NBS Standard Reference Materials Catalog 1984-85

NBS Special Publication 260

U.S. Department of Commerce
National Bureau of Standards

TO ORDER
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NBS Standard Reference Materials Catalog 1984-85

C. H. Hudson, Editor

Office of Standard Reference Materials
National Measurement Laboratory
National Bureau of Standards
Washington, DC 20234

CAUTION: The values given in the following sections are listed primarily as a guide to purchase. 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
Malcolm Baldrige, Secretary

National Bureau of Standards
Ernest Ambler, Director

Issued February 1984

National Bureau of Standards
Special Publication 260
Supersedes NBS Spec. Publ. 260-1981-83 catalog
Nat. Bur. Stand. (U.S.), Spec. Publ. 260-1984-85
catalog, 180 pages (February 1984)
CODEN: XNBSAV

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON: 1984

For sale by the Superintendent of Documents,
U.S. Government Printing Office, Washington, DC 20402

Contents


NBS
1000 ml
PYREX

Abstracts and Key Words

National Bureau of Standards
Catalog of Standard Reference Materials—1984–85

This Catalog lists those Standard Reference Materials (SRM's) that are available from the National Bureau of Standards (NBS), and those that are soon to be available. The Catalog describes these materials as to their certified characterization, unit size, and type, as well as providing ordering information. Prices for these materials are listed separately in annual supplements to this Catalog.

Key words: accuracy; analysis; calibration; characterization; composition; materials; measurement; properties; Standard Reference Materials.

National Bureau of Standards
[Oficina Nacional de Pesas y Medidas]
Catalogo de Materiales Tipo de Referencia—1984–85

Este Catálogo enumera los Materiales Tipo de Referencia (SRM) que se pueden obtener de la National Bureau of Standards (NBS), y los que pronto estarán disponibles. El Catálogo describe estos materiales de acuerdo con su caracterización certificada, tamaño de la unidad, y tipo, y tambien provee información sobre pedidos. Los precios de estos materiales aparecen separadamente en suplementos anuales de este Catálogo.

Palabras claves: precisión; calibración; caracterización; composición; materiales; medida; propiedades; Materiales Tipo de Referencia.

Bureau National des Normes (National Bureau of Standards)
Catalogue des Materiels de Reference Standard 1984–85

Ce catalogue donne la liste des Matériels de Référence Standard (Standard Reference Materials—SRM) que l'on peut obtenir du Bureau National de Normes (NBS), et de ceux qui seront bientôt disponibles. Le catalogue donne une description de ces matériels concernant leur caractérisation certifiée, la taille et le type de chaque unité, ainsi que les instructions pour rediger la commande. Une liste de prix de ces matériels est donnée séparément chaque année dans des suppléments au catalogue.

Mots-clés: précision; analyse; calibrage; caractérisation; composition; matériels; mesure; propriétés; Matériels de Référence Standard.

National Bureau of Standards
Normenprobenverzeichnis 1984–85

Dieses Verzeichnis enthaelt sowohl diejenigen Normenproben, die zur Zeit vom National Bureau of Standards (NBS) erhaeltlich sind, als auch solche, die in Baelde verfuegbar sein werden. Das Verzeichnis enthaelt ferner eine Beschreibung der Proben nach Art der gepruefteN Kennzeichnung, nach Einheitsgroesse und Typus, sowie Angaben ueber den Bestellvorgang. Eine Preisliste erscheint alljaehrlich als Nachtrag zu diesem Verzeichnis.

Stichwörter: Genauigkeit; Analyse; Kalibrierung; Kennzeichnung; Zusammensetzung; Materialien; Messung; Eigenschaften; Normenproben.

Introduction

The National Bureau of Standards issues over 1000 different materials through its Standard Reference Materials Program. These materials are primarily Standard Reference Materials (SRM's) certified for their chemical composition, chemical property, or physical property, but also include Research Materials (RM's) and Special Reference Materials (GM's). All SRM's, RM's, and GM's bear distinguishing names and numbers by which they are permanently identified. Thus, each SRM, RM, or GM bearing a given description is identical (within the required or intended limits) to every other sample bearing the same designation—with the exception of individually certified items, which are further identified by serial number.

The first materials issued by NBS were called Standard Samples and consisted of a group of ores, irons, and steels certified for their chemical composition. Since the mid-1960's these materials have been issued as Standard Reference Materials, and cover a wide range of chemical and physical properties and an equally wide range of measurement interests.

Definitions

The different terms, SRM, RM, or GM, are used to indicate differences in the types of information supplied and in the purposes for which the material is intended. (The terms RM and GM are no longer being used as prefixes for these materials; the numbers 8000 through 9999 are reserved for RM's and GM's.)

Standard Reference Materials have been characterized by the National Bureau of Standards for some chemical or physical property and are issued with a Certificate that gives the results of the characterization. These results are obtained by one of the three established routes of certification, i.e., measurement of the property using: (1) a previously validated reference method, (2) two or more independent, reliable measurement methods, or (3) a network of cooperating laboratories, technically competent and thoroughly knowledgeable with the material being tested. These routes are described in detail in, "The Role of Standard Reference Materials in Measurement Systems," NBS Monograph 148, 54 pages (Jan. 1975). SRM's are defined as being well-characterized and certified materials produced in quantity to improve measurement science. They are prepared and used for three main purposes: (1) to help develop accurate methods of analysis (reference methods); (2) to calibrate measurement systems used to: (a) facilitate the exchange of goods, (b) institute quality control, (c) determine performance characteristics, or (d) measure some property at the limit of the state-of-the-art; (3) to assure the long-term adequacy and integrity of quality control processes. In these ways, SRM's help ensure the compatibility and accuracy of measurements in many facets of national life—from science and technology to trade and commerce.

Research Materials, unlike SRM's, are not certified. Instead of a Certificate, RM's are issued with a "Report of Investigation," the sole authority of which is the NBS staff member who authored the report. An RM is intended primarily to further scientific or technical research on that particular material. The principal consideration in issuing an RM is to provide a homogeneous material so that investigators in different laboratories are assured that they are investigating the same material.

Special Reference Materials differ from both SRM's and RM's in that NBS does not participate in the characterization of these materials. GM's are reference materials produced and certified or guaranteed by

other government agencies, standards bodies, or other non-profit organizations. When deemed to be in the public interest and when alternate methods of national distribution do not exist, NBS acts as the distributor for such materials. This service is available to all organizations that qualify and have reference materials that would help solve a national measurement problem.

SRM Catalog

New Catalogs of NBS Standard Reference Materials are published approximately every three years, listing new materials available, materials in preparation, and deleting discontinued materials. To keep the Catalog current between editions, annual supplements are published that list the current prices charged, and any new materials issued.

The materials listed in this Catalog are separated into several major groups: Chemical Composition Standards, Physical Property Standards, Engineering Type Standards, Research Materials, and Special Reference Materials. The first three groups include SRM's only and are subdivided into the categories shown in the Table of Contents.

The numerical values given in the Catalog to describe the materials' properties are nominal values only and are to be used only as guides in selecting the materials. They are not to be used in lieu of the Certificate issued with the materials.

Note: Some SRM's are not issued with Certificates. These exceptions are noted in both the SRM description and the numerical index.

The numerical index provides the SRM, RM, and GM numbers of all materials listed in the Catalog, together with either the date of the current Certificate or a note to explain the absence of a Certificate.

An index by category provides a generic listing of the SRM and the primary constituent or element in an SRM.

An alphabetical index is also provided listing the specific name of the SRM as indicated on the Certificate of Analysis.

Preparation and Availability of Standard Reference Materials

New and renewal SRM's are being prepared continually. Prospective users are notified directly of the availability of these new items, and the SRM's are described in the next edition of the catalog. To place your name on the mail list maintained by NBS to notify customers of new materials, please contact the Office of Standard Reference Materials at the address listed for placing orders.

In preparing revewal SRM's, the intention is to complete the renewal before the supply of the existing SRM is exhausted. Frequently, this is not possible and the SRM will be out-of-stock for a time. When this occurs, those ordering the material are so notified and, when feasible, possible substitutes are suggested. When the renewal becomes available, customers who have requested either the previous lot or the renewal are promptly notified.

Renewal SRM's will not usually be identical to their predecessors, but will be quite similar especially with regard to the characteristics certified. 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 renewals, 8a, 8b, etc., were prepared. The current SRM 8j, Bessemer Steel (simulated), 0.1% Carbon, represents the tenth renewal batch of this material. While each of these batches differs somewhat in detailed analysis, all have had 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 the renewal series when the stock is exhausted. If little demand exists or an alternate source of supply becomes available for a material, production may be discontinued permanently.

Ordering

Orders should be addressed to:
Office of Standard Reference Materials
Room B311, Chemistry Building
National Bureau of Standards
Washington, DC 20234
Telephone: (301) 921-2045

Orders should give number of units, catalog number, and name of the material requested. For example: 1 each,

No. 11h, Basic-Open-Hearth Steel, 0.2 percent C. The materials described in this Catalog are distributed only in the units listed or in multiples thereof.

Acceptance of an order 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 quoted are in U.S. dollars, and are published in the SRM Price List. When SRM Price Lists are issued they are sent to persons or organizations who have requested them. These prices are subject to revision without notice and orders will be billed for the prices in effect at the time of shipment. No discounts are given on purchases of SRM's, RM's, or GM's.

Remittances of the purchase price need not accompany purchase orders. 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. banker's draft against U.S.A. bank
b. bank to bank transfer to U.S.A. bank
c. cash against documents
d. sight draft
e. International Money Order
f. UNESCO coupons

Letters of Credit cannot be accepted. If a Letter of Credit or any method of payment other then those listed above is to be used, you must secure the services of an agent in the United States to act in your behalf. Your agent would purchase the material and our invoice would indicate that he is the purchaser. The material would be shipped to your agent, who would transship in accordance with your instructions.

NBS cannot "prepay and add" shipping charges to the invoice. Restricted categories such as hydrocarbons, organic sulfur compounds, compressed gasses, rubber compounding materials, radioactive standards, and similar materials are shipped FOB Gaithersburg, MD.

Late Charges

Unless otherwise notified, payment for SRM's is due within 30 days of shipment of the order to the customer. For non-Federal customers, the U.S. Treasury regulations require late charges, based on the current value of funds to Treasury, be assessed for each 30-day period or portion thereof that the payment is overdue.

Proforma Invoice (Price Quotation)

Proforma invoice service will frequently require three to four weeks to process, and will be furnished only to those requiring such service.

Domestic Shipments

Shipments of material (except for certain restricted categories) intended for the United States and Canada are normally shipped prepaid (providing that the parcel does not exceed the weight limitations as prescribed by postal laws and regulations).

Foreign Shipments

The regulations of various nations covering the importation of SRM's, GM's, and RM's differ widely; any attempt to list all possible variations would be impractical. Therefore, where the shipping practices outlined below do not apply, purchasers will be informed of the best method of shipment for their countries.

