM's permits the preparation of any desired blend of known concentrations of metal in the appropriate lubricating oil. They are used primarily for the calibration of spectrochemical equipment used in the determination of metals in lubricating oil. This technique is used extensively in the defense program, the transportation industry, and other industries where the consequences of failure of a moving metal part may range from inconvenient to catastrophic. Details of the selection, preparation, and analysis of the compounds can be found in NBS Monograph 54. (See inside back cover for ordering instructions.)

The Certificate supplied with each SRM gives the percentage of the element of interest and directions for preparing a solution of known concentration in lubricating oil.

SRM	Constituent Certified		Wt/Unit (grams)	Type
	Element	(wt. percent)		
1075a	Al	8.1	5	Aluminum 2-ethylhexanoate
1051b	Ba	28.7	5	Barium cyclohexanebutyrate
1063a	B	2.4	5	Menthyl borate
1053a	Cd	24.8	5	Cadmium cyclohexanebutyrate
1074a	Ca	12.5	5	Calcium 2-ethylhexanoate
1078b	Cr	9.6	5	Tris(1-phenyl-1,3-butanediono)chromium(III)
1055b	Co	14.8	5	Cobalt cyclohexanebutyrate
1080	Cu	16.5	5	Bis(1-phenyl-1,3-butanediono)copper(II)
1079b	Fe	10.3	5	Tris(1-phenyl-1,3-butanediono)iron(III)
1059b	Pb	36.7	5	Lead cyclohexanebutyrate
1060a	Li	4.1	5	Lithium cyclohexanebutyrate
1061c	Mg	6.5	5	Magnesium cyclohexanebutyrate
1062a	Mn	13.8	5	Manganous cyclohexanebutyrate
1064	Hg	36.2	5	Mercuric cyclohexanebutyrate
1065b	Ni	13.9	5	Nickel cyclohexanebutyrate
1071a	P	9.5	5	Triphenyl phosphate
1066a	Si	14.1	5	Octaphenylcyclotetrasiloxane
1076	K	10.1	5	Potassium erucate
1077a	Ag	42.6	5	Silver 2-ethylhexanoate
1069b	Na	12.0	5	Sodium cyclohexanebutyrate
1070a	Sr	20.7	5	Strontium cyclohexanebutyrate
1057b	Sn	23.0	5	Dibutyltin bis(2-ethylhexanoate)
1052b	V	13.0	5	Bis(1-phenyl-1,3-butanediono)oxovanadium(IV)
1073b	Zn	16.7	5	Zinc cyclohexanebutyrate

Analyzed Gases

These SRM's are intended for the calibration of apparatus used for the measurement of various components in gas mixtures, and in some cases for particular atmospheric pollutants. Each SRM is accurately certified and is primarily intended to monitor and correct for long-term drifts in instruments used.

SRM	Type	Vol/Unit (liters at STP)	Certified Constituents
1601	Carbon dioxide in Nitrogen	68	CO_2, 308 ppm
1602	Carbon dioxide in Nitrogen	68	CO_2, 346 ppm
1603	Carbon dioxide in Nitrogen	68	CO_2, 384 ppm
1604a	Oxygen in Nitrogen	68	O_2, 1.5 ppm
1605	Oxygen in Nitrogen	68	O_2, 10 ppm
1606	Oxygen in Nitrogen	68	O_2, 112 ppm
1607	Oxygen in Nitrogen	68	O_2, 212 ppm
1608	Oxygen in Nitrogen	68	O_2, 978 ppm
1609	Oxygen in Nitrogen	68	O_2, 20.95 mole percent
1610	Hydrocarbon in Air	68	Methane, 0.103 mole percent
1611	Hydrocarbon in Air	68	Methane, 0.0107 mole percent
1613	Hydrocarbon in Air	68	Methane, 0.000102 mole percent

Note: SRM's 1665 through 1669, Propane in Air, and SRM's 1673 through 1675, Carbon Dioxide in Nitrogen, are available for calibrating equipment used to monitor automotive emission gases.

Permeation Tubes

These SRM's are intended for calibrating air-pollution monitoring apparatus, and may be used to verify air-pollution analytical methods and procedures. Each tube is individually calibrated and its permeation rate is certified over the temperature range of 20 to 30 °C.

The following table is provided for information only. The values given in the table do not represent certified values for any individual SRM. The concentrations of SO_2 in ppm are based on an approximate permeation rate of 0.28 μg per cm per minute at 25 °C, for flow rates of 1, 5, and 10 liters per minute.

SRM	Type	Tube Length (cm)	Permeation Rate (μg per min)	Typical Concentrations (ppm) Flow Rates (liters per minute)		
				1	5	10
1625	Sulfur Dioxide Permeation Tube	10	2.8	1.07	0.214	0.107
1626	Sulfur Dioxide Permeation Tube	5	1.4	0.535	.107	.0535
1627	Sulfur Dioxide Permeation Tube	2	0.56	.214	.0428	.0214

Analyzed Liquids

These SRM's are intended for use in the analysis of liquids for elements that, when liberated, could become environmental pollutants.

SRM	Type	Element Certified	Wt %	Vol/Unit (ml)
1621	Sulfur in Residual Fuel Oil	S	1.05	100
1622	Sulfur in Residual Fuel Oil	S	2.14	100
1623	Sulfur in Residual Fuel Oil	S	0.268	100
1624	Sulfur in Distilate Fuel Oil	S	.211	100

Analyzed Solids

These SRM's are intended for use in the analysis of materials for elements of interest in health or environmental problems. (See also Clinical SRM's, page 43 .)

SRM	Type	Element Certified	Content	Wt/Unit
1579	Powdered Lead Based Paint	Pb	11.87 wt%	35
1630	Mercury in Coal	Hg	0.13 ppm	50
1631	Sulfur in Coal	S		set(3)

Hydrocarbon Blends

Eight standard hydrocarbon blends are available for calibration of mass spectrometers and gas chromatographic procedures used in the analysis of gasolines, naphthas and blending stocks. The even numbered SRM's, 592, 594, 596, and 598, are representative of typical virgin napthas and the odd numbered SRM's 593, 595, 597, and 599, are representative of typical catalytically cracked naphthas in the C_7 and C_8 paraffin and cycloparaffin series.

Each SRM is supplied in a unit of ten sealed ampoules. Each ampoule contains 0.03 ml of the blend. Each ampoule is intended to provide material for only one calibration analysis so that possible fractionation of components will be avoided.

For individual components present in the mixtures in the amount of 10% or less (by volume), the limits of error in composition are not greater than ± 0.01 percent and for components present in more than 10 percent, the limits of error are not greater than ± 0.10 percent.

SRM	592	593	594	595	596	597	598	599
Blend No.	1	2	3	4	5	6	7	8
Unit (Ampoules)	10	10	10	10	10	10	10	10
Hydrocarbon	Volume Percent (Nominal)							
n-Heptane	45	17	----	----	----	----	----	----
2-Methylhexane	23	25	----	----	----	----	----	----
3-Methylhexane	16	30	----	----	----	----	----	----
2,2-Dimethylpentane	4	----	----	----	----	----	----	----
2,3-Dimethylpentane	6	20	----	----	----	----	----	----
2,4-Dimethylpentane	5	8	----	----	----	----	----	----
3,3-Dimethylpentane	1	----	----	----	----	----	----	----
n-Octane	----	----	39	12	----	----	----	----
2-Methylheptane	----	----	19	25	----	----	----	----
3-Methylheptane	----	----	16	23	----	----	----	----
4-Methylheptane	----	----	8	8	----	----	----	----
3-Ethylhexane	----	----	3	3	----	----	----	----
2,3-Dimethylhexane	----	----	4	9	----	----	----	----
2,4-Dimethylhexane	----	----	5	5	----	----	----	----
2,5-Dimethylhexane	----	----	6	9	----	----	----	----
3,4-Dimethylhexane	----	----	----	6	----	----	----	----
Methylcyclohexane	----	----	----	----	57	32	----	----
Ethylcyclopentane	----	----	----	----	9	14	----	----
1,1-Dimethylcyclopentane	----	----	----	----	4	3	----	----
1,trans-2-Dimethylcyclopentane	----	----	----	----	14	30	----	----
1,trans-3-Dimethylcyclopentane	----	----	----	----	16	21	----	----
Ethylcyclohexane	----	----	----	----	----	----	20	17
1,trans-2-Dimethycyclohexane	----	----	----	----	----	----	18	7
1,cis-3-Dimethylcyclohexane	----	----	----	----	----	----	25	19
1,trans-4-Dimethylcyclohexane	----	----	----	----	----	----	11	14
1-Methyl-cis-2-ethylcyclopentane	----	----	----	----	----	----	7	20
1,1,3-Trimethylcyclopentane	----	----	----	----	----	----	5	4
1,trans-2-cis-3-Trimethylcyclopentane	----	----	----	----	----	----	9	6
1,trans-2-cis-4-Trimethylcyclopentane	----	----	----	----	----	----	5	13

Ores

These SRM's are intended for use in checking the accuracy of assay methods. They are certified for their content of elements of economic interest, and occasionally, have additional data given for information only. These SRM's are supplied in the form of fine powders, usually passing a 100-mesh or finer sieve.

Chemical Composition (Nominal Weight Percent)

SRM	Type	Wt/Unit (Gram)	CaF	Fe	Mn	Li_2O	SiO_2	P_2O_5	P	Available Oxygen
25c	Manganese	100	-----	-----	57.85	---	2.36	0.22	-----	16.7
27e	Iron (Sibley)	100	-----	66.58	-----	---	3.65	----	0.042	----
79a	Fluorspar	120	97.39	-----	-----	---	----	----	-----	----
113a	Zinc, concentrate	IN PREP								
180	Fluorspar, high-grade	120	98.8	-----	-----	---	----	----	-----	----
181	Lithium (Spodumene)	45	-----	-----	-----	6.4	----	----	-----	----
182	Lithium (Petalite)	45	-----	-----	-----	4.3	----	----	-----	----
183	Lithium (Lepidolite)	45	-----	-----	-----	4.1	----	----	-----	----

Chemical Composition
(Nominal Weight Percent as the Oxide)

SRM	Type	Wt/Unit (gram)	Al_2O_3	CaO	P_2O_5	SiO_2	Fe_2O_3	F	CO_2	TiO_2	Na_2O	MgO
69a	Bauxite	50	55.0	0.29	0.08	6.01	5.8	----	----	2.78	<0.01	0.02
120b	Phosphate Rock (Florida)	90	1.06	49.40	34.57	4.68	1.10	3.84	2.79	0.15	< .35	.28

	ZrO_2	K_2O	K_2O	Cr_2O_3	SO_3	MnO	V_2O_5	BaO	CdO	Loss on Ignition
69a	0.18	<0.01	-----	0.05	0.04	0.02	0.03	0.01	-----	29.55
120b	----	< .12	0.090	----	----	.28	----	----	0.002	-----

Concentrations in weight percent
(except as noted)

SRM	TYPE	Wt/Unit (grams)	Total Cu	Re	Mo	Au	Ag
330	Copper, millheads	100	0.84	(0.3)*	-----	-----	-----
331	Copper, milltails	100	.091	(.05)*	-----	-----	-----
332	Copper, concentrate	50	28.45	(10.2)*	-----	-----	-----
333	Molybdenum, concentrate	35	1.038	0.087	(+)	-----	-----

* parts per million

+ Nominal value 93% MoS_2

Cements

These SRM's are furnished for x-ray spectroscopic analysis and for chemical analysis of cements and related materials. Because these SRM's are hygroscopic, each unit consists of three sealed vials each containing approximately 5 g of material. The supply of the 1011, 1013-1016 Cements will soon be exhausted and replaced with seven new Cements, SRM's 633-639. (Values in parentheses are not certified, but are given for information only.)

Cements

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	Al_2O_3	Fe_2O_3	TiO_2	P_2O_5
633	Portland B (red)						
634	Portland C (gold)						
635	Portland D (blue)						
636	Portland F (yellow)	NOW AVAILABLE					
637	Portland G (pink)						
638	Portland I (green)						
639	Portland J (clear)						
1011	Portland	15	21.03	5.38	2.07	0.25	0.33
1013	Portland	15	24.17	3.30	3.07	.20	.20
1014	Portland	15	19.49	6.38	2.50	.25	.32
1015	Portland	15	20.65	5.04	3.27	.26	.05
1016	Portland	15	21.05	4.97	3.71	.34	.13

Fertilizer Standards

These SRM's are intended for use in the fertilizer industry as working standards for the determination of the certified constituents.