Most orders will be shipped by prepaid International Air Parcel Post. Exceptions are items in restricted categories and those shipments that exceed parcel post weight limitations. These exceptions will be shipped FOB Gaithersburg, MD, unless an agent (shipping or brokerage firm) located in the United States is

required. Where an agent is required, the purchaser will be so notified and will be requested to designate an agent of his/her choice. In this case, the material will be packaged for overseas shipment and will be forwarded to the agent FOB Gaithersburg, MD.

Documentation

Listed below are the only documents that we will furnish. All documents are printed in English.

a. six commercial invoices
b. two sight drafts
c. two packing slips
d. customs invoices for Canada, New Zealand, Australia, and South Africa
e. Certificate of Origin
f. parcel post receipts for parcel post shipments
g. air waybill for air shipments

If documents other than those listed above are required, the services of an agent in the United States will be needed to purchase and ship the materials.

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

Introductión

La NBS emite mas de 1,000 materiales diferentes por medio de su Programa de Materiales Tipo de Referencia. Estos materiales son principalmente Materiales Tipo de Referencia (SRM) que han sido certificados por su composición química, propiedades químicas, o propriedades físicas, pero tambien incluyen Materiales de Investigación (RM) y Materiales de Referencia Especial (GM). Todos los SRM, RM y GM tienen nombres y números distintivos por los cuales son identificados permanentemente asi que cada SRM, RM o GM con una descripcion dada es idéntico (dentro de los limites requeridos o proyectados) a cada muestra que tenga la misca designación—con la excepción de artículos individualmente certificados, que además son identificados por un número de serie.

Los primeros materiales emitidos por la NBS se llamaban Muestras Tipo y consistían de un grupo de minerales, hierros y aceros certificados por su composición química. Desde mediados de la década del 1960 se han distribuido estos materiales como Materiales Tipo de Referencia, y cubren una gran extension de propiedades químicas y físicas e igualmente gran extensión de intereses en medición.

Definiciones

Los diferentes términos, SRM, RM o GM, se usan para indicar diferencias en el tipo de información suministrada y en los propósitos a los cuales el material esta destinado. (Ya no se usan los terminos RM y GM como prefijos para esos materiales; los números desde 8000 hasta 9999 están reservados para RM y GM.)

Los Materiales Tipo de Referencia han sido caracterizados por la NBS por alguna propiedad química o física y son distribuidos con un Certificado que contiene los resultados de la caracterización. Estos resultados se obtienen mediante uno de los tres métodos de certificación establecidos, es decir, medición de la propiedad por medio de: (1) un método de referencia previamente validado, (2) dos o más métodos independientes y fidedignos de medición, o (3) una red de laboratorios cooperativos que sean técnicamente competente y de completo conocimiento sobre el material que se está probando. Estos métodos se describen en detalle en "The Role of Standard Reference Materials in Measurement Systems" [El Papel de Materiales Tipo de Referencia en Sistemas de Medición], Monografía 148 de la NBS, 54 páginas (enero de 1975). Se definen los SRM como materiales bien caracterizados y certificados que se producen en cantidad para mejorar la ciencia de metrología. Se preparan y usan para tres propósitos principales: (1) para ayudar a desarrollar metodos precisos de análisis (metodos de referencia); (2) para calibrar sistemas de medición que se usan para (a) facilitar el intercambio de mercancías, (b) establecer control de la calidad, (c) determinar características de funcionamiento, o (d) medir alguna propiedad con las técnicas mas avanzadas; (3) para asegurar que los procesos de control de calidad se mantengan adecuados e íntegros por un largo periodo. De esta forma, los SRM ayudan a asegurar la compatibilidad y exactitud de medidas en muchos aspectos de la vida nacional—desde ciencia y tecnología hasta comercio.

Los Materiales de Investigación (Research Materials), a diferencia de los SRM, no se certifican. En vez de un certificado, los RM se emiten con un "Informe de Investigación," del cual la unica autoridad es el miembro de NBS que escribió el informe. El propósito principal de un RM es fomentar la investigación científica o

técnica sobre ese material en particular. La principal consideración en la emision de un RM es de proveer un material homogéneo de manera que los investigadores en diferentes laboratorios tengan seguridad de que están investigando el mismo material.

Los Materiales Especiales de Referencia difieren tanto de los SRM como de los RM en que NBS no participa en la caracterización de esos materiales. Los GM son materiales de referencia producidos y certificados o garantizados por otras agencias gubernamentales, organismos de normalización, u otras organizaciones con fines lucrativos. Cuando ello se considera en el interes público y cuando no existen metodos alternativos de distribución nacional, la NBS actúa como distribuidora de tales materiales. Este servicio está a disposicion de todas las organizaciones calificadas que tienen materiales de referencia que ayudarían a resolver un problema nacional de medición.

Catálogo de SRM

Nuevos catálogos de Materiales de Referencia Regular de la NBS son publicados aproximadamente cada 3 años, enumerando nuevos materiales disponibles, materiales en preparación, y omitiendo materiales descontinuados. Para mantener el catálogo al día entre ediciones, se publican suplementos anuales que dan los precios actúalizados asi como todo material nuevo.

Los materiales enumerados en este catálogo estan divididos en varias categorías: Patrones de Composición Química, Patrones de Propiedad Física, Patrones de Ingeniería, Materiales de Investigación, y Materiales Especiales de Referencia. Los primeros tres grupos incluyen únicamente los SRM y están subdivididos en las categorías indicadas en el Indice.

Los valores numéricos que se dan en el Catálogo para describir las propiedades de los materiales son unicamente valores nominales y deben usarse solamente como guias para seleccionar los materiales. Ellos no se deben emplear en lugar del valor certificado emitido con el material.

Nota: Algunos SRM no se distribuyen con certificados. Estas excepciones se notan tanto en la descripción del SRM como en el índice numérico.

El índice numérico proporciona los números de los SRM, RM y GM para todos los materiales enumerados en el catálogo, conjuntamente con la fecha del certificado actúal o una nota explicando la ausencia de un certificado.

Un índice por categoría proporciona una lista genérica del SRM y el principal constituyente o elemento en un SRM.

Tambien se proporciona un índice alfabético dando el nombre específico del SRM indicado en el Certificado de Análisis.

Preparación y Disponibilidad de Materiales Tipo de Referencia

SRM nuevos y renovados se preparan continuamente. A los usuarios potenciales se les notifica directamente de la disponibilidad de estos nuevos artículos, y los SRM se describen en la edición siguiente del catálogo. Para incluir su nombre en la lista que la NBS mantiene para notificar clientes sobre materiales nuevos, por favor escriba a la Oficina de Materiales Tipo de Referencia, a la dirección indicada para pedidos.

Al prepararse SRM renovados, la intención es completar el reemplazo antes de agotarse los SRM existentes. Frecuentemente esto no es posible y el SRM no será disponsible por algún tiempo. Cuando esto sucede, los que piden el material seran notificados y, cuando posible, substitutos serán sugeridos. Cuando la nueva partida esté disponible, los clientes que hayan pedido la partida anterior, o su reemplazo, serán notificados inmediatamente.

Los SRM renovados usualmente no son idénticos a sus antecesores, pero serán muy similares, especialmente en cuanto a las características certificadas. Generalmente la neuva partida puede usarse en lugar de su antecesor. Por ejemplo, cuando el primer acero Bessemer de 0.1 por ciento de carbón se preparó en el 1909, se le llamo Muestra Regular Num. 8. Durante los años subsiguientes se preparó una serie de renovaciones, 8a, 8b, etc. El actúal SRM 8j, Acero Bessemer (Simulado), 0.1 por ciento de carbón, representa la décima partida de renovación de este material. Aunque cada una de estas partidas difiere en algo en el

análisis detallado, todas han mantenido el nivel relativamente alto de fósforo, azufre y nitrógeno, y bajo contenido de aleación de metal que son caracteristicos de esté tipo de material.

No es posible suministrar números anteriores de una serie de renovaciones cuando la existencia se ha terminado. La produccion puede ser descontinuada permanentemente si existe poca demanda o si se produjo una fuente alternativa de suministro de un material.

Información Sobre Pedidos

Los pedidos se deben enviar a:
Office of Standard Reference Materials
Room B311, Chemistry Building
National Bureau of Standards
Washington, DC 20234
Teléfono: (301) 921-2045

Los pedidos deben indicar cantidad de unidades, número de catálogo, y nombre del material pedido. Por ejemplo: 1, Num. 11h, Basic-Open-Hearth-Steel 0.2 Por Ciento de C. Los materiales descritos en este Catálogo se distribuyen solamente en las unidades enumeradas o en sus múltiples.

La aceptación de un pedido no significa aceptación de disposición alguna incluida en el pedido que sea contraria a las disposiciones, prácticas o reglamentos del National Bureau of Standards o del Gobierno de los Estados Unidos.

Pedidos de materiales que estan agotados se cancelarán si solamente se han pedido artículos que están fuera de existencia. En respuesta a otros pedidos, los materiales disponibles se enviarán y los artículos fuera de existencia se cancelarán. No se aceptan pedidos de materiales agotados; si una emisión nueva del material está disponible, se le proporcionará automáticamente.

Términos

Los precios citados son en dolares de los Estados Unidos, y son los publicados en la Lista de Precios de SRM. Cuando las Listas de Precios de SRM se publican, estas se envían a usuarios que han hecho compra durante los 12 meses ateriores y a personas u organizaciones que las han solicitado. Estos precios estan sujetos a cambios sin notificación previa y los pedidos se facturarán de acuerdo con los precios en efecto al momento del envío. No se hacen descuentos en las compras de los SRM, RM o GM.

No se requiere pago por el precio de compra acompañando el pedido. Se espera el pago de la factura dentro de 30 días del recibo de la factura. El pago por pedidos del exterior se puede hacer en una de las siguientes formas:

a. giro bancario contra un banco de los Estados Unidos.
b. transferencia de banco a banco a un banco de los Estados Unidos.
c. al contado en cambio de documentos.
d. giro a la vista.
e. giro internacional.
f. cupones de la UNESCO.

No se pueden aceptar Cartas de Crédito. Para usar una Carta de Crédito o cualquier metodo de pago que no esté enumerado arriba, debe obtenerse los servicios de un agente en los Estados Unidos para que actue en el nombre del comprador. Su agente compraría el material y nuestra factura indicaría que el es el comprador. El material se enviaría a su agente, quien so lo enviaría a usted de acuerdo con sus instrucciones.

NBS no puede pagar por adelantado cargos de embarque y añadírlos a la factura. Categorías restringidas como hidrocarburos, compuestos de azufre orgánico, gases comprimídos, materiales de mezcla para caucho, patrones radioactivos, y materiales similares se envían franco a bordo (F.O.B.) Gaithersburg, MD.

Cargos Por Demora

A menos que se estipule lo contrario, el pago por los SRM vence dentro de los 30 días del envío del pedido al cliente. Para clientes no federales, los reglamentos del Departamento del Tesoro de los Estados Unidos

requieren que cargos por demora, basados en el valor actúal de fondos al Tesoro, se hagan por cada período de 30 días o porción de tal período que el pago esté atrasado.

Factura Pro Forma

El servicio de factura pro forma frecuentemente requerirá de 3 a 4 semanas para procesarse, y se proporcionará solamente a aquellos que lo soliciten.

Envíos Internos

El envío de material (excepto ciertas categorías restringidas) destinado para los Estados Unidos y el Canada normalmente se hace con pago anticipado (siempre y cuando el paquete no exceda las limitaciones de peso prescritas por las leyes y reglamentos postales).

Envios al Exterior

Los reglamentos de diferentes naciones acerca de la importación de SRM, GM y RM varían mucho; y sería impráctico tratar de enumerar todas las variaciones posibles. Por tanto, cuando las prácticas de embarque que aparecen a continuación no apliquen, se informará a los compradores del mejor método de embarque a sus países.

La mayoría de los pedidos se enviará por Servicio Aereo Internacional de Paquetes Postales con pago adelantado. Las excepciones son artículos en categorías restringidas y aquellos embarques que excedan las limitaciones de peso de paquetes postales. Estas exceptiones se enviarán F.O.B. Gaithersburg, MD, a menos que se requiera un agente (compañía naviera o de corretaje) localizado en los Estados Unidos. Cuando se requiere un agente, se notificará al comprador y se le pedira que nombre un agente de us eleccion. En tal caso, el material será embalado para embarque a ultramar y será enviado al agente F.O.B. Gaithersburg, MD.

Documentación

A continuacion se enumeran los únicos documentos que se proporcionarán. Todos los documentos se publican en inglés.

a. seis facturas comerciales
b. dos giros a la vista
c. dos hojas de embalaje
d. facturas de aduana para el Canadá, Nueva Zelandia, Australia y Africa del Sur
e. Certificado de Origen
f. recibos de paquetes postales, para envíos de paquetes postales
g. hoja de ruta aérea para envíos aéreos

Si se requieren otros documentos además de los enumerados arriba, se necesitarán los servicios de un agente en los Estados Unidos para comprar y enviar los materiales.

Nota: Los pedidos y preguntas que se envien en inglés seran atendidos mas rapidamente que aquellos que requieran traducción.

Introduction

Le Bureau of National des Normes émet plus de 1000 matériels différents au moyen de son Programme de Matériels de Référence Standard. Ces matériels sont essentiellement des Matériels de Référence Standard (SRM) porteurs d'un certificat garantissant leur composition chimique, leur propriété chimique, ou leur propriété physique. Cependant, ils incluent aussi des Matériels de Recherche (Research Materials—RM), et des Matériels de Référence Spéciaux (Special Reference Materials—GM). A tous les SRM, RM et GM sont assignés des noms et des numéros distinctifs grace auxquels ils sont identifiés de façon permanente. Par conséquent, chaque SRM, RM ou GM porteur d'une description donnée est identique (dans les limites imposées ou voulues) à tout autre échantillon désigné de la même façon—a l'exception des articles certifiés séparément, qui sont en plus identifiés par un numéro de série.

Les premiers matériels que le NBS ait sortis s'appelaient Echantillons Standard (Standard Samples). Il s'agissait d'un groupe de minerais, de fers et d'aciers porteurs d'un certificat garantissant leur composition chimique. Depuis les années 1960, ces matériels sortent sous l'appellation "Matériels de Référence Standard", et couvrent un large éventail de propriétés chimiques et physiques, de même qu'un éventail tout aussi large d'intérêts de mesures.

Définitions

Les différents termes de SRM, RM et GM, sont utilisés pour indiquer des différences dans le type de renseignements donnés, ainsi que dans l'usage auquel l'article est destiné. (Les termes RM et GM ne sont plus utilisés commme préfixes pour ces articles; les numéros 8000 a 9000 leur sont reservés.)

Les Matériels de Référence Standard ont été caractérisés par le Bureau National de Normes comme ayant une propriété chimique ou physique particulière, et sont émis avec un certificat qui donne les résultats de leur caractérisatión. Ces résultats sont obtenus par l'un des trois moyens conventionnels utilisés pour délivrer un certificat. Il s'agit de mesurer la propriété en utilisant: (1) une methode a reference préalablement validée, (2) au moins deux méthodes de mesure qui soient independantes l'une de l'autre et fiables, ou bien (3) un réseau de laboratories travaillant en coopération, qui soient techniquement compétents et qui connaissent parfaitement le matériel analysé. Ces moyens sont décrits en detail dans "Le Rôle des Matériels de Référence Standard dans les Systèmes de Mesures" (The Role of Standard Reference Materials in Measurement Systems), Monographie 148 du NBS (NBS Monograph 148), 54 pages (édition de janvier 1975). Les SRM sont définis comme des matériels bien caractérisés et certifiés, qui sont produits en nombre pour perfectionner la science des mesures. Ils sont preparés et utilisés à trois fins principales: (1) pour aider au developpement de méthodes exactes d'analyse (méthodes de référence); (2) pour calibrer les systèmes de mesures utilisés pour: (a) faciliter l'échange de marchandises, (b) instituer le contrôle de qualité, (c) determiner les caracteristiques de fonctionnement du matériel, ou bien (d) mesurer une propriété particulière dans la limite des connaissances scientifiques, et (3) pour assurer la congruité et l'exactitude a long terme des procedés de contrôle de qualité. De cette manière, les SRM aident a assurer la compatibilité et la precision des mesures dans bien des aspects de la vie nationale—de la science et la technologie aux échanges et au commerce.

Les Matériels de Recherche, a l'inverse des SRM, ne sont pas certifiés. Les RM sont emis avec, à la place d'un certificat, un "Rapport d'investigation", accordé par la seule autorité du membre du personnel du NBS qui a produit le rapport. Un RM a pour but essential de faire avancer les recherches scientifiques ou

techniques sur ce matériel particulier. La première des considérations lors de la sortie d'un RM est de fournir un matériel homogène, afin que les chercheurs de divers laboratoires aient l'assurance d'étudier le même matériel.

Les Matériels de Référence Spéciaux diffèrent des SRM et des RM en ce que le NBS ne participe pas a la caractérisatión de ces materiaux. Les GM sont des matériels de reference émis et certifiés, ou bien garantis, par d'autres agences gouvernementales, par des jurys de norme, ou par d'autres organismes a but non lucratif. Quand il est estimé qu'il s'agit d'intérêt public et qu'il n'existe pas d'autres moyens de distributión nationale, c'est au NBS que revient le rôle de distribuer de tels matériels. Ce service est a la dispositión de tous les organismes qui sont qualifiés et qui possèdent des matériels de référence pouvant aider à résoudre un problème national de mesure.

Le catalogue des SRM

De nouveaux catalogues des Matériels de Référence Standard du NBS sont publiés environ tous les trois ans. Ces catalogues donnent la liste des nouveaux matériels disponibles, des matériels en preparation, et en omettent les matériels discontinués. Pour garder le catalogue à jour entre deux éditions, des suppléments annuels sont publiés, quit donnent la liste des prix en cours et de tous les matériels nouveaux.

Les matériels repertories dans ce catalogue sont classés en plusieurs groupes principaux: les étalons de composition chimique, les étalons de propriété physique, les matériels de recherche, et les matériels de référence spéciaux. Les trois premiers groupes ne comprennent que des SRM et sont subdivisés en catégories indiquées dans la table des matières.

Les valeurs numériques données dans le catalogue pour décrire les propriétés des matériels ne sont là qu'a titre indicatif et ne doivent être utilisées que comme guide pour choisir les matériels. Elles ne doivent pas etre employées à la place du certificat fourni avec le matériel.

Remarque: certains SRM sont emis sans certificat. Ces exceptions sont indiquées à la fois dans la description du SRM et dans l'index numérique.

L'index numérique donne les numéros SRM, RM et GM de tous les matériels répertoriés dans le catalogue, ainsi que la date du certificat actuel, ou bien une note pour expliquer l'absence du certificat.

Un index par catégorie donne une liste générique des SRM et de leur principal composant ou élément.

Un index alphabetique est également fourni. Il donne le nom exact du SRM tel qu'il est indiqué sur son certificat d'analyse. Les RM et GM sont repertories en tant que groupes uniquement.

Préparation et Disponibilité des Matériels de Référence Standard

Les nouveaux SRM et ceux qui sont renouvelés sont préparés continuellement. Les éventuels clients sont mis directement au courant de la disponibilité de ces articles nouveaux, et les SRM sont decrits dans l'édition suivante du catalogue. Si vous desirez avoir votre nom sur la liste d'adresses que le NBS garde afin de prévenir les clients de la production de matériels nouveaux, veuillez contacter le Bureau des Matériels de Référence Standard (Office of Standard Reference Materials) à l'adresse indiquée pour les commandes.

Lorsque l'on prépare des SRM renouvelés, c'est avec l'intentión de terminer le renouvellement avant que le stock actuel de SRM no soit épuisé. Très souvent, ceci n'est pas possible et les SRM ne sont alors pas disponibles pour quelque temps. Lorsque c'est le cas, les personnes ayant passé commande de ce matériel sont prevenues de la situation et, quand c'est possible, on leur propose d'éventuels substituts. Lorsque le stock renouvelé est disponible, les clients ayant demandé soit le lot précédent, soit le nouveau, en sont rapidement prévenus.

Les SRM renouvelés ne sont genéralement pas identiques à ceux qu'ils remplacent, mais y sont tout a fait semblables, surtout en ce qui concerne leurs caracteristiques certifiées. En principe, le SRM renouvelé peut être utilisé à la place de son précedent. Par example, quant, en 1909, le premier acier Bessemer à teneur en charbon de 0.1% a été préparé, on l'a appelé Echantillon Standard No. 8. Les années suivantes, plusieurs matériels de remplacement, 8a, 8b, etc., ont été préparés. L'actual SRM 8j, l'acier (simulé) Bessemer a teneur en charbon de 0.1%, représente le dixième lot de renouvellement de ce matériel. Alors que ces lots different

quelque peu les uns des autres dans les détails de leur composition, tous possèdent un niveau relativement élevé de phosphore, de soufre et de nitrogène, et un faible niveau de métaux alliés, ce qui est caractéristique de ce genre de matériel.

Il n'est pas possible de fournir des numerós antérieurs a un lot renouvelé lorsque leur stock est epuisé. Si l'article est peu demandé, ou qu'une autre source d'approvisionnement devient disponible pour un matériel donné, la production de celui-ci peut être arretée définitivement.

Les commandes

Toute commande doit être envoyée à l'adresse suivante:
Office of Standard Reference Materials
Room B311, Chemistry Building
National Bureau of Standards
Washington, DC 20234
Tel. (301) 921-2045

Les commandes doivent preciser le nombre d'unités désirées, le numéro de référence, et le nom du matériel demandé. Par exemple: 1 unité (1 each), No. 11h, acier basique de four à sole (Basic-Open-Hearth-Steel), 0.2 pour cent de C. (0.2 percent C.). Les matériels décrits dans ce catalogue sont uniquement livres en nombre entier d'unités indiquées.