SRM	Type	Wt/Unit (g)	Certified Composition (Wt percent) N	P	K
193	Potassium Nitrate	90	13.85	-----	38.66
194	Ammonium Dihydrogen Phosphate	90	12.15	29.92	-----

Minerals, Refractories, Carbides, and Glasses

These SRM's are supplied in the form of powders, usually 100 mesh or finer. They are intended to provide materials for checking the accuracy of methods used in the analysis of similar materials, primarily in the glass, ceramics, and steel industries.

Minerals

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	Fe_2O_3	Al_2O_3	TiO_2	MnO	CaO
1b	Limestone, argillaceous	50	4.92	0.75	1.12	0.046	0.20	50.9
88a	Limestone, dolomitic	50	1.20	.28	0.19	.02	.03	30.1
70a	Feldspar, potash	40	67.1	.075	17.9	.01	----	0.11
99a	Feldspar, soda	40	65.2	.065	20.5	.007	----	2.14
97a	Clay, flint	60	43.7	.45	38.8	1.90	----	0.11
98a	Clay, plastic	60	48.9	1.34	33.2	1.61	----	.31
81a	Glass sand	IN PREP						
165a	Glass sand (low iron)	IN PREP						
154b	Titanium dioxide	90	-----	-----	-----	99.74	-----	----

Cements (Continued)

CaO (+SrO)	SrO	MgO	SO_3	Mn_2O_3	Na_2O	K_2O	Li_2O	Rb_2O	Loss on Ignition	SRM
										633
										634
										635
										636
										637
										638
										639
66.60	0.11	1.12	1.75	0.03	0.08	0.26	(0.002)	(0.001)	1.13	1011
64.34	.08	1.39	1.80	.05	.20	.32	(.001)	(.004)	0.99	1013
63.36	.26	2.80	2.70	.07	.24	.99	(.005)	(.007)	.81	1014
61.48	.11	4.25	2.28	.06	.16	.87	(.004)	(.005)	1.70	1015
65.26	.25	0.42	2.27	.04	.55	.04	(.012)	(<.001)	1.20	1016

Minerals (Continued)

SrO	MgO	Cr_2O_3	Na_2O	K_2O	Li_2O	ZrO_2	BaO	Rb_2O	P_2O_5	CO_2	Loss on Ignition	SRM
0.14	0.36	----	0.04	0.25	-----	-----	-----	----	0.08	40.4	41.1	1b
.01	21.3	----	.01	.12	-----	-----	-----	----	.01	46.6	46.7	88a
-----	-----	----	2.55	11.8	-----	-----	0.02	0.06	----	----	0.40	70a
-----	0.02	----	6.2	5.2	-----	-----	.26	----	.02	----	0.26	99a
.18	.15	0.03	0.037	0.50	0.11	0.063	.078	----	.36	----	13.32	97a
.039	.42	.03	.082	1.04	.070	.042	.03	----	.11	----	12.44	98a
												81a
												165a
----	----	-----	-----	----	----	----	----	-----	-----	----	-----	154b

Refractories

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent as the Oxide) SiO_2	Al_2O_3	Total as Fe_2O_3	FeO	TiO_2
76a	Burned Refractory (Al_2O-40%)	IN PREP					
77a	Burned Refractory (Al_2O_3-60%)	IN PREP					
78a	Burned Refractory (Al_2O_3-70%)	IN PREP					
103a	Chrome refractory	60	4.6	29.96	----	12.43	0.22
198	Silica refractory	45	----	0.16	0.66	-----	.02
199	Silica refractory	45	----	.48	.74	-----	.06
104	Burned magnesite	60	2.54	.84	7.07	-----	.03

SRM	ZrO_2	MnO	P_2O_5	Cr_2O_3	CaO	MgO	Li_2O	Na_2O	K_2O	Loss on Ignition
76a										
77a										
78a										
103a	0.01	0.11	0.01	32.06	0.69	18.54	-----	-----	-----	----
198	<.01	.008	.022	------	2.71	0.07	0.001	0.012	0.017	0.21
199	.01	.007	.015	------	2.41	.13	.002	.015	.094	.17
104	----	.43	.057	0.026	3.35	85.67	.001	.015	.015	----

Carbides

SRM	Type	Wt/Unit (grams)	Carbon Total	Carbon Free	Silicon Total	Silicon SiC	Chemical Composition (Nominal Weight Percent) Fe	Al	Ti	Zr	Ca	Mg
112	Silicon carbide	85	29.10	0.09	69.11	96.85	0.45	0.23	0.025	0.027	0.03	0.02

Glasses

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) SiO_2	PbO	Al_2O_3	Fe_2O_3	ZnO	MnO	TiO_2	ZrO_2
89	Lead-Barium	45 g	65.35	17.50	0.18	0.049	----	0.088	0.01	0.005
91	Opal	45 g	67.53	0.097	6.01	.081	0.08	.008	.019	.0095
92	Low-Boron	45 g	-----	------	----	-----	----	-----	----	------
93a	High-Boron	Wafers 32 mm D X 6 mm	80.8	------	2.3	.029	----	-----	.012	.03
620	Soda-Lime, Flat	3 platelets 35 X 35 X 3 mm	72.1	------	1.8	.04	----	-----	.02	------
621	Soda-Lime, Container	IN PREP								

SRM	CaO	BaO	MgO	K_2O	Na_2O	B_2O_3	P_2O_5	As_2O_5	As_2O_3	SO_3	Cl	F	Loss on Ignition
89	0.21	1.40	0.03	8.40	5.70	-----	0.23	0.36	0.03	0.03	0.05	----	0.32
91	10.48	----	.008	3.25	8.48	-----	.022	.102	.091	----	.014	5.72	----
92	-----	----	------	----	-----	0.70	-----	-----	-----	----	-----	----	----
93a	<0.02	----	<.01	0.01	4.0	12.6	-----	-----	-----	----	-----	----	----
620	7.1	----	3.7	.4	14.4	----	-----	-----	.06	.3	-----	----	----
621													

Trace Element Standards

These SRM's are intended for use in calibrating instruments and in checking analytical techniques and procedures employed in the determination of trace elements in various inorganic matrices. [Note: For trace elements in biological matrices, see Biological Standards, page 43.]

SRM	Type – Matrix	Size	Unit of Issue
606	Trace Elements in Calcium Carbonate		10 gram
607	Trace Elements in Feldspar		5 gram
608	Trace Elements in Glass, Set	Wafers 3 mm Diameter	Set: 2 each 614 and 616
609	Trace Elements in Glass, Set	Wafers 1 mm Diameter	Set: 2 each 615 and 617
610	Trace Elements in Glass, 500 ppm	Wafers 3 mm Diameter	6 Wafers
611	Trace Elements in Glass, 500 ppm	Wafers 1 mm Diameter	6 Wafers
612	Trace Elements in Glass, 50 ppm	Wafers 3 mm Diameter	6 Wafers
613	Trace Elements in Glass, 50 ppm	Wafers 1 mm Diameter	6 Wafers
614	Trace Elements in Glass, 1 ppm	Wafers 3 mm Diameter	6 Wafers
615	Trace Elements in Glass, 1 ppm	Wafers 1 mm Diameter	6 Wafers
616	Trace Elements in Glass, 0.02 ppm	Wafers 3 mm Diameter	6 Wafers
617	Trace Elements in Glass, 0.02 ppm	Wafers 1 mm Diameter	6 Wafers
618	Trace Elements in Glass, Set	Wafers 3 mm Diameter	Set: 1 each 610, 612, 614 and 616
619	Trace Elements in Glass, Set	Wafers 1 mm Diameter	Set: 1 each 611, 613, 615 and 617

NOTE: Glass – Nominal Composition: 72% SiO_2, 12% CaO, 14% Na_2O, and 2% Al_2O_3.

Element	606	607	610–611 500 ppm	612–613 50 ppm	614–615 1 ppm	616–617 0.02 ppm
Antimony	-----	-----	-----	-----	(1.06)	(0.078)
Barium	-----	-----	-----	(41)	-----	-----
Boron	-----	-----	(351)	(32)	(1.30)	(0.20)
Cadmium	-----	-----	-----	-----	(0.55)	-----
Cerium	-----	-----	-----	(39)	-----	-----
Chromium	-----	-----	-----	-----	(0.99)	-----
Cobalt	-----	-----	(390)	(35.5)	0.71	-----
Copper	-----	-----	(444)	(37.7)	1.34	(0.65)
Dysprosium	-----	-----	-----	(35)	-----	-----
Erbium	-----	-----	-----	(39)	-----	-----
Eurpoium	-----	-----	-----	(36)	(0.99)	-----
Gadolinium	-----	-----	-----	(39)	-----	-----
Gallium	-----	-----	-----	-----	(1.3)	(0.23)
Gold	-----	-----	(25)	(5)	(0.5)	(0.18)
Indium	-----	-----	-----	-----	(0.75)	(0.26)
Iron	-----	-----	458	51	13.5	(11)
Lanthanum	-----	-----	-----	(36)	(0.83)	(0.034)
Lead	(0.374)	-----	426	38.57	2.32	1.85
Manganese	-----	-----	485	(39.6)	(1.41)	(0.65)
Molybdenum	-----	-----	(111)	-----	-----	-----
Neodymium	-----	-----	-----	(36)	-----	-----
Nickel	-----	-----	458.7	38.8	(0.95)	-----
Potassium	-----	-----	(461)	(64)	30	29
Rhenium	-----	-----	(49.1)	-----	-----	-----
Rubidium	-----	523.90	425.7	31.4	0.855	(0.0998)
Samarium	-----	-----	-----	(39)	-----	-----
Scandium	-----	-----	-----	-----	(0.59)	(0.026)
Silver	-----	-----	(254)	22.0	0.42	-----
Strontium	-----	65.485	515.5	78.4	45.8	41.72
Thallium	-----	-----	(61.8)	(15.7)	(0.269)	(0.0082)
Thorium	-----	-----	457.2	37.79	0.748	0.0252
Titanium	-----	-----	(437)	(50.1)	(3.1)	(2.5)
Uranium	-----	-----	461.5	37.38	0.823	0.0721
Ytterbium	-----	-----	-----	(42)	-----	-----
Zinc	-----	-----	(433)	-----	(2.43)	-----

In addition to the 35 elements listed above, the Glass SRM's contain the following 26 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Ta, Te, Tb, Tm, Sn, W, V, Y, and Zr.

Nuclear Materials

Special Nuclear Materials

These SRM's consist of four groups: Plutonium Assay Standards, Plutonium Isotopic Standards, Uranium Assay Standards, and Uranium Isotopic Standards.

These SRM's are available to AEC contractors, AEC or State Licensees, and foreign governments that have entered an Agreement for Cooperation with the U.S. Government concerning the Civil Uses of Atomic Energy. The purchase request for these SRM's must be made on special forms obtainable from the Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234.

Plutonium Assay Standards

SRM	Type	Certified for	Wt/Units (grams)	Purity (%)
944	Plutonium sulfate tetrahydrate	Plutonium Content	0.5	47.50*
945	Plutonium metal, standard matrix	Impurities	5	(99.9)
949d	Plutonium metal assay	Plutonium Content	0.5†	99.99

*Stoichiometric

†Nominal weight, each SRM is issued with an individual weight.

(Values in parentheses are not certified, but are given for information only.)