L'acceptation d'une commande n'implique pas l'acceptation de toute disposition inclue dans celle-ci et contraire aux normes, aux usages ou aux règlements du Bureau National des Normes ou du gouvernement americain.

Les commandes reçues pour les matériels épuisés sont annulées si tous les articles commandés sont des articles épuisés. Pour les autres commandes, les matériels disponibles sont expédiés, et les articles épuisés sont annulés. Les commandes renouvelées ne sont pas acceptées pour les matériels épuisés; si un lot renouvelé du matériel est disponible, il est automatiquement envoyé.

Modes de paiement

Les prix sont donnés en dollars U.S., et sont publiés sur la liste des prix des SRM. Quand les listes des prix sont publiées, elles sont envoyées aux personnes ou organismes qui en ont fait la demande. Ces prix sont sujets à être révisés sans préavis, et les commandes sont facturées selon les tarifs en vigueur au moment de l'envoi. On ne fait pas de remise sur les achats de SRM, de RM et de GM.

Il n'est pas necessaire d'envoyer de paiement avec la commande. Le paiement de la facture doit etre effectué dans les 30 hours après réception de celle-ci. Le paiement des commandes faites hors des Etats-Unis peut etre effectué de l'une des façons suivantes:

a. par chèque bancaire à préveler sur un compte aux Etats-Unis
b. par transfert bancaire sur un compte aux Etats-Unis
c. en liquide sur presentation de documents
d. par effet à vue
e. par mandat international
f. par bons de l'UNESCO.

Les lettres de credit ne sont pas acceptées. Si une lettre de credit, ou tout mode de paiement autre que ceux indiqués ci-dessus doit être utilisé, vous devrez vous assurer les services d'un representant aux Etats-Unis qui agira en votre nom. Votre représentant fera l'achat du matériel, et notre facture le considérera comme acheteur. Le matériel lui sera expédié, et il le fera suivre selon vos instructions.

Le NBS ne peut pas payer d'avance les frais d'expédition et les inclure dans la facture. Certaines categories de matériel soumises à des restrictions, telles que les hydrocarbures, les composés organiques de soufre, les gaz compressés, les matériels caoutchoutes composés, les matériels standard radioactifs, et autres matériels semblables sont expediés F.O.B. a Gaithersburg (état de Maryland).

Pénalités pour paiement tardif

Sauf avis contaire, le paiement des SRM est dû dans les 30 hours suivant l'expédition de la commande au client. Pour les clients non gouvernementaux, les règles de la Trésorerie americaine exigent que des pénalités

pour paiement tardif, basées sur la valeur courante de la rente sur l'Etat, soient imposées pour chaque periode de 30 jours ou moins après échéance du paiement.

Facture proforma (Detail de la facture)

Le service de facture proforma demande généralement de trois a quatre semaines pour être preparé, et n'est fourni qu'à ceux qui en font la demande.

Envois Internes

Les matériels (sauf certaines catégories soumises à des restrictions) envoyés aux Etats-Unis et au Canada sont normalement expédiés frais de transport compris—à condition que le colis soit dans les limites de poids imposées par les lois et règlements du service postal.

Envois à l'étranger

Les reglements de divers pays concernant l'importation de SRM, GM et RM varient considerablement; toute tentative de faire la liste de toutes les différences possibles serait mal aisée. Par conséquent, dans tous les cas ou les usages d'expedition decrits ci-dessus ne sont pas applicables, les clients sont informés du meilleur mode d'expedition pour leur pays.

La plupart des commandes sont expédiées, frais de transport compris, par poste internationale des colis par avoin. Les exceptions sont les articles soumis à des restrictions, et les envois hors des limites de poids pour les paquets postaux. Ces exceptions sont envoyées F.O.B. à Gaithersburg (état de Maryland), à moins qu'un représentant (compagnie d'expédition ou de courtage) etabli aux Etats-Unis ne soit obligatoire. Lorsqu'un representant est necessaire, le client en est prevenu et il lui est demandé d'en désigner un de son choix. Dans ce cas, le matériel est empaqueté en prévision d'un transport à l'étranger, et expédié F.O.B. au representant a Gaithersburg (état de Maryland).

Documentation

Vous trouverez ci-dessous la liste des seuls documents que nous fournissons. Tous ces documents sont en anglais.

a. six factures commerciales
b. deux effets à vue
c. deux fiches detaillant le contenu du paquet
d. des factures douanières pour le Canada, la Nouvelle-Zelande, l'Australie et l'Afrique du Sud
e. un certificat d'origine
f. des reçus de la poste pour les paquets envoyés par la poste
g. un bordereau d'expédition aerienne pour les envois par avion.

Si des documents autres que ceux indiqués sur la liste ci-dessus sont demandés, les services d'un représentant aux Etats-Unis sont nécessaires pour acheter et envoyer les matériels.

N.B. Les commandes et requêtes soumises en anglais recevront reponse plus rapidement que celles nécessitant une traduction.

Einleitung

Im Rahmen seines Normenprobenprogramms gibt das National Bureau of Standards ueber tausend verschiedene Proben aus. In erster Linie handelt es sich um Standard Reference Materials (SRM), die nach ihrer chemischen Zusammensetzung und ihrer chemischen und physikalischen Eigenschaften geprueft worden sind und zusaetzlich um sogenannte Research Materials (RM) und Special Reference Materials (GM). Alle SRM (Normenproben), RM (Forschungsproben) und GM (Spezialproben) tragen gesonderte Bezeichnungen und Kennummern, wodurch sie permanent identifiziert werden. Das will heissen, dass jede SRM, RM und GM, die eine bestimmte Beschreibung erhalten hat, identisch ist (innerhalb der erforderlichen oder beabsichtigten Grenzen) mit jeder anderen Probe, die auf die gleiche Art gekennzeichnet ist. Die einzige Ausnahme bilden solche Proben, die einzeln geprueft wurden. Diese tragen eine laufende Nummer zur genaueren Kennzeichnung.

Die ersten von NBS herausgegebenen Materialien trugen die Bezeichnung Standard Samples (Standardproben) und bestanden aus einer Reihe von Erzen, Eisen und Stahlen, deren chemische Zusammensetzung bestaetigt worden war. Seit Mitte der sechziger Jahre werden diese Materialien als SRM herausgegeben. Sie umfassen ein breites Spektrum von chemischen und physikalischen Eigenschaften und ein ebenso breites Spektrum von Messungsinteressen.

Definitionen

Die SRM, RM oder GM werden auf verschiedene Weise benutzt, um Verschiedenheiten in der Art der uebermittelten Information anzuzeigen, wie auch Unterschiede in der geplanten Anwendung des Materials. (Die Bezeichnungen RM und GM werden nicht mehr als Kenncode fuer diese Materialien benutzt; die Nummern 8000 bis 9999 sind ausschliesslich fuer die RM und GM vorgemerkt.)

Die Standard Reference Materials erhalten vom NBS eine Kennzeichnung nach chemischen oder physikalischen Eigenschaften und werden dann mit einem Zertifikat versehen, das das Ergebnis der Analyse angibt. Diese Ergebnisse werden nach einem der drei traditionellen Begutachtungsverfahren gewonnen, d.h. durch die Messung der jeweiligen Eigenschaft auf Grund (1) einer vorher belegten Pruefungsmethode; (2) zweier oder mehrerer unabhaengiger und verlaesslicher Messverfahren, oder (3) einer Gruppe zusammenarbeitender Laboratorien, die technisch kompetent sind und ueber das zu pruefende Material genauestens Bescheid wissen. "The Role of Standard Reference Materials in Measurement Systems" (Die Rolle der SRM in Messystemen), NBS Monograph 148, 54 pages (Jan. 1975) beschreibt diese Verfahren in Einzelnen. Die SRM lassen sich als genau gekennzeichnete und mit Zertifikat versehene Materialien bezeichnen, die in genuegend grossen Mengen hergestellt werden, um zu einer Verbesserung der Messwissenschaft beizutragen. Sie werden aus hauptsaechlich drei Gruenden ausgearbeitet und benutzt: 1. um genaue analytische Methoden (Referenzmethoden) zu entwickeln; 2. um Messysteme zu kalibrieren, die verwendet werden, um (a) den Warenaustausch zu erleichtern; (b) Qualitaetskontrollen einzufurhren; (c) Leistungscharakteristika festzulegen oder (d) eine bestimmte Eigenschaft an der Grenze des Hoechstentwicklungsstandes zu messen und 3. um die langfristige Zulaenglichkeit und Intergritaet von

Qualitaets-kontrollsystemen zu gewaehrleisten. Auf diese Weise tragen die SRM dazu bei, die Vereinbarkeit und Genauigkeit von Massen auf den verschiedensten Gebieten—von der Wissenschaft und Technik bis zu Handel und Gewerbe—zu sichern.

Anders als die SRM, enthalten die Research Materials kein Zertifikat, sondern statt dessen einen "Report of Investigation" (Untersuchungsbericht), der einzig und allein auf der Autoritaet des NBS-Angestellten basiert, der den Bericht verfasst hat. Ein RM dient vor allem dem Zweck, wissenschaftliche oder technische Forschungsarbeit an diesem bestimmten Material voranzutreiben. Die hauptsaechliche Ueberlegung bei der Publikation eines solchen RM ist, homogenes Material anzubieten, um Wissenschaftlern in verschiedenen Labors die Gewissheit zu geben; dass sie an denselbem Material Forschung treiben.

Special Reference Materials (FM) unterscheiden sich sowohl von den SRM und den RM darin, dass sich das NBS nicht an der Kennzeichnung dieser Proben beteiligt. Bei den GM handelt es sich um Proben, die von anderen Regierungsbehoerden, Eichaemtern oder auch von sonstigen gemeinnuetzigen Institutionen ausgearbeitet und ueberprueft, bezw. garantiert worden ist. In den Faellen, wo es im oeffentlichen Interesse zu liegen scheint oder wo keine anderweitigen landesweiten Verteilungsverfahren verfuegbar sind, betaetigt sich das NBS als Verteiler derartiger Materialien. Dieser Service wird all jenen Organisationen zur Verfuegung gestellt, die den geltenden Bestimmungen entsprechen und ueber Material verfuegen, das zur Loesung eines nationalen Messproblems beitragen mag.

Das SRM-Verzeichnis

Neue SRM-Verzeichnisse kommen etwa alle drei Jahre heraus. Sie enthalten Listen von neuem, verfuegbaren Material; von Material, das sich in Vorbereitung befindet und Material, das aus dem Katalog gestrichen worden ist. Um das Verzeichnis in der Zwischenzeit auf dem Laufenden zu halten, werden alle Jahre Nachtraege gedruckt, die eine aktuelle Preisliste, sowie etwaige neue Materialien enthalten.

Die Materialien, die in diesem Verzeichnis aufgefuehrt sind, fallen in mehrere Hauptgruppen: chemische Zusammensetzungsnormen; physikalische Eigenschaftsnormen; Fachnormen; Forschungsmaterialien und Special Reference Materials (also besonderes Quellenmaterial). Die drei ersten Gruppen enthalten nur SRM und sind in die Kategorien unterteilt, die im Inhaltsverzeichnis angegeben sind.

Die im Verzeichnis angegebenen Zahlenwerte, die die Eigenschaften der Proben beschreiben, sind als nominelle Werte zu verstehen und sollten daher nur als Richtwerte zur Auswahl der Materialien benutzt werden—und nicht etwa an Stelle eines Zertifikats.

Anmerkung: Manche SRM werden ohne Zertifikat herausgegeben. Ausnahmen dieser Art sind sowohl im Zusammenhang mit der Beschreibung des jeweiligen SRM, als auch in numerischen Inhaltsverzeichnis angegeben.

Dies Inhaltsverzeichnis enthaelt die SRM-, RM- und GM-Kennziffern aller Materialien, die im Gesamtverzeichnis aufgefuehrt sind, wie auch das Datum des derzeit geltenden Zertifikats oder aber eine Erklaerung fuer das Fehlen desselben.

Ein Verzeichnis nach Kategorien bietet eine allgemeine Liste der SRM, sowie den Hauptteil oder das Hauptelement, das im SRM Erwaehnung findet.

In einem alphabetischen Verzeichnis wird schliesslich die genaue Bezeichnung des SRM—so wie sie in dem Zertifikat der Analyse aufscheint—angefuehrt.

Vorbereitung und Verfuegbarkeit von SRM

Neue SRM, wie auch Neuauflagen sind staendig in Vorbereitung. Etwaige Abnehmer werden direkt von der Verfuegbarkeit solcher neuer Materialien in Kenntnis gesetzt und die SRM werden auch in der naechstfolgenden Ausgabe des Verzeichnisses beschrieben. Falls Sie wuenschen, dass Ihr Name in die NBS-Kartei aufgenommen wird, damit Sie von neuen Proben erfahren, dann wenden Sie sich bitte an das Office of Standard Reference Materials, dessen Adresse weiter unten angegeben ist.

Bei Neuauflagen von SRM wird versucht, diese fertigzustellen, bevor der Vorrat an bereits existierenden SRM aufgebraucht ist. Oft ist das jedoch nicht moeglich, was bedeutet, das das betreffende SRM zeitweilig nicht lieferbar sein wird. Sollte das der Fall sein, dann wird der Besteller dahingehend benachrichtigt und wenn angebracht, wird Ersatzmaterial angegeben. Wenn die Neuauflage dann verfuegbar ist, wird der Kunde, der entweder die bisherige Probe oder die Neuauflage bestellt hat, umgehend benachrichtigt.

Normalerweise sind die Neuauflagen nicht mit den bisherigen Proben identisch, jedoch einander aehnlich vor allem mit Bezug auf die gepruefften Charakteristika. Im allgemeinen kann die Neuauflage an

Stelle der vorangegangenen Probe benutzt werden. Als beispielsweise im Jahre 1909 zum ersten Mal 0.1 Prozent kohlenstoffhaltiger Bessemer Flusstahl hergestellt wurde, erhielt er die Bezeichnung Normenprobe No. 8. In den darauffolgenden Jahren wurden eine Reihe von Neuauflagen mit der Ziffer 8a, 8b usw. herausgegeben. Die derzeit gueltige Ausgabe SRM 8j (Bessemer Stahl [simuliert] 0.1 Prozent kohlenstoffhaltig) ist die zehnte Neufassung der Probe. Obwohl diese saemtlichen Proben sich in der Einzelanalyse voneinander etwas unterscheiden, besitzen jedoch alle den charakteristischen, relativ hohen Anteil solchen Materials an Phosphor, Schwefel, Stickstoff, sowie einen niedrigen Metallegierungsgehalt.

Vorangegangene Nummern einer Neuauflagenserie sind nicht lieferbar, wenn der Vorrat erschoepft ist. Im Falle geringen Bedarfs oder des Vorhandenseins einer alternativen Lieferquelle, wird die Herstellung eines bestimmten Materials unter Umstaenden voellig eigestellt.

Bestellinformation

Office of Standard Reference Materials
Room B311, Chemistry Building
National Bureau of Standards
Washington, DC 20234
Telefon: (301) 921-2045

Bestellungen sollten die Anzahl der Einheiten, die Kennummer im Verzeichnis und die namentliche Bezeichnung der Proben enthalten, z.B. one each, No. 11h, Basic-Open-Hearth Steel, 0.2 percent C. Die in diesem Verzeichnis aufgefuehrten Materialien werden ausschliesslich in den angegebenen Einheiten oder in Mehrfachsaetzen derselben geliefert.

Annahme einer Bestellung bedeutet jedoch nicht die gleichzeitige Annahme irgendeiner in der Bestellung angegebenen Bedingung, sofern diese den Gepflogenheiten, der Praxis oder den Richtlinien des NBS oder der amerikanischen Regierung zuwiderlaeuft.

Falls eine Bestellung ausschliesslich aus "nicht lieferbaren" Proben besteht, wird sie gestrichen. Bei anderen Bestellungen wird das lagernde Material geschickt und das nicht lieferbare gestrichen. Nachbestellungen fuer nicht lieferbares Material werden nicht angenommen. Wenn jedoch Neuauflagen verfuegbar sind, werden diese automatisch geliefert.

Bestimmungen

Preise sind in US Dollar angegeben und scheinen in der SRM Preisliste auf. Nach Erscheinen dieser SRM Preislisten werden diese an Kunden geschickt, die in den vorangegangen 12 Monaten Einkaeufe getaetigt haben wie auch an Einzelpersonen und Organisationen, die darum ersucht haben. Die Preise moegen ohne vorherige Ankuendigung geaendert werden und Bestellungen werden gemaess der am Versandtag geltenden Preise fakturiert. Ermaessigungen beim Kauf von SRM, RM und GM werden nicht gewaehrt.

Der Kaufpreis muss nicht gleichzeitig mit der Bestellung ueberwiesen werden. Zahlung wird innerhalb von 30 Tagen nach Eintreffen der Faktura erwartet. Zahlung von Bestellungen aus dem Ausland kann auf folgende Weise erfolgen:

a. per Bankscheck auf eine amerikanische Bank ausgestellt;
b. durch Ueberweisung eines Bankwechsels an eine amerikanische Bank;
c. durch Barzahlung;
d. per Tratte;
e. durch internationale Postanweisung;
f. mit UNESCO Kupons.

Kreditbriefe werden nicht akzeptiert. Falls jedoch ein Kreditbrief oder ein sonstiger Zahlungsmodus benutzt werden soll, moege sich der Besteller an einen Agenten in den Vereinigten Staaten wenden, der ihn vertritt. Der Agent kauft das Material und scheint auch als der Kaeufer auf unserer Faktura auf. Das Material wird an den Agenten geliefert und dieser schickt es dann an den Besteller gemaess dessen Anweisungen weiter.

Das NBS kann die Faktura nicht mit dem Vermerk "Vorauszahlung und Aufschlag" der Versandkosten versehen. Materialien, die Beschraenkungen unterworfen sind, werden fob Gaithersburg, MD

verschickt—so etwa Kohlewasserstoffverbindungen, Schwefelverbindungen, Gase in Druckbehaeltern, Kautschukverbundstoffe, radioaktive Normen und aehnlicke Stoffe.

Strafgebuehren fuer Spaetzahler

Falls nicht anderweitig angegeben, soll die Zahlung fuer SRM-Bestellungen innerhalb von 30 Tagen des Versanddatums erfolgen. Nach den Bestimmungen des amerikanischen Finanzministeriums sind Nicht-Regierungskunden dazu angehalten, fuer jede 30-Tage Frist oder Teil derselben eine Strafgebuehr auf ueberfaellige Rechnungen auf der Basis des derzeitigen Wertes an das Finanzministerium zu entrichten.

Proforma Faktura [Preisangabe]

Die Bearbeitung von Proforma-Fakturen nimmt gewoehnlich drei bis vier Wochen in Anspruch und wird nur denjenigen gewaehrt, die darum ersucht haben.

Inlandlieferungen

Sendungen von Materialien (ausser solchen, die Beschraenkungen unterworfen sind) an Adressen in den Vereinigten Staaten, oder Kanada erfolgen normalerweise mit vorbezahltem Porto—es sei denn, das Paket uebersteige das vom Postgesetz und den Postbestimmungen zugelassene Hoechstgewicht.)

Auslandslieferungen

Die Bestimmungen betreffend den Import von SRM, GM und RM sind in den verschiedenen Laendern ausserrordentlich verschieden. Es wäre daher auch nicht zweckdienlich, die vielen verschiedenen Bestimmungen hier aufzufuehren. In den Faellen, wo die weiter unten angefuehrten Versandbestimmungen nicht gelten, wird der Bezieher von dem guenstigsten Versandmodus fuer sein Land unterrichtet werden.

Die meisten Bestellungen werden mit vorbezahltem Porto als internationales Luftpostpaket versendet. Die Ausnahme bilden Proben, die Beschraenkungen unterworfen sind oder das zulaessige Hoechstgewicht ueberschreiten. Derartige Sendungen werden fob Gaithersburg, MD geliefert, falls nicht ein Agent in den Vereinigten Staaten (eine Versandgesellschaft oder ein Makler) eingeschaltet werden muss. In solchen Faellen wird des Bezieher davon in Kenntnis gesetzt und ersucht, einen Agenten seiner Wahl zu benennen. Die Probe wird dann ueberseemaessig verpackt und dem Agenten fob Gaithersburg, MD zugeschickt.