Plutonium Isotopic Standards

SRM	Type	Wt/Units (grams)	Atom Percent ^{238}Pu	^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu
946	Plutonium Sulfate Tetrahydrate	0.25	0.247	83.128	12.069	3.991	0.565
947	Plutonium Sulfate Tetrahydrate	.25	.296	75.696	18.288	4.540	1.180
948	Plutonium Sulfate Tetrahydrate	.25	.011	91.574	7.914	0.468	0.0330

Uranium Assay Standards

SRM	Type	Certified For	Wt/Unit (grams)	Purity (%)
950a	Uranium Oxide	Uranium Oxide	25	99.94 (U_3O_8)
960	Uranium Metal	Uranium	26	99.975 (U)

Uranium Isotopic Standards

SRM	Uranium Oxide (U_3O_8)	Wt (grams)	Atom Percent ^{234}U	^{235}U	^{236}U	^{238}U
U-0002	Depleted	1.0	0.00016	0.01755	<0.00001	99.9823
U-005	Depleted	1.0	.00218	.4895	.0046	99.504
U-010	Enriched	1.0	.00541	1.0037	.00681	98.984
U-015	Enriched	1.0	.00850	1.5323	.0164	98.443
U-020	Enriched	1.0	.0125	2.038	.0165	97.933
U-030	Enriched	1.0	.0190	3.046	.0204	96.915
U-050	Enriched	1.0	.0279	5.010	.0480	94.915
U-100	Enriched	1.0	.0676	10.190	.0379	89.704
U-150	Enriched	1.0	.0993	15.307	.0660	84.528
U-200	Enriched	1.0	.1246	20.013	.2116	79.651
U-350	Enriched	1.0	.2498	35.190	.1673	64.393
U-500	Enriched	1.0	.5181	49.696	.0755	49.711
U-750	Enriched	1.0	.5923	75.357	.2499	23.801
U-800	Enriched	1.0	.6563	80.279	.2445	18.820
U-850	Enriched	1.0	.6437	85.137	.3704	13.848
U-900	Enriched	1.0	.7777	90.196	.3327	8.693
U-930	Enriched	1.0	1.0812	93.336	.2027	5.380
U-970	Enriched	1.0	1.6653	97.663	.1491	0.5229

Neutron Density Standards

These SRM's are provided as reference sources of a cobalt-in-aluminum alloy to serve as a neutron density monitor wire SRM. Accurate determination of thermal neutron densities is essential in irradiation tests to obtain a basis for comparison of densities among reactors, in applying data in the design of reactors, in understanding the mechanisms of radiation damage, and for use in neutron activation analysis. The wire is 0.5 mm in diameter and is available in four lengths.

SRM	Type	Unit	Cobalt Content (Weight percent)
953	Neutron density monitor wire (Co in Al)	1 meter	0.116
953L1	Neutron density monitor wire (Co in Al)	5 meters	.116
953L2	Neutron density monitor wire (Co in Al)	10 meters	.116
953L3	Neutron density monitor wire (Co in Al)	25 meters	.116

Isotopic Reference Standards

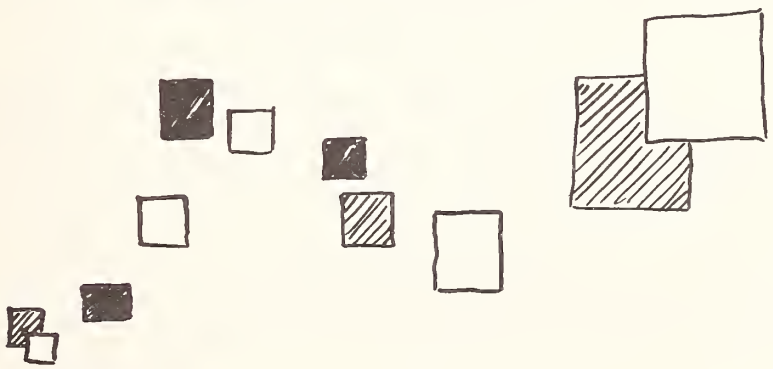
SRM's for isotopic ratio are natural-ratio materials, unless otherwise noted, and are furnished with a certificate of isotopic composition.

The isotopic composition of these SRM's has been determined by mass spectrometry, by comparison with mixtures prepared from high-purity separated isotopes. They are useful for those looking for small variations in the isotopic composition of the elements, and for the evaluation of mass discrimination effects encountered in the operation of mass spectrometers.

A description of the methods used in the characterization of the normal and enriched boric acid, SRM's 951 and 952, is given in NBS Special Publication 260-17. (See inside of back cover for ordering instructions.)

SRM	Isotopic Reference Standards	Element Certified	Wt/Unit (grams)
951	Boric Acid	Boron	1.0
952	Boric Acid, 95% Enriched ^{10}B	Boron	100
975	Sodium Chloride	Chlorine	0.25
976	Copper Metal	Copper	.25
977	Sodium Bromide	Bromine	.25
978	Silver Nitrate	Silver	.25
979	Chromium Nitrate	Chromium	.25
980	Magnesium Metal	Magnesium	.25
*981	Lead Metal, Natural	Lead	1.0
*982	Lead Metal, Equal Atom (206/208)	Lead	1.0
*983	Lead Metal, Radiogenic (92%-206)	Lead	1.0
984	Rubidium Chloride, assay and isotopic	Rubidium	0.25
987	Strontium Carbonate, assay and isotopic	Strontium	.25
988	Strontium-84 Spiked, assay and isotopic	Strontium	10

*Sold as a set only of three 981, 982, and 983



Ion Activity Standards

These SRM's are intended for use in the preparation of solutions for the calibration of specific-ion electrodes. This includes the pH and pD measuring systems.

pH Standards

These SRM's are furnished as crystals for the preparation of solutions of known hydrogen ion concentration for calibrating and checking the performance of commercially available pH materials and instruments. They are furnished with certificates giving directions for preparation of the solutions and tables of pH values at various temperatures.

SRM's 186Ic and 186IIc, 191 and 192, and 922 and 923, are certified for use in admixture only. At an equimolar (0.025 molal) mixture of SRM's 186Ic and 186IIc, a pH(S) of 6.863 at 25 °C is obtained. Directions also are furnished for the preparation of a physiological reference solution from 186Ic and 186IIc having a pH(S) of 7.415 at 25 °C.

SRM	Type	pH(S) (at 25 °C)	Wt/Unit (grams)
185e	Potassium Acid Phthalate	4.004	60
186Ic	Potassium dihydrogen phosphate	{6.863}	30
186IIc	Disodium hydrogen phosphate	{7.415}	30
187b	Borax	9.183	30
188	Potassium hydrogen tartrate	3.557	60
189	Potassium tetroxalate	1.679	65
191	Sodium bicarbonate	10.01	30
192	Sodium carbonate		30
922	Tris(hydroxymethyl)aminomethane	7.699	25
923	Tris(hydroxymethyl)aminomethanehydrochloride		35

pD Standards

These SRM's are furnished as crystals for preparation of solutions of known deuterium-ion concentration for the calibration and correction of pH indicating equipment to indicate pD data. SRM's 2186I and 2186II, and 2191 and 2192, are certified for use in admixtures only.

SRM	Type	pD(S) Values	Wt/Unit (grams)
2186-I	Potassium dihydrogen phosphate	7.43	30
2186-II	Disodium hydrogen phosphate		30
2191	Sodium bicarbonate	10.74	30
2192	Sodium carbonate		30

Ion - Selective Electrodes

These SRM's are certified for the calibration of ion-selective electrodes and have conventional ionic activities based on the Stokes-Robinson hydration theory for ionic strengths greater than 0.1 mole per liter.

SRM	Type	Certified Property	Wt/Unit (grams)
2201	Sodium Chloride	pNa, pCl	125
2202	Potassium Chloride	pK, pCl	160

Mechanical and Metrology Standards

These SRM's are intended to relate measurement units made in industrial, university, and government laboratories to the mechanical and metrological units related through a National Measurement System[1] to the base units of mass, length, and time.

Coating Thickness Standards

These SRM's have a specimen size of 3 X 3 cm and are for calibrating coating thickness gages of the magnetic type for the measurement of thickness of nonmagnetic coatings on steel, nickel on steel, or nickel on nonmagnetic substrates. The steel substrates have the magnetic properties of AISI 1010 steel and the nickel coatings have the magnetic properties of an annealed, Watts nickel electrodeposit free of cobalt and iron.

The magnetic type thickness gages are often used to measure the thickness of paint and other organic coatings on steel, as well as zinc (galvanized) and other nonmagnetic metallic coatings. SRM's in the 1301 to 1320 series (sets 1351, 1361-64) are used to calibrate these gages. The number of different thicknesses required for these calibrations depends on the type of gage and the coating thicknesses to be measured.

The magnetic type thickness gages can be used to estimate magnetic properties of austenitic stainless steel weld metal. Because the magnetic properties of the weld metal are closely related to the ferrite content of the weld, these instruments are used to estimate the ferrite content. For these measurements, the coating thickness SRM's 1312–1319 (as sets 1368–70) are used to calibrate the instrument. The ferrite contents having magnetic properties similar to those of the various coating thickness SRM's have been established by other laboratories. For sets 1351 to 1369, the specimens are mounted on one card. Set 1370 is mounted on two cards, but packed in one box.

SRM's with gold and tin coatings on various substrates have a specimen size of 15 X 15 mm and are for calibrating coating thickness gages of the beta-backscatter type and for calibrating x-ray fluorescence methods for the measurement of the weight per unit area of gold or tin coatings. For gold and tin sets, the specimens are mounted on separate cards, but are packed in one box.

The gold coating standards were measured by beta-ray backscatter and x-ray fluorescence techniques relative to NBS gold coating materials for which the average weights per unit area were determined by weight and area measurements. They are suitable for the direct calibration of equipment used to measure weight per unit area of gold coating of equivalent purity. From the density and weight per unit area, the instruments can be calibrated in terms of the thickness of the standard.

For the tin coating standards, x-ray fluorescence techniques were used to measure the thickness of the tin coating relative to NBS tin coating material for which the average weights per unit area were determined by weight and area measurements.

ASTM Methods of Measuring Coating Thickness

Instrumental methods of measuring coating thickness are set forth in the following ASTM Methods of Test. [NOTE: Metric units. ASTM plating specifications use μm and mil, but do not go to thicknesses greater than about 75 μm: 1 mil = 0.001 inch = 25.4 μm.]

- B499 Method of Measurement of Coating Thicknesses by the Magnetic Method; Nonmagnetic Coatings on Magnetic Basis Metals.
- B529 Measurement of Coating Thicknesses by the Eddy-Current Test Method: Nonconductive Coatings on Nonmagnetic Basis Metals.
- B530 Measurement of Coating Thicknesses by the Magnetic Method: Electrodeposited Nickel Coatings on Magnetic and Nonmagnetic Substrates.
- B504 Measuring the Thickness of Metallic Coatings by the Coulometric Method.
- B244 Measuring Thickness of Anodic Coatings on Aluminum with Eddy-Current Instruments.
- E376 Recommended Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods.
- D1400 Measurement of Dry Film Thickness of Nonmetallic Coatings of Paint, Varnish, Lacquer, and Related Products Applied on a Nonmagnetic Metal Base.
- D1186 Measurement of Dry Film Thickness of Nonmagnetic Organic Coatings Applied on a Magnetic Base.

[1] "Concept of a National Measurement System," Science 158, 67-71 (1967).