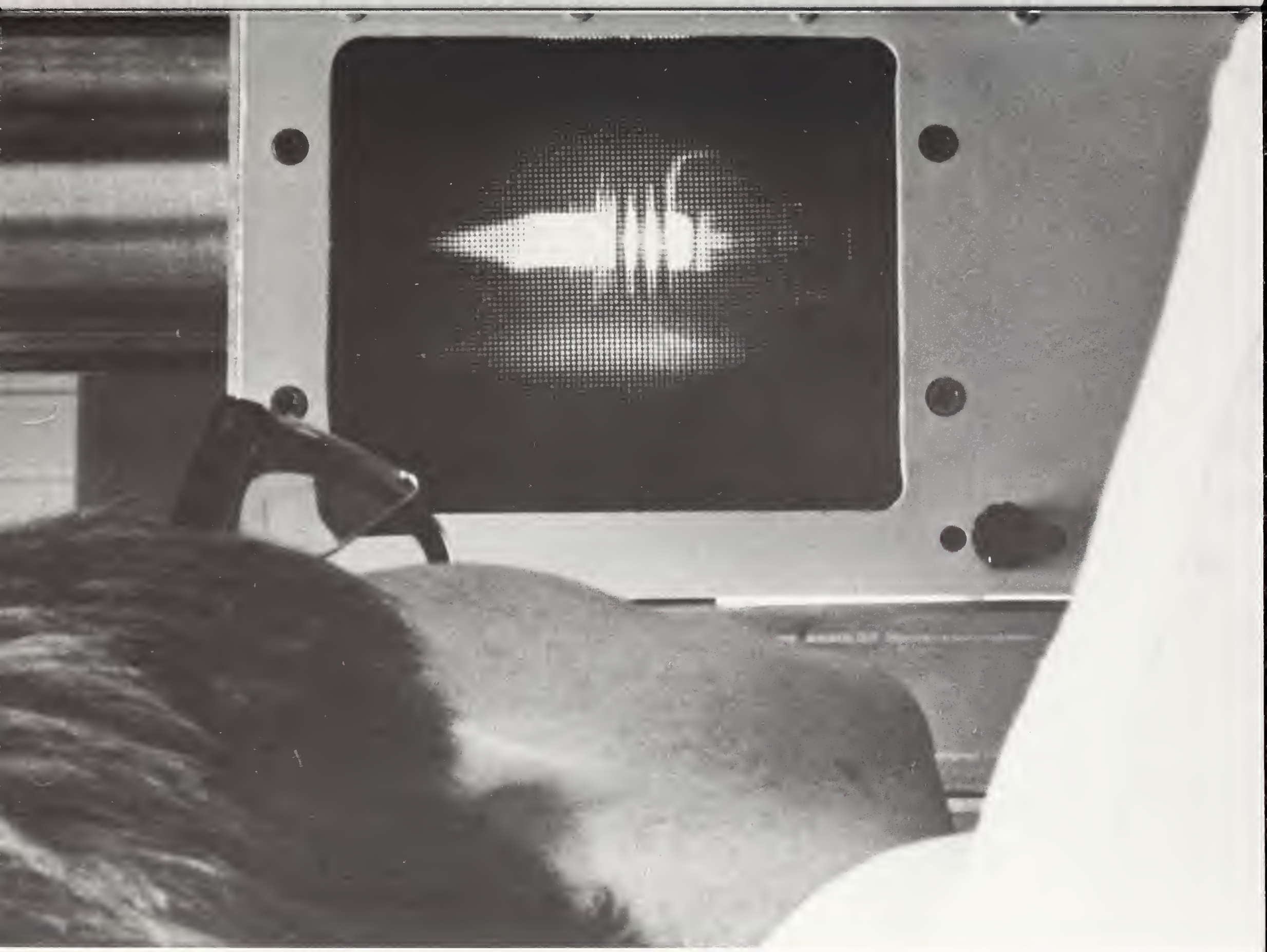
Dokumentennachweis

Die folgenden Dokumente sind die einzigen, die von uns bereitgestallt werden. Saemtliche Dokumente sind in englischer Sprache abgefasst.

a. 6 Rechnungen
b. 2 Tratten
c. 2 Packzettel
d. Zolldeklarationen fuer Kanada, Neuseeland, Australien und Sued-afrika
e. Ursprungsbestaetigung
f. Empfangsscheine fuer Paketpostversand
g. Frachtschein fuer Luftfrachtversand

Falls Dokumente anderer Art als die hier angefuehrten benoetigt werden, sollte man sich beim Einkauf und Versand des Materials eines Agenten in den Vereinigten Staaten bedienen.

Anmerkung: In englischer Sprache eingereichte Bestellungen und Anfragen werden schneller bearbeitet als solche, die uebersetzt werden muessen.



Certified Chemical Composition Standards

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 for both production control and customer acceptance. These SRM's consist of nominal composition steel alloys selected to provide a wide range of analytical values for various elements of vital concern to the chemist. They are furnished in 150-gram units (unless otherwise noted) as chips usually sized between 0.4 to 1.2 mm, prepared from selected portions of commercial ingots.

Plain Carbon Steels

SRM	Type	Chemical Composition (Nominal Weight Percent)					
		C	Mn	P	S		Si
					Grav	Comb	
8j	Bessemer (simulated), 0.1C	0.081	0.505	0.095		0.077	0.058
11h	BOH, 0.2C	0.200	0.510	0.010		0.026	0.21_1
12h	BOH, 0.4C	0.407	0.842	0.018		0.027	0.235
13g	BOH, 0.6C	0.613	0.853	0.006		0.031	0.35_5
14f	BOH, 0.8C	0.753	0.410	0.009		0.039	0.172
15g	BOH, 0.1C	0.094	0.485	0.005		0.026	0.095
16f	BOH, 1.1C	0.97	0.404	0.014		0.026	0.214
19g	AOH, 0.2C	0.223	0.554	0.046	0.032	0.033	0.186
20g	AISI 1045	0.462	0.665	0.012		0.028	0.305
152a	BOH, 0.5C (Tin bearing)	0.486	0.717	0.012		0.030	0.202
178	Basic Oxygen 0.4C	0.395	0.824	0.012		0.014	0.163
335	BOH, 0.1C (Carbon only) 300 g	0.092					
337	BOH, 1.1C (Carbon only) 300 g	1.07					
368	AISI 1211	0.089	0.82	0.084		0.132	0.007

Robert Watters checks the alignment of the plasma flame image on the entrance mask of the inductively coupled plasma (ICP) spectrometer.

Plain Carbon Steels (Continued)

SRM	Cu	Ni	Cr	V	Mo	Co	Ti	Sn	Al (total)	N	Other
8j	0.020	0.113	0.047	0.015	0.038						
11h	0.061	0.028	0.025	0.001			0.004				
12h	0.073	0.032	0.074	0.003	0.006				(0.038)	0.006	
13g	0.066	0.061	0.050	0.001					0.04_8		
14f	0.072	0.053	0.070	0.002	0.013				0.060		
15g	0.036	0.017	0.028	0.001							
16f	0.006	0.008	0.020	0.002	0.003	0.003					
19g	0.093	0.066	0.374	0.012	0.013	0.012	0.027	0.008	0.031		Nb 0.026
20g	0.034	0.034	0.036	0.002	0.008				0.040		
152a	0.023	0.056	0.046	0.001	0.036			0.032			
178	0.032	0.010	0.016	0.001	0.003						
335											
337											
368	0.010	0.008	0.030	0.001	0.003					0.010	

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

Low Alloy Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent) C	Mn	P	S Grav	S Comb	Si	Cu	Ni	Cr
30f	Cr-V (SAE 6150)		0.490	0.79	0.011		0.009	0.283	0.074	0.070	0.945
32e	Ni-Cr (SAE 3140)		0.409	0.798	0.008	0.022	0.021	0.278	0.127	1.19	0.678
33d	Ni-Mo (SAE 4820)		0.173	0.537	0.006	0.010	0.011	0.253	0.123	3.58	0.143
36b	Cr2-Mol		0.114	0.404	0.007		0.019	0.258	0.179	0.203	2.18
72g	Cr-Mo (SAE X4130)		0.278	0.492	0.009		0.014	0.223	0.011	0.016	0.905
100b	Manganese (SAE T1340)		0.397	1.89	0.023	0.029	0.028	0.210	0.064	0.030	0.063
105	High-Sulfur 0.2C (Carbon only)		0.193				(0.60)				
106b	Cr-Mo-Al (Nitralloy G)		0.326	0.506	0.008	0.016	0.017	0.274	0.117	0.217	1.18
125b	High-Silicon	1134	0.028	0.278	0.029		0.008	2.89	0.071	0.038	0.019
129c	High-Sulfur		0.125	0.769	0.076		0.245	0.020	0.013	0.251	0.014
131c	Low Carbon-Silicon (100g)		0.0029				0.020				0.488
139b	Cr-Ni-Mo (AISI 8640)	1222	0.403	0.778	0.013		0.019	0.242	0.097	0.510	0.485
155	Cr0.5-W0.5		0.905	1.24	0.015	0.010	0.011	0.322	0.083	0.100	0.022
179	High-Silicon	1135	0.027	0.094	0.006		0.026	3.19	0.056	0.050	1.33
291	Cr-Mo (ASTM A213)		0.177	0.55_0	0.008		0.020	0.23_0	0.047	0.065	0.51_0
293	Cr-Ni-Mo (AISI 8620)		0.222	0.96_0	0.018		0.022	0.30_0	0.032	0.48_0	
361	AISI 4340	661,1095,1261a	0.383	0.66	0.014		0.014	0.222	0.042	2.00	0.69_4
362	AISI 94B17 (Mod)	662,1096,1262a	0.160	1.04	0.041		0.036	0.39	0.50	0.59	0.30
363	Cr-V (Mod)	663,1097,1263a	0.62	1.50	0.02_9		0.0068	0.74	0.10	0.30	1.31
364	High Carbon (Mod)	664,1098,1264a	0.87	0.25_5	0.01		0.0250	0.06_5	0.24_9	0.14_4	0.06_3
1036	Low Carbon Silicon (25g)	Carbon and Sulfur					0.0007				

Low Alloy Steels (Continued)

SRM	V	Mo	W	Co	Ti	As	Sn	Al (total)	Nb	Ta	Zr	N	Ca
30f	0.182											0.010	
32e	0.002	0.023					(0.011)					0.009	
33d	0.002	0.246										(0.011)	
36b	0.004	0.996											
72g	0.003	0.170											
100b	0.003	0.237										0.004	
105													
106b	0.003	0.199						1.07					
125b		0.008					0.003	0.329					0.0051
129c	0.012	0.002											
139b	0.004	0.182										0.007	
155	0.014	0.039	0.517										
179	<0.01	0.014					0.004	0.0028					
291		0.53_8						0.002					
293	0.004	0.20_4						0.039					
361	0.011	0.19	0.017	0.032	0.020	0.017	0.010	0.02_1	0.022	0.020	0.009	(0.0037)	0.0001_0
362	0.040	0.068	0.20	0.30	0.084	0.09_2	0.016	0.09_5	0.29	0.20	0.19	(0.00404)	0.0002_1
363	0.31	0.028	0.046	0.048	0.050	0.010	0.10_4	0.24	0.049	(0.053)	0.049	(0.0041)	0.0002_2
364	0.10_5	0.49	0.10	0.15	0.24	0.05_2	0.008	(0.008)	0.15_7	0.11	0.068	(0.0032)	0.00003

SRM	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd	Fe
361	0.0003_7	0.00002_5	0.0042	(0.0004)	0.0004	(0.004)	(0.0006)	0.0040	(0.001)	0.0007_5	(95.6)
362	0.0025	0.0004_8	0.013	(0.002)	0.0011	(0.0012)	(0.0011)	0.0019	(0.001)	0.0007_5	(95.3)
363	0.0007_8	0.0018_6	0.002	(0.0008)	0.0037	(0.00016)	(0.0009)	0.0030	(0.002)	0.0012	(94.4)
364	0.0106	0.023_0	0.034	(0.0009)	(0.00002)	(0.00021)	(0.0002)	0.0005_7	(0.0002)	0.0001_5	(96.7)

SRM	Mg	Zn	Pr	Ge	O	H	Au	Hf	Sr
361	0.0002_6	(0.0001)	(0.0003)	[0.006]	(0.0009)	(<0.0005)	(<0.00005)	(0.0002)	–(<0.0005)
362	0.0006_8	(0.0005)	(0.0003)	[0.002]	(0.00107)	(<0.0005)	(<0.00005)	(0.0003)	–(<0.0005)
363	0.0006_2	(0.0004)	(0.0004)	[0.010]	(0.00066)	(<0.0005)	0.0005	(0.0005)	
364	0.00016	[0.001]	(0.0001)	[0.003]	(0.0010)	(<0.0005)	0.0001	(0.0013)	(0.001)

Values in parentheses are not certified, but are given for information only.
Brackets indicate approximate value from heat analysis.
Dash indicates "not detected." Value in parentheses following dash is the conservative "upper limit" of detection.

High Alloy Steels

SRM	Type	Chemical Composition (Nominal Weight Percent)						
		C	Mn	P	S		Si	Cu
					Grav	Comb		
126c	High-Nickel (36% Ni)	0.025	0.468	0.004		0.005	0.194	0.040
344	Cr15-Ni7-Mo2-All	0.69	0.57	0.018		0.019	0.395	0.106
345	Cr16-Ni4-Cu3	0.048	0.224	0.018	0.012	0.012	0.610	3.44
348	Ni26-Cr15 (A286)	0.044	1.48	0.015		0.002	0.54	0.22

SRM	Ni	Cr	V	Mo	Co	Ti	Al (total)	Nb	Ta	B	Fe
126c	36.05	0.062	0.001	0.011	0.008						
344	7.28	14.95	0.040	2.40		0.076	1.16				
345	4.24	16.04	0.041	0.122	0.089			0.231	0.002		
348	25.8	14.54	0.25	1.3		2.24	0.23			0.0031	53.3

Stainless Steels

SRM	Type	(Other Forms)	Chemical Composition (Nominal Weight Percent)					
			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	0.067	1.80	0.019	0.013	0.54	0.121
123c	Cr17-Ni11-Nb0.6 (AISI 348)	1172	0.056	1.7_5	0.024	0.014	0.59	0.103
133b	Cr13-Mo0.3-S0.3		0.128	1.07	0.018	0.328	0.327	0.080
160b	Cr19-Ni12-Mo3	1155	0.044	1.64	0.020	0.018	0.50_9	0.172
166c	Low Carbon (AISI 3162) Carbon Only (100g unit)		0.0078					
339	Cr17-Ni9-Se0.2 (SAE 303Se)		0.052	0.738	0.129	0.013	0.654	0.199
367	Cr24-Ni0.3 (AISI 446)	1267	0.093	0.315	0.018	0.016	0.58	

Stainless Steels (Continued)

SRM	Ni	Cr	V	Mo	Co	Ti	Nb	Ta	Pb	Se	N
73c	0.246	12.82	0.030	0.091							0.037
121d	11.17	17.4_3		0.165	0.10	0.342					
123c	11.3_4	17.4_0		0.22	0.12		0.65	<0.001			
133b	0.230	12.63	0.071	0.052							
160b	12.2_6	18.4_5	0.047	2.38	0.10_1				0.001		0.03_9
166c											
339	8.89	17.42	0.058	0.248	0.096					0.247	
367	0.29	24.19	0.08								0.168

Tool Steels

SRM	Type	Chemical Composition (Nominal Weight Percent)						
		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	0.864	0.341	0.012		0.004	0.185	0.008
134a	Mo8-W2-Cr4-V1	0.808	0.218	0.018	0.007	0.007	0.323	0.101
153a	Co8-Mo9-W2-Cr4-V2	0.902	0.192	0.023	0.007	0.007	0.270	0.094

SRM	Ni	Cr	V	Mo	W	Co	Sn	As	N
50c	0.069	4.13	1.16	0.082	18.44		0.018	0.022	0.012
132b	0.230	4.38	1.83	4.90	6.28	0.029			
134a	0.088	3.67	1.25	8.35	2.00				
153a	0.168	3.72	2.06	8.85	1.76	8.47			0.024

Steels (Granular Form)

These granular-form SRM's are prepared by a pre-alloyed powder metallurgical process, which generally includes argon atomization and hydrogen annealing. The materials normally are sized between 0.07 to 0.7 mm to ensure satisfactory homgeneity and are issued in 100-gram units.

SRM	Type	Chemical Composition (Nominal Weight Percent)						
		C	Mn	P	S	Si	Cu	Ni
163	Low Alloy, 1.0 Cr	0.933	0.897	0.007	0.027	0.488	0.087	0.081
101f	Stainless (AISI 304 L)	0.014	0.087	0.008	0.008	0.876	0.030	9.96

Steels (Granular Form) (Continued)

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

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

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.

Note: 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.

Nominal Sizes for Solid Steel SRM's

400 Series: 5.5 mm (7/32 in) diameter, 102 mm (4 in) long
600 Series: 3.2 mm (1/8 in) diameter, 51 mm (2 in) long
800 Series: 13 mm (1/2 in) diameter, 51 mm (2 in) long
D800 Series: 31 mm (1 1/4 in) diameter, 6.4 mm (1/4 in) thick
1100 and 1200 Series: 31 mm (1 1/4 in) diameter, 19 mm (3/4 in) thick
C indicates a chill cast sample: 31 mm (1 1/4 in) diameter, 19 mm (3/4 in) thick.

Ingot Iron and Low-Alloy Steels

The preparation of these original spectroscopic SRM's began in 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.

Ingot Iron and Low-Alloy Steels

SRM		Type	Chemical Composition (Nominal Weight Percent) 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	0.44	0.050	0.040	0.025
405a	805a	Medium Manganese	1.90	0.27	0.032	0.065	0.37
407a	807a D807a	Chromium-Vanadium	0.76	0.29	0.132	0.169	0.92
408a	808a	Chromium-Nickel	0.76	0.28	0.10	1.20	0.655
409b	809b	Nickel	0.46	0.27	0.104	3.29	0.072
413		Acid Open Hearth, 0.4C	0.67	0.22	0.25	0.18	0.055
414		Cr-Mo (SAE 4140)	0.67	0.26	0.11	0.080	0.99
417a	817a	Basic Open Hearth, 0.4C	0.78		0.13	0.062	0.050
418a		Cr-Mo (SAE X4130)	0.52	0.27	0.040	0.125	1.02
420a	820a	Ingot Iron	0.017		0.027	0.0092	0.0032
	821	Cr-W, 0.9C	1.24		0.080	0.10	0.49
427	827	Cr-Mo (SAE 4150)(B only)					

SRM		V	Mo	Sn	Al (total)	Other
803a	D803a	0.005	0.033			
404a	804a	0.002	0.007			
405a	805a		0.005		0.056	
407a	807a D807a	0.146				
408a	808a	0.002	0.065			
409b	809b	0.002	0.009	0.012		Co 0.025
413		0.007	0.006			
414		0.003	0.32	0.014	0.020	
417a	817a		0.013	0.036		
418a			0.21			
420a	820a		0.0013	0.0017	0.003	Co 0.006
	821	0.012	0.040			W0.52
427	827					B0.0027

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.

The 1200 series replaces the 1100 series which has been exhausted and 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; 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; 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. The preparation of the 1200 series involved a cooperative effort between industry and NBS, and represents the first application of the "benchmark" concept to SRM's. With thousands of industrial processes requiring analytical control, demands for SRM's far exceeded the NBS production capacity. An ever widening gap between supplies and demands led to a program to produce essential "benchmark" SRM's to serve as calibration points in measurement systems. While other selected low-alloy steel SRM's will be prepared to augment the 1200 series, this series is expected to be the primary "benchmarks," especially for some 25 trace elements that affect the physical properties of steels.

Special Ingot Irons and Low-Alloy Steels

				Chemical Composition (Nominal Weight Percent)				
SRM	Type		(Other Forms)	C	Mn	P	S	Si
	1134	High-Silicon	125b	0.026	0.277	0.028	0.009	2.89
	1135	High-Silicon	179	0.027	0.094	0.006	0.026	3.19
	1136	High-Silicon	129c	0.11_3	0.75_5	0.066	0.220	0.018
461		Low Alloy A		0.15	0.36	0.053	0.019	0.047
462		Low Alloy B		0.40	0.94	0.045	0.019	0.28
464		Low Alloy D		0.54	1.32	0.017	0.021	0.48
465		Ingot Iron E		0.037	0.032	0.008	0.01	0.029
466	1166	Ingot Iron F		0.065	0.11_3	0.012	0.009	0.025
467		Low Alloy G		0.11	0.27_5	0.033	0.009	0.26
468		Low Alloy H		0.26	0.47	0.023	0.020	0.075
	1169b	Lead-Bearing		0.1	(1.1)	(0.07)	(0.3)	(0.01)
	C1221	Resulfurized/Rephosphorized		0.020	0.102	0.090	0.112	0.876
	1222	Cr-Ni-Mo (AISI 8640)	139b	0.43	0.78	0.013	0.022	0.24
	1224	Carbon		0.75	0.41	0.009	0.039	0.173
	1225	Low Alloy (AISI 4130)		0.274	0.48	0.007	0.014	0.221
	1226	Low Alloy		0.085	0.274	0.0022	0.0044	0.231
	1227	Basic Open Hearth, 1%		0.97	0.402	0.014	0.026	0.215
	1228	Basic Open Hearth, 0.1%		0.072	0.365	0.004	0.018	0.007
	1254	Ca in Low Alloy (Si)		(0.03)	(0.28)	(0.03)	(0.008)	(2.9)
*661	1261a	AISI 4340	361,1095	0.39	0.66	0.015	0.015	0.223

Special Ingot Irons and Low-Alloy Steels (Continued)

SRM		Type	(Other Forms)	Chemical Composition (Nominal Weight Percent) C	Mn	P	S	Si
*662	1262a	AISI 94B17 (Mod)	362,1096	0.163	1.05	0.044	0.037	0.40
*663	1263a	Cr-V (Mod)	363,1097	0.57	1.50	0.02_9	0.0055	0.74
*664	1264a	High Carbon (Mod)	364,1098	0.871	0.25_8	0.010	0.025	0.066
*665	1265a	Electrolytic Iron	365,1099	0.008	0.0057	0.002_5	0.0059	0.0080
	1269	Low Alloy (AISI 1526, Mod)		0.298	1.35	0.012	0.0061	0.189
	1270	Cr-Mo Low Alloy		0.077	0.626	0.0065	0.0065	0.247
	C1285	Low Alloy (A242 Mod)		0.058	0.332	0.072	0.020	0.36
	1286	Low Alloy (Hy 80)		0.196	0.152	0.008	0.017	0.130