Nonmagnetic Coatings on Steel, or Nickel on Nonmagnetic Substrate

Nonmagnetic Coating on Magnetic Substrate (Copper and Chromium on Steel)

SRM	Nominal Coating Thickness		
	(inch)	(metric)	(mil)
1301	0.00010	2.54 μm	0.10
1302	.00025	6.25 μm	.25
1303	.00050	12 μm	.50
1304	.00075	19 μm	.75
1305	.0010	25 μm	1.0
1306	.0015	38 μm	1.5
1307	.0020	51 μm	2.0
1308	.0025	62 μm	2.5
1309	.0027	68 μm	2.7
1310	.0032	81 μm	3.2
1311	.0055	0.14 mm	5.5
1312	.0080	.23 mm	8.0
1313	.010	.25 mm	10.0
1314	.015	.38 mm	15.0
1315	.020	.51 mm	20.0
1316	.025	.62 mm	25.0
1317	.03	.76 mm	30.0
1318	.04	1.0 mm	40.0
1319	.06	1.5 mm	60.0
1320	.08	2.0 mm	80.0
1351	Set of 2: 1307 and 1311		
1361	Set of 4: 1302, 1303, 1305, and 1307		
1362	Set of 4: 1306, 1310, 1311, and 1312		
1363	Set of 4: 1313, 1314, 1315, and 1316		
1364	Set of 4: 1317, 1318, 1319, and 1320		
1368	Set of 4: 1312, 1313, 1314, and 1315		
1369	Set of 4: 1316, 1317, 1318, and 1319		
1370	Set of 8: 1312, 1313, 1314, 1315, 1316, 1317, 1318, and 1319		

Magnetic Coating on Magnetic Substrate (Nickel on Steel)

SRM	Nominal Coating Thickness		
	(inch)	(micrometer)	(mil)
1331	0.00012	3.0	0.12
1332	.00035	8.9	.35
1333	.00055	14	.55
1334	.00075	19	.75
1335	.0010	25	1.0
1336	.0013	33	1.3
1337	.0016	40	1.6
1338	.0020	51	2.0
1339	.0025	62	2.5
1352	Set of 2: 1332 and 1334		
1353	Set of 2: 1335 and 1339		
1365	Set of 4: 1331, 1332, 1333, and 1334		
1366	Set of 4: 1335, 1336, 1337, and 1338		

Magnetic Coating on Non-Magnetic Substrate (Nickel and Chromium on Brass)

SRM	Nominal Coating Thickness		
	(inch)	(micrometer)	(mil)
1341	0.00012	3.0	0.12
1342	.00035	8.9	.35
1343	.00065	16.5	.65
1344	.0010	25	1.0
1345	.0015	38	1.5
1346	.0020	51	2.0
1367	Set of 4: 1341, 1342, 1343, and 1344		

Gold and Tin Coating Thickness Standards

Gold Coating on Glass Sealing Alloy – ASTM Designation F15; Fe-53, Ni-29, and Co-17.

SRM	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness (micrometers)	(microinches)
1371	1.5	0.8	30
1372	3.0	1.5	60
1373	6.0	3.0	120
1374	14.0	7.1	280
1381	Set of 2: 1371 and 1372		
1382	Set of 2: 1372 and 1373		
1383	Set of 2: 1373 and 1374		
1398	Set of 4: 1371, 1372, 1373, and 1374		

Gold Coating on Nickel

SRM	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness (micrometers)	(microinches)
1375	1.5	0.8	30
1376	3.0	1.5	60
1377	6.0	3.0	120
1378	17.0	8.9	350
1384	Set of 2: 1375 and 1376		
1385	Set of 2: 1376 and 1377		
1386	Set of 2: 1377 and 1378		
1399	Set of 4: 1375, 1376, 1377, and 1378		

Gold Coating on Copper-Clad, Glass-Epoxy Laminate

SRM	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness (micrometers)	(microinches)
2301	1.5	0.8	30
2302	3.0	1.5	60
2303	6.0	3.0	120
2304	14.0	7.1	280
2305	Set of 2: 2301 and 2302		
2306	Set of 2: 2302 and 2303		
2307	Set of 2: 2303 and 2304		
2308	Set of 4: 2301, 2302, 2303, and 2304		

Gold Coating on Copper

SRM	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness (micrometers)	(microinches)
2311	1.5	0.8	30
2312	3.0	1.5	60
2313	6.0	3.0	120
2314	14.0	7.1	280
2315	Set of 2: 2311 and 2312		
2316	Set of 2: 2312 and 2313		
2317	Set of 2: 2313 and 2314		
2318	Set of 4: 2311, 2312, 2313, and 2314		

Tin Coating on Steel

SRM	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness (micrometers)	(microinches)
2331	1.1	1.5	60
2332	2.0	2.8	110
2333	3.0	4.0	160
2334	5.0	7.0	275
2335	12.0	16.5	650
2336	14.0	19.0	750
2338	Set of 2: 2332 and 2335		
2339	Set of 4: 2331, 2333, 2334, and 2336		
2340	Set of 6: 2331, 2332, 2333, 2334, 2335, and 2336		

Density Standards

These SRM's are certified with respect to values of density, for air-saturated material at 1 atm, at 20, 25, and 30 °C, to ± 0.00002 g/ml. These SRM's may be used to calibrate picnometers and density balances. A Certificate is supplied with each of these SRM's. SRM 217b-8S is contained in a special ampoule with an internal breakoff tip, the others are sealed "in vacuum" in plain glass ampoules.

SRM	Type	Approx.d^{20}	Amount, ml
217b-5	2,2,4-Trimethylpentane	0.6918	5
217b-8S	2,2,4-Trimethylpentane	.6918	8
217b-25	2,2,4-Trimethylpentane	.6918	25
217b-50	2,2,4-Trimethylpentane	.6918	50

Glass Viscosity Standards

SRM's 710, 711, and 717 are furnished as rectangular-shaped bars, and are certified for viscosity between values of 10^2 and 10^{12} poises. They are furnished to check the performance of high-temperature viscosity equipment (rotating cylinders) and low-temperature viscosity equipment (fiber elongation). In addition, values are furnished for the softening point, annealing point, and strain point by ASTM Designations (C338-61 and C336-61). Certificates of Data from participating laboratories are furnished for each of the three glasses.

SRM's 712, 713, 714, 715, and 716 are furnished in cane, gobs, or patties as listed, and are certified only for softening point, annealing point, and strain point. Certificates of Data from three laboratories are furnished for each of these glasses.

SRM	Type	Unit of Issue
710	Soda-lime silica glass-type 523/586	2 lb
711	Lead-silica glass-type 617/366	3 lb
712	Mixed alkali lead silicate glass, 1/4 in patties (6 pcs.)	0.5 lb
713	Dense barium crown 620/603 glass, 1 3/8 in diam × 5/8 in thick gobs (4 pcs.)	.5 lb
714	Alkaline earth alumina silicate glass, 1/4 in diam cane (16 pcs–6 in long)	.5 lb
715	Alkali-free aluminosilicate glass, 1/4 in diam cane (13 pcs–6 in long)	200 g
716	Neutral (borosilicate) glass, 1/2 in diam cane (6 pcs–6 in long)	250 g
717	Borosilicate glass, 4.2 cm × 4.2 cm × 12.5 cm bar	500 g

SRM	Viscosity (Poises at Indicated Temperature (° C)											Softening Point °C	Annealing Point °C	Strain Point °C
	10^2	10^3	10^4	10^5	10^6	10^7	10^8	10^9	10^{10}	10^{11}	10^{12}			
710	1434.3	1181.7	1019.0	905.3	821.5	757.1	706.1	664.7	630.4	601.5	576.9	724	546	504
711	1327.1	1072.8	909.0	794.7	710.4	645.6	594.3	552.7	518.2	489.2	464.5	602	432	392
712	----	----	----	----	----	----	----	----	----	----	----	528	386	352
713	----	----	----	----	----	----	----	----	----	----	----	738	631	599
714	----	----	----	----	----	----	----	----	----	----	----	908	710	662
715	----	----	----	----	----	----	----	----	----	----	----	961	764	714
716	----	----	----	----	----	----	----	----	----	----	----	794	574	530
717	1545.1	1248.8	1059.4	927.9	831.2	757.1	698.6	651.1	611.9	579.0	550.9	720	516	471

Polymer Standards

Four Polymer SRM's are available: Two polystyrenes, one with a narrow molecular weight distribution (SRM 705), the other with a broad distribution (SRM 706), and two polyethylenes, linear (SRM 1475) and branched (SRM 1476).

These materials are certified for the properties indicated in the table, such as weight and number average molecular weight, molecular weight distribution, limiting viscosity numbers (intrinsic viscosities) in several solvents, density, and melt flow.

These SRM's have wide application not only in the calibration of instruments used in polymer characterization, such as light scattering photometers, osmometers, gel permeation chromatographs, but also wherever a well characterized polymer material is needed, as for example in studies of dilute solution behavior, rheology, and polymer crystal physics.

The certificate for SRM 1475 is accompanied by a series of papers, reprinted from the Journal of Research of the National Bureau of Standards, which describe how the measurements were obtained.

SRM	Type	Wt/Unit (grams)
705	Polystyrene, narrow molecular weight distribution, $M_W \approx 179{,}000$, $M_W/M_n \approx 1.07$	5
706	Polystyrene, broad molecular weight distribution, $M_W \approx 258{,}000$, $M_W/M_n \approx 2.1$	18
1475	Polyethylene, linear, $M_W \approx 52{,}000$, $M_W/M_n = 2.9$	50
1476	Polyethylene, branched.	50

The following table lists the properties (and method) certified for these SRM's.

Property (and method)		705	706	1475	1476
Molecular Weight					
Weight Average	(Light Scattering)	X	X	X	---
	(Sedimentation Equilibrium)	X	X	---	---
	(Gel Permeation Chromatography-GPC)	---	---	X	---
Number Average	(Osmometry)	X	---	---	---
	(GPC)	---	---	X	---
Molecular Weight Distribution	(GPC)	---	---	X	---
Limiting Viscosity Number	(Capillary Viscometer)				
Benzene 25 °C		X	X	---	---
Benzene 35 °C		X	---	---	---
Cyclohexane 35 °C		X	X	---	---
1-Chloronaphthalene 130 °C		---	---	X	X
1,2,4-trichlorobenzene 130 °C		---	---	X	X
Decahydronapthalene 130 °C		---	---	X	X
Melt Flow	(ASTM)	---	---	X	X
Density	(ASTM)	---	---	X	X

Elasticity Standards

This SRM is polycrystalline alumina prepared from a single block of material by isostatically cold pressing and then sintering alumina powder containing 0.1 percent magnesium oxide. It is intended for the calibration of apparatus used in the measurement of resonance frequencies from which elastic moduli are calculated. Each bar has been individually measured and calibrated, and all surfaces were machined flat and parallel.

SRM	Type	Size
718	Polycrystaline Alumina	12.7 X 1.27 X 0.32 cm

Heat Standards

These SRM's are intended to relate heat and temperature measurements made in industrial, university, and government laboratories with the International Practical Temperature Scale-1968[1].

Superconductive Thermometric Fixed Point Devices

The SRM is a device composed of small cylinders of high purity lead, indium, aluminum, zinc, and cadmium mounted in a threaded copper stud and enclosed by a mutual inductance coil set. It provides convenient temperature calibrations in the range 0.5 - 7 K with precision of ± 0.001 K. It should prove particularly valuable to users of ^{3}He-^{4}He dilution refrigerators, in which direct calibrations on the liquid helium vapor pressure-temperature scales are difficult, and to those who wish to determine the temperature reproducibility of physical phenomena or of cryogenic equipment.

SRM	Type	Element	Nominal Temperature (K)
767	Superconductive Thermometric Fixed Point Device	Lead	7.2
		Indium	3.4
		Aluminum	1.2
		Zinc	0.8
		Cadmium	.5

Freezing Point Standards

Defining Fixed Points – International Practical Temperature Scale

These SRM's are of such purity that they are suitable for defining fixed points for the International Practical Temperature Scale of 1968.[1]

SRM	Type	Temperature C	Wt/Unit (grams)
740	Zinc	419.58	350
741	Tin	231.9681	350

Determined Reference Points

These SRM's are intended for use in calibration of thermometers, thermocouples, and other temperature measuring devices. The temperatures certified are in accord with the International Practical Temperature Scale of 1968.

SRM	Type	Temperature C	Wt/Unit (grams)
42g	Tin	231.967	350
43h	Zinc	419.58*	350
44f	Aluminum	660.3	200
45d	Copper	1084.8	450
49e	Lead	327.493	600

* SRM 43h is less pure than SRM 740 and has a freezing point 0.001 C lower.

[1] "International Practical Temperature Scale of 1968," Metrologia, 5 35-44 (1969).

Melting Point Standard

This SRM is calcined alpha alumina the purity of which (99.9+ percent) makes it a suitable pyrometric standard for melting point on the International Practical Temperature Scale of 1968.

SRM	Type	Temperature °C	Wt/Unit (grams)
742	Alumina	2053	10

Calorimetric Standards

These SRM's are intended to relate the gain or loss of energy and work experienced during a chemical reaction or by change of temperature to the units of energy and work as defined by the National Measurement System. This system uses the units prescribed by the International System of Units (SI). The unit for energy and work under this system is the joule, which is related to the historically defined calorie by the equation: 4.184 joule = 1 calorie.

Combustion Calorimetric Standards

These SRM's are issued primarily to check the performance of calorimetric methods for the determination of the heat of combustion. SRM 217b-8S is contained in a special ampoule with an internal break-off tip, the others are sealed "in vacuum" in plain glass ampoules.

SRM	Type	Unit Amount
39i	Benzoic acid, 26.434 absolute kilojoules/gram	30 g
217b-5	2,2,4-Trimethylpentane, 47.713 absolute kilojoules/gram	5 ml
217b-8S	2,2,4-Trimethylpentane	8 ml
217b-25	2,2,4-Trimethylpentane	25 ml
217b-50	2,2,4-Trimethylpentane	50 ml

Solution Calorimetric Standards

These SRM's are issued primarily to check the performance of calorimetric methods used for the determination of heats of solution and heats of reactions in solution.

SRM	Type	Wt/Unit (grams)
724	tris(hydroxymethyl)aminomethane	50
1654	α-Quartz for HF acid solution calorimetry	25

Heat Source Calorimetric Standards

SRM	Type	Wt/Unit (grams)
1651	Zirconium-barium chromate heat source powder (ca 350 cal/g)	50
1652	Zirconium-barium chromate heat source powder (ca 390 cal/g)	50
1653	Zirconium-barium chromate heat source powder (ca 425 cal/g)	50

Enthalpy and Heat Capacity Standards

This SRM has been certified for enthalpy and heat capacity of 99.95+ percent α-alumina over a temperature range from 273.15 to 2250 K.

SRM	Type	Wt/Unit (grams)
720	Sapphire, synthetic (Al_2O_3)	15 g

Differential Thermal Analysis Standards

The first two of these SRM's, 755 and 756, were issued upon the recommendation of the International Confederation of Thermal Analysis (ICTA) as standards for checking the performance of differential thermal analysis equipment. SRM's 758, 759, and 760 have been issued by NBS in cooperation with ICTA as standards for calibrating differential thermal analysis and related thermoanalytical equipment under operating conditions. SRM's 758, 759, and 760 comprise a total of eight inorganic substances and two metals.

SRM	Type	Temperature/Range (°C)	Unit of Issue
755	Quartz SiO_2	575	2 g
756	Potassium Nitrate	130	5 g
758	DTA Temperature Standard	125-435	Set of 5 (See below)
759	DTA Temperature Standard	295-675	Set of 5 (See below)
760	DTA Temperature Standard	570-940	Set of 5 (See below)

758 (125-435 °C)	759 (295-675 °C)	760 (570-940 °C)	Peak Temp. °C	Wt(g)
KNO_3	------	------	135	10
In (Metal)	------	------	159	3
Sn (Metal)	------	------	237	3
$KClO_4$	$KClO_4$	------	309	10
Ag_2SO_4	Ag_2SO_4	------	433	3
------	SiO_2	SiO_2	574	3
------	K_2SO_4	K_2SO_4	588	10
------	K_2CrO_4	K_2CrO_4	673	10
------	---	$BaCO_3$	819	10
------	---	$SrCO_3$	938	10

Vapor Pressure Standards

These SRM's are intended for use in the testing and calibration of vapor pressure measurement apparatus and techniques. The materials ultimately will include gold, cadmium, platinum, silver, and tungsten, and will cover a temperature range of 600 to 3,000 K.

SRM	Type	Pressure Range (atmosphere)	Temperature Range (K)	Unit Size
745	Gold	10^{-3} to 10^{-8}	1300 - 2100	Wire 1.44 mm X 152 mm
746	Cadmium	10^{-4} to 10^{-11}	350 - 594	Rod 6.4 mm X 64 mm
747	Platinum	------	------	IN PREP
748	Silver	10^{-3} to 10^{-12}	800 - 1600	Rod 6.4 mm X 64 mm
749	Tungsten	------	------	IN PREP

Thermal Conductivity Standards

These SRM's cover the high, medium, and low conductivity ranges. They will be useful for intercomparing thermal conductivity apparatus, debugging new apparatus, and calibrating comparative apparatus.

SRM	Type	Temperature Range (K)	Diameter (mm)	Length (mm)
734-S	Electrolytic Iron	6-280	6.4	305
734-L1	Electrolytic Iron	6-280	31.8	152
734-L2	Electrolytic Iron	6-280	31.8	305
735-S	Stainless Steel	5-280	6.5	300
735-M1	Stainless Steel	5-280	12.5	150
735-M2	Stainless Steel	5-280	12.5	300
735-L1	Stainless Steel	5-280	35	50
735-L2	Stainless Steel	5-280	35	100

Thermal Expansion Standards

These SRM's cover the temperature range from 20 to 1900 K having coefficients of thermal expansion over the range of 0.5 to 25 $\times$ 10^{-6}/K.

SRM	Type	Temperature Range (K)	Diameter (mm)	Length (mm)
731-L1	Borosilicate Glass	80-680	6.4	51
731-L2	Borosilicate Glass	80-680	6.4	102
731-L3	Borosilicate Glass	80-680	6.4	152
732-L1	Sapphire	IN PREP		
732-L2	Sapphire	IN PREP		
732-L3	Sapphire	IN PREP		
736-L1	Copper	20-800	6.4	51
736-L2	Copper	20-800	6.4	102
736-L3	Copper	20-800	6.4	152
737-L1	Tungsten	IN PREP		
737-L2	Tungsten	IN PREP		
737-L3	Tungsten	IN PREP		
739-L1	Fused Silica	80-1000	6.4	51
739-L2	Fused Silica	80-1000	6.4	102
739-L3	Fused Silica	80-1000	6.4	152

Thermocouple Materials

This SRM is intended to serve as a convenient mechanism for the comparison of manufactured wire to standard reference thermocouple tables.

SRM	Type	Form
733	Silver-28 Atomic Percent Gold	Wire: 32AWG(0.2019 mm) diameter 3 meters long

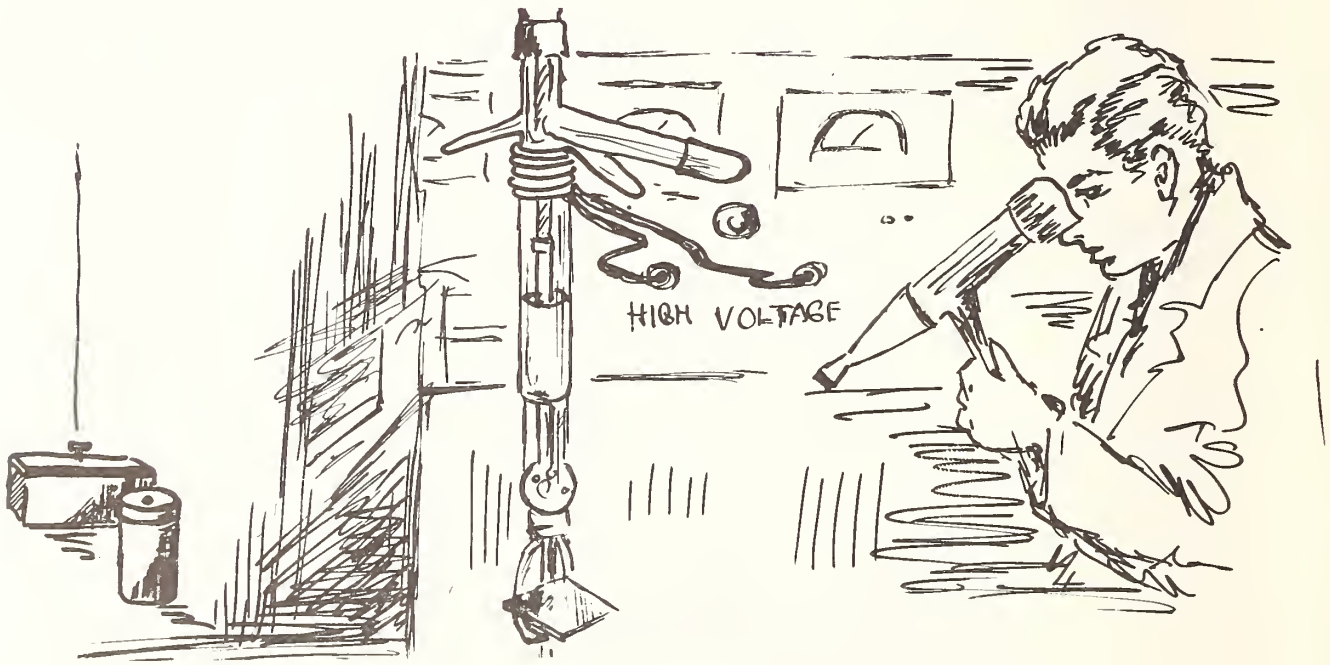
Magnetic Standards

Magnetic Susceptibility Standards

These SRM's are intended for use in the calibration of instruments used to measure magnetic susceptibility. The susceptibility values shown are nominal for 297 K.

SRM	Type	Gram Susceptibility $\chi, cm^3 \cdot g^{-1}$	Volume Susceptibility k	Form/Unit	
763-1	Aluminum *	0.605×10^{-6}	1.63×10^{-6}	Cylinder	3 mm diameter × 3 mm
763-2	Aluminum			Wire	0.5 mm diameter × 250 mm
763-3	Aluminum			Rod	6 mm diameter × 175 mm
764-1	Platinum	0.990×10^{-6}	21.2×10^{-6}	Cylinder	3 mm diameter × 3 mm
764-2	Platinum			Wire	0.5 mm diameter × 50 mm
765-1	Palladium	5.25×10^{-6}	63.1×10^{-6}	Cylinder	3 mm diameter × 3 mm
765-2	Palladium			Wire	0.5 mm diameter × 50 mm
765-3	Palladium			Sponge	1 gram
766-1	Manganese Fluoride	123.5×10^{-6}	484×10^{-6}	Cube	3 × 3 × 3 mm

*At 77.7K, Gram Susceptibility for SRM 763: $\chi = 0.695 \times 10^{-6}\ cm^3 \cdot g^{-1}$



Optical Standards

Spectrophotometric Standards

Color Standards for Spectrophotometer-Tristimulus Integrator Systems

This SRM is a set of 5 transparent colored glass filters to check the performance of spectrophotometer-tristimulus integrator systems, the automatic recording and computing devices used in routine color measurements. Each glass filter is 2-inches (5 cm) square (approximately 3.0 mm thick) with polished faces. A chart of tristimulus values for CIE sources A, B, and C, representing incandescent-lamp light, noon sunlight, and average daylight; and a detailed report on the changes in tristimulus values caused by errors in the 100-percent and zero adjustments of the photometric scale, wavelength errors, slit-width errors, errors due to stray energy, and inertia errors of the recording mechanisms are furnished with each set of glasses. Through the use of these filters the user of a spectrophotometer-integrator combination will be able to determine when the instrument goes out of adjustment. From the pattern of the discrepancies between measured and reported tristimulus values, he will also be able to obtain some clue as to the type of maladjustment.

This SRM is available only as a set of five filters.

SRM	Type	Unit Size
2101	Orange-red glass	Supplied only as a set - one each of 5 filters
2102	Signal yellow glass	
2103	Sextant green glass	
2104	Cobalt blue glass	
2105	Selective neutral glass	

Glass and Liquid Filters for Spectrophotometry

These SRM's are intended primarily for use in checking the accuracy of the photometric scale of spectrophotometers and to provide a means of interlaboratory comparisons of spectrophotometric data.

The Glass Filters, SRM 930a, consists of three filters having transmittances of approximately 10, 20, and 30 percent. Each filter is individually calibrated and certified for absorbance and transmittance over a spectral wavelength range from 440 to 635 nanometers.

The Liquid Filters, SRM 931, are absorbance standards for use in ultraviolet and visible spectrophotometry. This SRM consists of three sets of four vials containing approximately 10 ml of solution. Each set contains a "Blank" and three concentrations of the liquid filter. The net absorbance of these filters are certified at 302, 395, 512, and 678 nanometers.

SRM	Type	Unit of Issue
930a	Glass filters for Spectrophotometry	Set of 3 filters
931	Liquid Absorbance Standards for Ultraviolet and Visible Spectrophotometry	3 Sets of 4 vials

Thermal Emittance Standards

SRM's of normal spectral emittance are available in three materials, platinum-13 percent rhodium alloy having low emittance, sandblasted and oxidized Kanthal (an iron-chromium-aluminum alloy) having intermediate emittance, and sandblasted and oxidized Inconel (a nickel-chromium-iron alloy) having high emittance. SRM's of all three materials have been calibrated for normal spectral emittance at 800 and 1100 K; the Kanthal and Inconel standards at 1300 K and the platinum-13 percent rhodium at 1400 and 1600 K. Normal spectral emittance data is supplied at 156 wavelengths in the one to fifteen micron range for all the combinations listed above. In addition, data for the platinum-13 percent rhodium SRM's is supplied in the fifteen to thirty-five micron range at 1100 K.

SRM	Type	Unit Size
1402	Emittance standards	1/2 in disks Pt-13% Rh
1403	Emittance standards	7/8 in disks Pt-13% Rh
1404	Emittance standards	1 in disks Pt-13% Rh
1405	Emittance standards	1 1/8 in disks Pt-13% Rh
1406	Emittance standards	1 1/4 in disks Pt-13% Rh
1407	Emittance standards	2 in x 2 in squares Pt-13% Rh
1408	Emittance standards	1 in x 10 in strips Pt-13% Rh
1409	Emittance standards	3/4 in x 10 in strips Pt-13% Rh
1420	Emittance standards	1/2 in disks Kanthal
1421	Emittance standards	7/8 in disks Kanthal
1422	Emittance standards	1 in disks Kanthal
1423	Emittance standards	1 1/8 in disks Kanthal
1424	Emittance standards	1 1/4 in disks Kanthal
1425	Emittance standards	2 in x 2 in squares Kanthal
1427	Emittance standards	3/4 in x 10 in strips Kanthal
1428	Emittance standards	1/4 in x 8 in strips Kanthal
1440	Emittance standards	1/2 in disks Inconel
1441	Emittance standards	7/8 in disks Inconel
1442	Emittance standards	1 in disks Inconel
1443	Emittance standards	1 1/8 in disks Inconel
1444	Emittance standards	1 1/4 in disks Inconel
1445	Emittance standards	2 in x 2 in squares Inconel

Refractive Index Standards

These SRM's are certified for refractive index for each of seven wavelengths: helium 668 and 502, hydrogen 656(C) and 486(F), mercury 546(e) and 436(g), and sodium 589(D_1,D_2) at 20, 25, and 30 °C to ±0.00002. A certificate is supplied with each of these samples. 217b-8S is contained in a special ampoule with an internal breakoff tip, the others are sealed "in vacuum" in plain glass ampoules.

SRM	Type	Approx. n_D^{20}	Quantity (ml)
217b-5	2,2,4-Trimethylpentane	1.3915	5
217b-8S	2,2,4-Trimethylpentane	1.3915	8
217b-25	2,2,4-Trimethylpentane	1.3915	25
217b-50	2,2,4-Trimethylpentane	1.3915	50

These standards are also certified for density.

Reflectance Standards

These SRM's are intended primarily for calibration of (1) reflectometers used in the evaluation of the appearance properties of polished metals and metal plated objects, and (2) reflectometers and other equipment used in the evaluation of thermal radiation properties of materials. These properties are of particular importance in the automotive and aerospace industries, although they also have many other applications.

The SRM's are mirrors produced by vacuum deposition of gold on glass and aluminum on glass, and are calibrated for near-normal (9°) specular reflectance. They are certified in terms of absolute reflectance over the wavelength range from 0.25 to 30 micrometers.

Specular Spectral Reflectance Standards

SRM	Type	Blank Size (cm)	Coated Area Size (cm)
2001	Aluminum on Glass	7.6 × 10.2 × 1.9	5.2 × 7.6
2002	Aluminum on Glass	3.8 × 3.8 × 1.3	2.5 × 2.5
2003	Aluminum on Glass	Disk 2.9 dia. × 1.0	entire surface
2005	Gold on Glass	7.6 × 10.2 × 1.9	5.1 × 7.6
2006	Gold on Glass	3.8 × 3.8 × 1.3	2.5 × 2.5
2007	Gold on Glass	Disk 2.9 dia. × 1.0	entire surface
2008	Gold on Glass	Disk 2.4 dia. × 0.6	entire surface

Information concerning the SRM appears on it or its container. A Certificate containing pertinent information on the SRM is sent under separate cover; a photocopy of the certificate is sent with the SRM. Copies of these Certificates and information concerning the applications of these SRM's are available on request to the NBS Office of Standard Reference Materials. These Materials (except the carbon-14 contemporary dating standard) are shipped only by express or air freight (shipping charges collect). The prices of SRM's may change as current stocks are depleted and are replaced. Purchasers will be billed at the prices in effect at the time of shipment.

Certain Radioactivity SRM's are not economical to maintain in stock because of short half lives and low demand. When sufficient demand for them exists, based on letters of inquiry, these SRM's are renewed and those who have expressed an interest in them are notified of their availability.

If you need radioactivity standards other than those listed below, or additional technical information on the listed Radioactivity SRM's, please contact the Radioactivity Section, Room C114, Radiation Physics Building, National Bureau of Standards, Washington, D.C. 20234. (Telephone 301-921-2668). NOTE: Chemically stable solutions of most radionuclides, including those no longer issued by NBS or that are currently out of stock, may be submitted to NBS for calibration as described in "Calibration and Test Services of the National Bureau of Standards," NBS Special Publication 250. Requests for these tests should be submitted, with full source information for approval of suitability, to the Radioactivity Section.

The stated accuracies of the older standards are, in general, an estimate of the standard deviation added to an estimate of maximum possible systematic error. The accuracies of more recent standards are based on the 99 percent confidence level of precision, with the same estimate of systematic error.

The International Commission on Radiation Units (ICRU) recommended definition of the activity (A) of a quantity of a radioactive nuclide is the quotient of ΔN by Δt, where ΔN is the number of nuclear transformations that occur in this quantity, in time Δt: $(A=\Delta N/\Delta t)$. NBS uses the abbreviation ntps for nuclear transformation per second. In this list both ntps and dps are used; the latter when dps has been used in certificates printed before 1968. The terms: αps, β^-ps, β^+ps, K-x-rays ps, γps are used for the emission rates of alpha particles, beta particles, positrons, K-x-rays, and gamma-rays, respectively.

The SRM's listed below, not marked with an asterisk (*), may be ordered singly, without a license, under the general licensing provisions of the Atomic Energy Act of 1954. Those marked by an asterisk are available only under the special licensing provisions of the Atomic Energy Act of 1954.

Alpha-Particle Standards

These SRM's consist of a practically weightless deposit of the nuclide on a thin platinum foil cemented to a monel disk.

SRM	Radionuclide	Approximate Activity at Time of Calibration (Month, Year)	Accuracy (%)
+4900	Polonium-210	100 αps	
+4901	Polonium-210	200 αps	
+4902	Polonium-210	500 αps	
*4906	Plutonium-238	1.4×10^3 to 3.4×10^4 ntps (4/69)	±0.8
4904-D	Americium-241	2×10^3 to 5×10^4 ntps (2/70)	1.0
4907	Gadolinium-148	IN PREP	

+ Available on Request

Beta-Ray and Gamma-Ray Gas Standards

These SRM's contain the Radionuclide in the inactive gas at a pressure of about one atmosphere in a glass break-seal ampoule.

SRM	Radionuclide	Approximate Activity at Time of Calibration (Month, Year)	Accuracy (%)
4935-C	Krypton-85	7×10^7 ntps per mole (7/69)±	3†
*4235	Krypton-85	1 to 2×10^7 ntps (per source) (9/69)	3.8†
4236	Xenon-133	IN PREP	
4306	Xenon-133	IN PREP	
4307	Xenon-133	IN PREP	
4300	Argon-37	4×10^6 ntps per mole (5/72)	4.3
4301	Argon-37	4×10^3 ntps per mole (5/72)	5.8
4302	Argon-39	IN PREP	
4303	Argon-39	IN PREP	
4304	Xenon-131m	IN PREP	
4305	Xenon-131m	IN PREP	

†These are provisional accuracies. When the final accuracies are determined, previous purchasers will be notified.

Beta-Ray, Gamma-Ray, and Electron-Capture Solution Standards

These standard reference materials are contained in flame-sealed ampoules.

SRM	Radionuclide	Approximate Activity or Emission Rate per gram of Solution at Time of Calibration (Month, Year)	Approx. Weight of Solution (gram)	Accuracy (%)
4925	Carbon-14 (benzoic acid in toluene)	2×10^4 dps (7/58)	3	±2.0
4222	Carbon-14 (n-hexadecane)	4×10^4 dps (6/67)	3	3.1
4223	Carbon-14 (n-hexadecane)	4×10^3 dps (6/67)	3	3.1
4224	Carbon-14 (n-hexadecane)	4×10^2 dps (6/67)	3	3.1
4943	Chlorine-36	1×10^4 β^-ps (1962)	3	2.0
4941-C	Cobalt-57	3×10^5 ntps (3/69)	5.2	1.0
4926	Hydrogen-3 (Water)	9×10^3 dps (9/61)	25	1.0
4927	Hydrogen-3 (Water)	9×10^5 dps (9/61)	3	1.0
4947	Hydrogen-3 (Tritiated toluene)	3×10^5 dps (2/64)	4	1.0
4929-C	Iron-55	2×10^4 K-x-rays ps (4/70)	3.9	2.7
*4226	Nickel-63	1.5×10^6 ntps (5/68)	4.1	1.0
4940-B	Promethium-147	5×10^4 dps (11/67)	3	1.9
*4228	Selenium-75	2.5×10^5 ntps (3/71)	4.6	2.3
4921-C	Sodium-22	1×10^4 β^+ ps (8/64)	2.8	1.0
4922-E	Sodium-22	2×10^5 β^+ ps (3/67)	5.1	1.4
4229	Aluminum-26	39 ntps (11/71)	4.6	1.1
4230	Chromium-51	IN PREP		
4232	Silver-110m	IN PREP		
4245	Carbon-14 (Na_2CO_3 in H_2O)	10 μCi (1972)	5	
4246	Carbon-14 (Na_2CO_3 in H_2O)	1 μCi (1972)	5	
4247	Carbon-14 (Na_2CO_3 in H_2O)	0.01 μCi (1972)	5	
4949	Iodine-129	IN PREP		
4231	Cobalt-56	IN PREP		
4233	Cesium-137-Barium-137m	IN PREP		
4234	Barium-140-Lanthanum	IN PREP		

Contemporary Standard for Carbon-14 Dating Laboratories

SRM	Description
4990-B	Oxalic acid; no specific activity is given. (One pound of oxalic acid taken from specially prepared material for use as a common contemporary standard against which world-wide measurements can be compared.)

NOTE: These SRM's are shipped parcel post, prepaid to domestic and overseas purchasers.

Environmental Standards

Mixed-radionuclide gamma-ray emission-rate standards have been issued for monitoring radioactive effluents of nuclear-power reactors.

These SRM's contain: Cadmium-109, Cobalt-57, Tin-113-Indium-113m, Cesium-137-Barium-137, Manganese-54, Cobalt-60, and Yttrium-88.

SRM	Type	Approximate Activity (month/year)	Unit (ml)
4242–B	Mixed Radionuclides	0.5 μCi total (1/72)	450
4242–B	Mixed Radionuclides	1 μCi total (1/72)	50
4244–B	Mixed Radionuclides	10^3 γps total (1/72)	15
4252	Mixed Radionuclides	Test Standard	450
4253	Mixed Radionuclides	Test Standard	50

Gamma-Ray "Point-Source" Standards

This group of Standard Reference Materials is usually prepared by depositing the radioactive material and sealing it between two layers of polyester tape, mounted on an aluminum ring. Exceptions to this procedure are americium, krypton, and thorium SRM's. The americium-241 SRM's, 4211 and 4213, are prepared by electroplating americium onto a 0.010-cm thick platinum foil, which is covered with a 0.005-cm thick aluminum foil. The aluminum-covered source is sandwiched between two layers of 0.036-cm thick polyurethane film tape. The krypton-85 SRM, 4212, is prepared by sealing a krypton-85 impregnated aluminum foil between two glass disks, with an epoxy adhesive. The thorium-228 SRM's, 4205 and 4206, are prepared by depositing and sealing the radionuclide between two layers of gold foil and this sandwich is then sealed between two double layers of polyurethane-film tape.

SRM	Radionuclide	Gamma-Ray Energy (MeV)	Approximate Activity (ntps) at Time of Calibration (month, year)	Accuracy (%)
4211	Americium-241	0.060	4.0 to 18×10^4 (2/70)	±2.8
*4213	Americium-241	0.060	1.9 to 4.1×10^5 (2/70)	2.8
4202	Cadmium-109	0.088	2×10^6 (12/67)	1.8
*4212	Krypton-85	0.514	6.5 to 37×10^6 (5/71)	2.6
4200-B	Cesium-137	0.662	7×10^4 (12/68)	1.3
4207	Cesium-137	0.662	5×10^5 (12/68)	1.3
4201-B	Niobium-94	0.702, 0.871	4 to 6×10^3 (4/70)	1.5
*4203	Cobalt-60	IN PREP		
*4210	Cobalt-60	1.173, 1.332	2×10^6 (4/69)	1.1
4991-C	Sodium-22	1.274	6×10^4 (4/69)	1.5
4996-B	Sodium-22	1.274	3×10^5 (4/69)	1.5
4205	Thorium-228	2.614	6×10^4 (8/68)	2.2
4206	Thorium-228	2.614	6×10^5 (8/68)	2.2
4240	Bismuth-207	IN PREP		
4214	Cobalt-57	IN PREP		
4215	Mixed Radionuclides	IN PREP		
4216	Mixed Radionuclides	IN PREP		

Radium Gamma-Ray Solution Standards

These samples are contained in flame-sealed glass ampoules.

SRM	Radium Content (in micrograms)	Accuracy (%)
4955	0.1	±3.6
4956	0.2	4.4
4957	0.5	1.8
4958	1.0	1.8
4959	2.0	1.3
4960	5.0	1.3
4961	10	1.1
4962	20	1.1
4963	50	1.1
4964-B	102	0.5

Radium Solution Standards for Radon Analysis

These samples are contained in flame-sealed glass ampoules.

SRM	Approximate Radium Content (gram)	Approx. Wt. Soln. (grams)	Accuracy (%)
4951	10^{-11}	100	±0.3
4950-B	10^{-9}	20	1.0
4953	10^{-8}	20	1.0

Metallurgical Standards

These SRM's are intended for calibrating x-ray diffraction equipment to determine the relative amounts of austenite and iron carbide in steel.

SRM	Type	Form
485	Austenite in Ferrite (4% nominal)	Disk: 20.6 mm Diameter, 2.5 mm thick
493	Spheroidized Iron Carbide (Fe_3C) in Ferrite	Wafer: 29 × 29 × 2.4 mm

Mossbauer Standards

These SRM's are issued for the calibration of the isomer shift of iron compounds and alloys and to provide a uniform basis for presentation of mossbauer isomer shift data.

SRM	Type	Form
725	Sodium Pentacyanonitrosylferrite II (Sodium Nitroprusside) for Isomer Shift of Iron Compounds	Platelet: 1 × 1 × 0.0775 cm
1541	Iron Foil	Foil: 2.5 cm × 2.5 cm × 23 μm

Permittivity Standards

The three solution SRM's (1511, 1512, and 1513) are for calibrating cells and test capacitors used to determine the relative permittivity (dielectric constant) of liquids. The nominal dielectric constants (ϵ) for SRM's 1511, 1512, and 1513 are: 2.0, 10.4, and 35.7, respectively. The four polymer SRM's (1516, 1517, 1518, and 1519) are for calibrating systems used to measure permittivity and related dielectric quantities. These SRM's are disks of a fluorinated ethylene-propylene copolymer and are individually calibrated.

SRM	Type	Unit Size
1511	Cyclohexane	400 ml
1512	1,2-Dichloroethane	400 ml
1513	Nitrobenzene	400 ml
1516	Permittivity	38 mm diameter 2.5 mm thick
1517	Permittivity	38 mm diameter 5 mm thick
1518	Permittivity	51 mm diameter 2.5 mm thick
1519	Permittivity	51 mm diameter 5 mm thick

Engineering Type Standards

These SRM's are intended to relate measurements used for production or quality control data to a central point of reference. The values certified for these materials are in some cases empirical and do not necessarily relate to the National Measurement System.

Standard Rubbers and Rubber-Compounding Material

These SRM's have been prepared to provide the rubber industry with standard materials for rubber compounding. They are useful for the testing of rubber and rubber-compounding materials in connection with quality control of raw materials and for the standardization of rubber testing.

Each material has been statistically evaluated for uniformity by mixing rubber compounds and vulcanizing them in accordance with ASTM Designation D-15 and determining the stress-strain properties of the resulting vulcanizates. Certificates are issued for the rubbers because the properties of different lots are not the same. Replacement lots of rubber-compounding SRM's impart essentially the same characteristics to rubber vulcanizates so that Certificates are not issued for these SRM's.

Standard Rubbers

SRM	Type	Wt/Unit (grams)
385b	Natural	34,000
386g	Styrene-butadiene 1500	34,000
388f	Butyl	34,000
389	Styrene-butadiene 1503	34,000
391	Acrylonitrile-butadiene	25,000

Rubber Compounding Materials

SRM	Type	Wt/Unit (grams)
370d	Zinc Oxide	8,000
371f	Sulfur	6,000
372g	Stearic Acid	3,200
373f	Benzothiazyl disulfide	2,000
374c	Tetramethylthiuram disulfide	2,000
375f	Channel Black	28,000
376a	Light Magnesia	450
377	Phenyl-beta-naphthylamine	600
378a	Oil Furnace Black	28,000
379	Conducting Black	5,500
380	Calcium Carbonate	6,000
381	Calcium Silicate	4,000
382a	Gas Furnace Black	32,000
383	Mercaptobenzothiazole	3,200
384a	N-tertiary-Butyl-2-benzothiazolesulfenamide	3,200

Reference Magnetic Tapes

This SRM is intended for use in evaluating the performance of magnetic computer tapes and maintaining control over their production. Each SRM is individually calibrated and certified.

SRM	Type	Unit of Issue
3200	Secondary standard magnetic tape—computer amplitude reference	Reel/600 ft

Sizing Standards

Glass Spheres for Particle Size

SRM	Type	Size (μm)	Sieve Nos.	Wt/Unit (grams)
1003	Calibrated Glass Spheres	5-30	-------	40-45
1004	Calibrated Glass Beads	34-120	400-140	63
1017a	Calibrated Glass Beads	100-310	140-50	84
1018a	Calibrated Glass Beads	225-780	60-25	74
1019	Glass Spheres	890-2590	18-8	100

Turbidimetric and Fineness Standard (Cement)

This SRM is available to calibrate the Blaine fineness meter according to the latest issue of Federal Test Method Standard 158, Method 2101 or ASTM Designation C204; to calibrate the Wagner turbidimeter according to ASTM Designation C115; and to determine sieve residue according to ASTM Designation C430. Each set consists of twenty sealed vials, each containing approximately 10 grams of cement. This SRM is supplied only in sets of twenty vials or multiples thereof.

SRM	Type	Certification	Unit
114m	Portland Cement	Residue on No. 325 sieve, electroformed wet method	Set of 20 vials
		Surface area (Wagner turbidimeter)	
		Surface area (Air-permeability)	
		Mean particle diameter (Air-permeability)	

Color Standards

The ISCC-NBS Centroid Color Charts

SRM 2106, ISCC-NBS Centroid Color Charts, is available to illustrate a characteristic color for each of the ISCC-NBS color-name blocks in NBS Circular 553. NBS Circular 553, The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names, may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2 (SD Catalog No. C13.4:553). SRM 2106, along with the table containing the history of the color-names project, the centroid number, and the Munsell denotation of each of the 251 color chips included, constitutes a supplement to NBS Circular 553. Each chart set contains 18 constant-hue centroid color charts. These centroid colors represent a systematic sampling of the whole color solid, each color of which has been carefully measured. Each centroid color has its own specification and can be used as a color standard. The centroid color charts can also be used for approximate color specifications wherever the ISCC-NBS color designations are applicable, for statistical studies of trends in industrial color usage, or for planning lines of merchandise intended to have coordinated colors.

SRM	Type	Unit of Issue
2106	Centroid color charts	Set of 18 charts

Paint Pigment Standards for Color and Tinting Strength

SRM	Type	Wt/Unit (grams)
307	Metallic brown	60

Light-Sensitive Papers and Plastic Chips

Light-Sensitive Papers

Standard light-sensitive paper and booklets of standard faded strips of this paper are available for use in standardizing the dosage of radiant energy when testing textiles for color fastness by exposure in commercial carbon-arc fading lamps. The paper is distributed in units of 100 pieces 2 5/8 by 3 1/4 in. The booklets contain six strips of the paper 1 1/4 in wide that have been faded by exposure in the NBS master lamp. A copy of NBS Misc. Publ. 260-41, which describes the preparation and use of the materials, is furnished with each booklet.

SRM	Type	Unit of Issue
700c	Light-sensitive paper	Pkg. of 100 pieces - 2 5/8 in x 3 1/4 in
701c	Standard faded strips	Booklet - 6 strips 1 1/4 in wide

Light-Sensitive Plastic Chips

Standard light-sensitive plastic chips are available for use in calibration and standardization of artificial weathering and fading apparatus. These chips are distributed in two thicknesses (0.060 and 0.124 in) in units of five plates 2 in by 4 1/8 in, and have been standardized by the measurement of the change of transmittance as a function of exposure (in standard fading hours) to the NBS master lamps.

SRM	Type	Unit of Issue
702	Light-sensitive plastic chips . .	Package of 5 chips 0.124 in thick
703	Light-sensitive plastic chips . .	Package of 5 chips 0.060 in thick

Photographic Standards

SRM's 1008 and 1009 are calibrated photographic step tablets of 21 steps that cover the optical density range from 0 to 4 and 0 to 3, respectively.

These step tablets are designated as Type Visual VI-b and are certified for diffuse transmission density in conformance with conditions specified for American National Standard Diffuse Visual Density, Type VI-b "ANSI PH2.19-1959, American National Standard Diffuse Transmission Density." The 21 steps of the 3.5 X 25 cm tablets cover the density range from 0 to 4 (1008) or 0 to 3 (1009) and are individually certified by a method having a precision such that three times the standard deviation of the mean is 1 percent or 0.01, whichever is greater.

SRM 1010a, Microcopy Resolution Test Charts, is used to test the resolving power of cameras or of whole microcopying systems. SRM 1010a consists of five charts printed photographically on paper, and have 26 high-contrast five-line patterns ranging in spatial frequency from one cycle per millimeter to 18 cycles per millimeter. Instructions for the use of the charts are supplied with each order.

SRM	Type	Unit of Issue
1008	Photographic Step Tablet (0-4)	1 tablet, 21 steps
1009	Photographic Step Tablet (0-3)	1 tablet, 21 steps
1010a	Microcopy Resolution Test Charts	Set of 5 charts

Surface Flammability Standard

SRM 1002b, Hardboard Sheet, is issued for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM Standard E162-67. Flame Spread Index, I_S = 190; Heat Evolution Factor, Q = 45.4.

SRM	Type	Certification		Unit of Issue
1002b	Hardboard Sheet	Flame Spread Index	190	Set of 4
		Heat Evolution Factor, Q	45.4	6 X 18 X 1/4 inch

Smoke Density Chamber Standards

These SRM's are certified for maximum specific optical density and are issued for performing operational checks of smoke density chambers.

SRM	Type	Maximum Specific Optical Density	Unit of Issue
1006	Non-flaming Exposure Condition (α-cellulose)	Dm(corr) = 170	Set of 3 sheets 11.7 × 9.2 inches
1007	Flaming Exposure Condition (plastic)	Dm(corr) = 455	Set of 3 sheets 9.5 × 9.2 inches

Water Vapor Permeance

This material is intended for use in the measurement of water vapor permeance in accordance with ASTM Method D–96. It may also be useful in other test methods where movement of water vapor across a barrier is involved. These SRM's are made from sheets of poly (ethylene terephthalate) approximately 0.001 inches thick (25.4 μm). They are certified for water vapor permeance for both dry cup and wet cup procedure.

SRM	Type	Certification	Unit of Issue
707–1	Water Vapor Permeance	Dry Cup – 0.66 perm	12 sheets, 6 in diameter
707–2	Water Vapor Permeance	Wet Cup – 0.72 perm	6 sheets, 10 × 12 inches

Internal Tearing Resistance Standard Paper

This SRM is available for calibration of instruments used for the determination of the internal tearing resistance of paper according to methods ASTM Designation D689 and TAPPI Standard T414. Sufficient material is furnished in each unit to provide 40 or more measurements. Initial distribution is in a set of twelve packages, one package shipped at approximately monthly intervals. Packages are also available on a four month cycle. The tearing strength value of the material is approximately 40 g. The exact value will be given in the certificate accompanying the standard.

This SRM is sold only on a subscription basis in sets of four packages or multiples thereof.

SRM	Type	Unit of Issue
704a	Internal tearing resistance paper	Sets of 4 packages

Linerboard Standard for Tape Adhesion Testing

This material is intended as a uniform source of linerboard for use under ASTM Designation D2860, Procedure A: Adhesion of Pressure Sensitive Tape to Fiberboard at 90 Degree Angle and Constant Stress.

SRM	Type	Unit
1810	Linerboard for Tape Adhesion Testing	Package of 50 sheets

Research Materials

Research Materials (RM's) are in addition to and distinct from the Standard Reference Materials (SRM's) issued by NBS. The distinctions between Research Materials and Standard Reference Materials are in the information supplied with them and purpose for which they are used. Unlike SRM's, the RM's are not issued with Certificates of Analysis; rather they are accompanied by a "Report of Investigation," the sole authority of which is the author of the report. A Research Material is intended primarily to further scientific or technical research on that particular material. One of the principal considerations in issuing an RM is to provide homogeneous material so that an investigator in one laboratory can be assured that the material he has is the same as that being investigated in a different laboratory.

High Purity Materials

RM-1C Ultra-purity aluminum single crystal cubes (1 cm on a side) are intended for use in studies of a variety of solid state phenomena for which both extreme purity and knowledge of crystallographic orientation are required; e.g., in studies of electron spin resonance, De Haas-Van Alphen effect, cyclotron resonance, and in a variety of studies relating to the Fermi surface and the transport properties of aluminum.

RM-1R Ultra-purity aluminum polycrystalline rods (4.2 mm in diameter and 25.4 mm long) are intended for use in research on the mechanical and physical properties of extremely pure aluminum: e.g., in the determination of resistivity as a function of strain at cryogenic temperatures to facilitate the design of cryogenic magnets or superconductor stabilizing elements.

Phosphors

These materials are issued without Certification. NBS Technical Note 417, Spectral Emission Properties of NBS Standard Phosphor Samples under Photo-Excition, is issued with these materials, and is equivalent to the "Report of Investigation" issued with Research Materials. They are issued so that those interested in developing methods of measurement for phosphor materials can work on a common source of materials. NBS Technical Note 417 may be purchased from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for 25 cents, by SD Catalog No. C13.46:47.

SRM	Type	Wt/Unit (grams)
1020	Zinc sulfide phosphor	14
1021	Zinc silicate phosphor	28
1022	Zinc sulfide phosphor	14
1023	Zinc-cadmium sulfide phosphor (Ag activator)	14
1024	Zinc-cadmium sulfide phosphor (Cu activator)	14
1025	Zinc phosphate phosphor	28
1026	Calcium tungstate phosphor	28
1027	Magnesium tungstate phosphor	28
1028	Zinc silicate phosphor	28
1029	Calcium silicate phosphor	14
1030	Magnesium arsenate phosphor	28
1031	Calcium halophosphate phosphor	28
1032	Barium silicate phosphor	28
1033	Calcium phosphate phosphor	28

General Materials

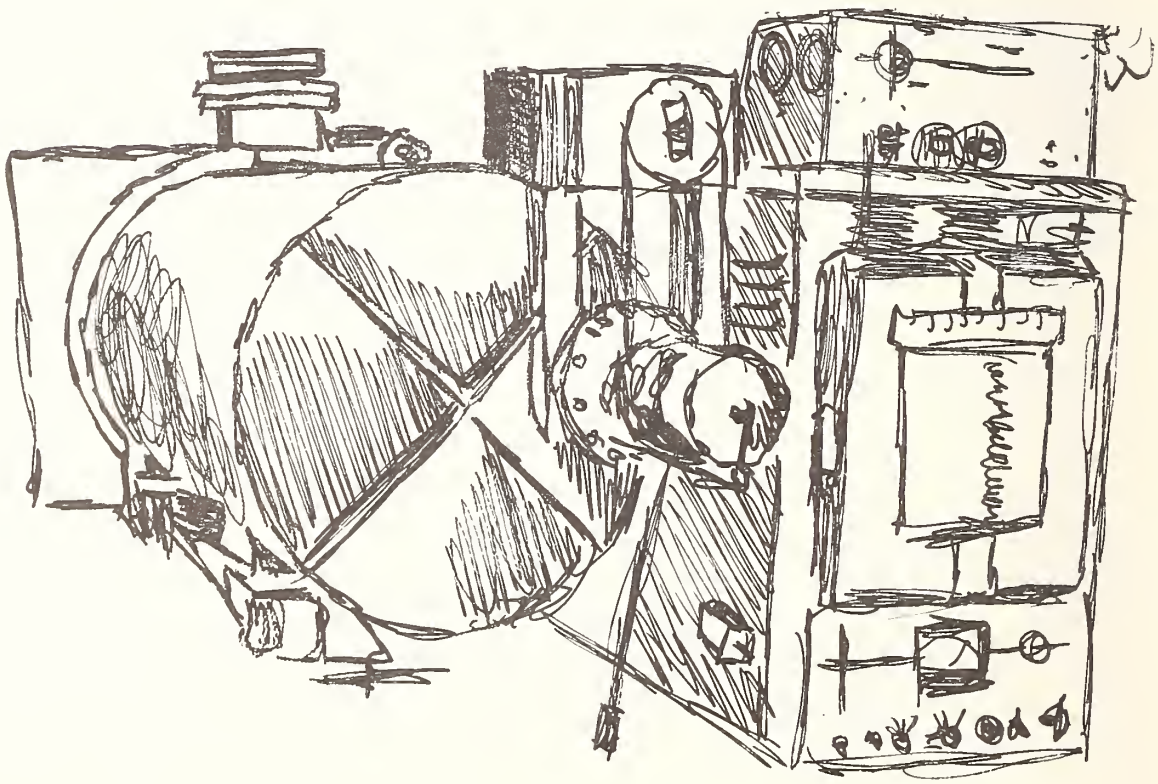
General Materials (GM's) are being distributed by NBS to meet industry needs. These materials have been standardized either by some Government agency other than NBS, or by some standards-making body such as the American Society for Testing and Materials (ASTM), the American National Standards Institute (ANSI), and the Organization for International Standardization (ISO). For this class of materials, NBS acts only as a distribution point and does not participate in the standardization of these materials.

GM-1 Hydrogen in Steel Standards were produced and certified by The Welding Institute in Cambridge, England, and are distributed in the United States by NBS. GM-1 is a set of 15 cylinders, 5 each of H1, H2, and H3, containing nominally 0.05, 0.10, and 0.20 ml hydrogen, respectively. The cylinders are 6.35 mm in diameter and about 30 mm long, weighing approximately 6 grams.

GM-2 Hydrogen in Steel Standards were produced and certified by the Welding Institute in Cambridge, England, and are distributed in the United States by NBS. GM-2 is a set of 15 cylinders, 5 each of H4, H5, and H6, containing nominally 0.20, 0.60, and 1.10 ml hydrogen, respectively. The cylinders are 12.7 mm in diameter and about 30 mm long, weighing approximately 22 grams.

GM-5 Nickel and Vanadium in Residual Oil was produced and analyzed under the sponsorship of the Western Oil and Gas Association and the American Petroleum Institute, and is distributed by NBS. The assigned values for nickel and vanadium are 93 and 79 ppm, respectively. GM-5 is issued in 475 ml units.

GM-2007 Attapulgus clay is distributed by NBS on request of the ASTM Committee D-2007. It is an adsorbant type clay, 30 to 60 mesh, having adsorptive characteristics as specified by ASTM D-2007.



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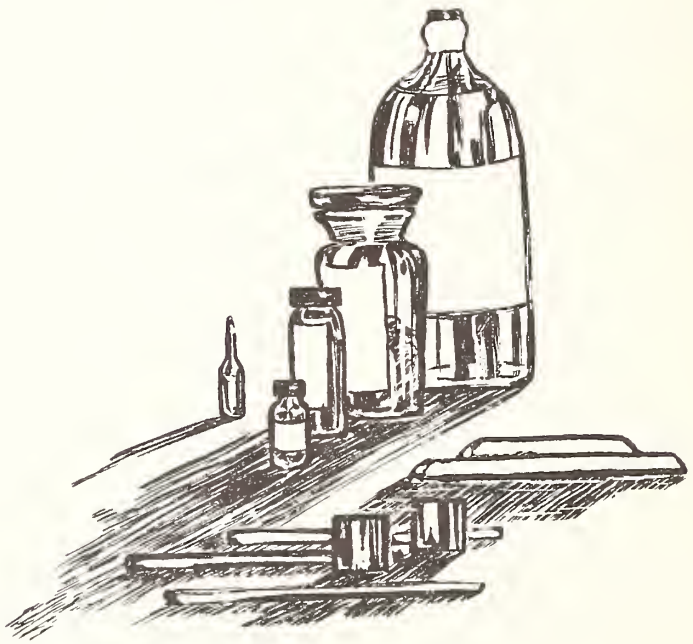

NUMERICAL INDEX TO SRM CERTIFICATES

The Certificate Date listed is the current version of the Certificate. Those dates followed by the letter "P" indicate that it is a Provisional Certificate.

In general, Provisional Certificates are issued for Standard Reference Materials before all of the values have been certified, but after a sufficient number of values are certified so that the material is a valuable standard for the intended purpose. As additional values are certified, the Provisional Certificate may be revised and when and if all of the values are certified, the final Certificate is issued.

When new or revised Certificates are issued for SRM's they are announced in the SRM Price and Availability List which supplements this catalog. SRM purchasers whose Certificate shows an earlier date than listed below may obtain the current version of the Certificate from the Office of Standard Reference Materials, Room B314, Chemistry Building, National Bureau of Standards, Washington, D.C. 20234.

One or more of the following letters apply to materials where no date is listed.

A. Individually Certified
B. The material is issued with "Instructions for Use" in lieu of a certificate
C. This material is not certified, refer to page reference for details
D. Material is in preparation
E. Research Material: Issued with a "Report of Investigation"
F. General Material: Information provided, but not certified by NBS
G. Set of SRM's: Issued with Certificates for the individual SRM's
H. Prepared on Request: Refer to page reference for details

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8j	4-10-72	16
10g	10-14-65	16
11h	9-1-66P	16
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363	9-30-70P	16
364	6-16-71P	16
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372g	C	73
373f	C	73
374c	C	73
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FORM NBS-114A (1-71)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBS SP260, 1973 Catalog	2. Gov't Accession No.	3. Recipient's Accession No.
4. TITLE AND SUBTITLE Standard Reference Materials			5. Publication Date April 1973 6. Performing Organization Code
7. AUTHOR(S) R. W. Seward, Technical Representative			8. Performing Organization
9. PERFORMING ORGANIZATION NAME AND ADDRESS NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, D.C. 20234			10. Project/Task/Work Unit No. 3020585 11. Contract/Grant No.
12. Sponsoring Organization Name and Address Same as No. 9			13. Type of Report & Period Covered Interim 14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

Supersedes NBS Special Publication 260, July 1970 Edition

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17. KEY WORDS (Alphabetical order, separated by semicolons)

Analysis; characterization, composition; General Materials; properties; Research Materials; Standard Reference Materials

18. AVAILABILITY STATEMENT	19. SECURITY CLASS (THIS REPORT)	21. NO. OF PAGES
[XX] UNLIMITED. [ ] FOR OFFICIAL DISTRIBUTION. DO NOT RELEASE TO NTIS.	UNCLASSIFIED	96
	20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED	22. Price $1.25, domestic postpaid $1.00, GPO Bookstore

USCOMM-DC 66244-P71

U. S. GOVERNMENT PRINTING OFFICE : 1973 O - 501-866

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