SRM		Cu	Ni	Cr	V	Mo	W	Co	Ti
	1134	0.070	0.038	0.019		0.008			
	1135	0.056	0.050	0.022	<0.01	0.014			
	1136	0.014	0.270	0.014	0.012	0.002			
461		0.34	1.73	0.13	0.024	0.30	0.012	0.26	(0.01)
462		0.20	0.70	0.74	0.058	0.080	0.053	0.11	0.037
464		0.094	0.135	0.078	0.29_5	0.029	0.022	0.02_8	0.004
465		0.019	0.026	0.004	0.002	0.005	(0.001)	0.008	0.20
466		0.033	0.051	0.011	0.007	0.011	(0.006)	0.04_6	0.057
467		0.067	0.088	0.036	0.041	0.021	0.20	0.07_4	0.26
468		0.26	1.03	0.54	0.17	0.20	0.077	0.16	0.011
	1169b	(0.07)	(0.04)	(0.05)	(0.001)	(0.01)			
	C1221	0.041	0.067	0.049	(0.0007)	0.038		(0.010)	(0.0014)
	1222	0.097	0.51	0.48	0.005	0.18		(0.016)	(0.002)
	1224	0.072	0.054	0.071	0.002	0.013			
	1225		0.018	0.91	0.004	0.166			
	1226	0.125	5.42	0.467	0.0018	0.446	(0.005)	0.029	0.0021
	1227	0.006	0.007	0.019	0.002	0.003		0.003	(0.0008)
	1228	0.012	0.018	0.016	<0.001	0.009			
	1254	(0.07)	(0.04)	(0.02)		(0.008)			
*661	1261a	0.042	1.99	0.69	0.011	0.19	0.017	0.032	0.020
*662	1262a	0.51	0.60	0.30	0.04_1	0.07_0	0.21	0.30	0.084
*663	1263a	0.098	0.32	1.31	0.31	0.030	0.046	0.048	0.050
*664	1264a	0.250	0.142	0.06_6	0.10_6	0.49	0.10_2	0.15	0.23
*665	1265a	0.0058	0.041	0.007_2	0.0006	0.005	(0.0004)	0.007_0	0.0006
	1269	0.095	0.108	0.201	0.004	0.036	(0.001)	(0.014)	(0.009)
	1270	0.114	0.174	2.34	0.013	0.956	(0.003)	0.038	(0.003)
	C1285	0.37	1.17	0.80					
	1286	0.043	2.81	1.53					

Special Ingot Irons and Low-Alloy Steels (Continued)

SRM		As	Sn	Al (total)	B	Pb	Ag	Ge
	1134		0.003	0.329				
	1135		0.004	0.0028				
	1136							
461		0.028	0.022	0.005	0.000_2	(0.003)	(0.001_5)	(0.001_5)
462		0.046	0.066	0.02_3	0.000_5	0.006	(<0.0002)	(0.003_0)
464		0.018	0.043	0.005	0.005	0.020	(0.003)	(0.001_5)
465		0.010	0.001	0.19	0.000_1	(<0.0005)	(0.0002_5)	(0.003_5)
466		0.014	0.005	0.01_5	(0.000_2)	(0.001_3)	(0.0004_5)	(0.003_0)
467		0.14	0.10	0.16	(0.00_2)	0.000_6	(0.004_0)	(0.003_0)
468		0.008	0.009	0.04_2	0.009	(<0.0005)	(<0.0002)	(0.0001)
	1169b					0.193		
	C1221			0.111				
	1222			(0.038)				
	1224			0.060				
	1225							
	1226		(0.003)	0.054				
	1227			(0.028)				
	1228			0.061				
	1254		(0.003)	(0.33)				
*661	1261a	0.017	0.011	0.02_1	0.0005	0.00002_5	0.0004	[0.006]
*662	1262a	0.092	0.016	0.09_5	0.0025	0.0004_3	(0.001)	[0.002]
*663	1263a	0.010	(0.095)	0.24	0.0009_1	0.0022	(0.0037)	[0.010]
*664	1264a	0.05_2	[0.005]	(0.008)	0.011	0.024	(0.00002)	[0.003]
*665	1265a	(0.0002)	(0.0002)	(0.0007)	0.00013	0.00001_5	(0.000002)	(~0.0014)
	1269	(0.006)	(0.039)	0.016	(<0.001)	0.005	(0.0002)	
	1270	(0.02)	(0.02)	(0.005)	(0.0033)	(0.0016)	(0.0001)	
	C1285							
	1286							

Special Ingot Irons and Low-Alloy Steels (Continued)

SRM		O	N	H	Nb	Ta	Zr
	1134						
	1135						
	1136						
461		(0.02_0)	(0.00_6)		0.011	0.002	(<0.005)
462		(0.006)	(0.00_8)		0.096	0.036	0.063
464		(0.006)	(0.00_7)		0.037	0.069	0.010
465		(0.003)	(0.00_5)		(0.001)	0.001	(0.002)
466		(0.005)	(0.00_6)		0.005	0.002	(<0.005)
467		(0.004)	(0.00_4)		0.29	0.23	0.094
468		(0.004)	(0.00_6)		0.006	0.005	(<0.005)
	1169b						
	C1221						(0.0017)
	1222		(0.007)		(0.002)		
	1224						
	1225						
	1226				(0.005)		(0.010)
	1227						(0.0006)
	1228						
	1254						
*661	1261a	(0.0009)	(0.0037)	[<0.0005]	0.022	0.020	0.009
*662	1262a	(0.0011)	(0.0041)	[<0.0005]	0.30	0.21	0.20
*663	1263a	(0.0007)	(0.0041)	[<0.0005]	0.049	(0.053)	0.050
*664	1264a	[0.0017]	[0.003]	[<0.0005]	0.15_7	0.11	0.69
*665	1265a	(0.0063)	(~0.0011)	(~0.0001)		-(<0.00005)	-(<0.00001)
	1269	(0.006)	(0.009)		(0.0002)	(0.008)	(0.003)
	1270				(0.008)	(0.005)	(0.010)
	C1285						
	1286						

SRM		Sb	Bi	Ca	Mg	Te	Zn
*661	1261a	0.0042	0.0004	(<0.0001)	(0.0001)	0.006	(0.0001)
*662	1262a	0.012_0	(0.002)	(0.0002)	(0.0006)	(0.0005)	(0.0005)
*663	1263a	0.002	(0.0008)	(<0.0001)	(0.0005)	(0.0022)	(0.0004)
*664	1264a	(0.035)	(0.0009)	(<0.0001)	(0.0001)	[0.0002]	[0.001]
*665	1265a	-(<0.00005)	-(<0.00001)	-(<0.00001)	-(<0.00002)	-(<0.00001)	(<0.0001)

Special Ingot Irons and Low-Alloy Steels (Continued)

SRM		Au	Ce	Hf	La	Nd	Pr	Fe
*661	1261a	(<0.00005)	0.0013	[0.0002]	0.0004	0.0003	(0.00014)	(95.6)
*662	1262a	(<0.00005)	(0.0011)	[0.006]	0.0004	(0.0005)	(0.00012)	(95.3)
*663	1263a	0.0005	(0.0016)	[0.0015]	0.0006	(0.0007)	(0.00018)	(94.4)
*664	1264a	0.0001	(0.00025)	[0.005]	0.00007	(0.00012)	(0.00003)	(96.7)
*665	1265a	-(<0.000002)	-(<0.000005)	-(<0.00002)	-(<0.000005)	-(<0.000005)	-(<0.000005)	(99.9)

*SRM's 661, 662, 663, 664, and 665 are sold in a set only as SRM S668.
Values in parentheses are not certified, but are given for information only.
Brackets indicate approximate value from heat analysis.
Dash indicates "not detected." Value in parentheses following dash is the conservative "upper limit" of detection.

Stainless Steels

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

Groups I and II 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 are 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.

Group I

		Chemical Composition (Nominal Weight Percent)								
SRM	Type	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	(0.15)	0.14	9.4	18.5	0.064	0.12	(0.09)	0.12
444	Cr20.5-Ni10	4.62	(0.65)	0.24	10.1	20.5	0.12	0.23	(0.17)	0.22

SRM	Ti	Sn	Nb	Ta	B	Pb	Zr	Zn
442	0.002	0.0035	0.032	(0.0006)	0.0005	0.0017	(0.004)	(0.003)
443	0.003	0.006	0.056	(0.0008)	0.0012	0.0025		(0.005)
444	0.019	0.014	0.20	(0.004)	0.0033	0.0037	(0.11)	(0.004)

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

Group II

SRM			Type	Chemical Composition (Nominal Weight Percent)					
				Mn	Si	Cu	Ni	Cr	V
445			Cr13-Mo0.9 (Mod. AISI 410)	0.77	0.52	0.065	0.28	13.31	(0.05)
446			Cr18-Ni9 (Mod. AISI 321)	0.53	1.19	0.19	9.11	18.35	(0.03)
447			Cr24-Ni13 (Mod. AISI 309)	0.23	0.37	0.19	13.26	23.72	(0.03)
448			Cr9-Mo0.3 (Mod. AISI 403)	2.13	1.25	0.16	0.52	9.09	(0.02)
449	849	D849	Cr5.5-Ni6.5	1.63	0.68	0.21	6.62	5.48	(0.01)
450	850	D850	Cr3-Ni25		0.12	0.36	24.8	2.99	(0.006)

SRM			Mo	W	Ti	Sn	Nb	Ta
445			0.92	(0.42)	(0.03)		0.11	(0.002)
446			0.43	(0.04)	(0.34)	(0.02)	0.60	(0.030)
447			0.059	(0.06)	(0.02)		0.03	(0.002)
448			0.33	(0.14)	(0.23)	(0.05)	0.49	(0.026)
449	849	D849	0.15	(0.19)	(0.11)	(0.07)	0.31	(0.021)
450	850	D850		(0.21)	(0.05)	(0.09)	0.05	(0.002)

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

Group III

SRM	Type	Other Forms	Chemical Composition (Nominal Weight Percent)							
			C	Mn	P	S	Si	Cu	Ni	Cr
1151a	Cr22-Ni7—IN PREP									
C1151	Cr22-Ni7		0.039	2.50	0.017	0.038	0.38	0.418	7.29	22.70
1152a	Cr18-Ni10—IN PREP									
C1152	Cr18-Ni10		0.148	0.96	0.021	0.0064	0.80	0.102	10.88	17.81
1153a	Cr16-Ni8—IN PREP									
C1153	Cr16-Ni8		0.264	0.50	0.030	0.018	1.07	0.23	8.77	16.69
1154a	Cr19-Ni12—IN PREP									
C1154	Cr19-Ni12		0.086	1.42	0.06	0.053	0.50	0.40	12.92	19.06
1155	Cr18-Ni12-Mo2 (AISI 316)	160b	0.046	1.63	0.020	0.018	0.502	0.169	12.18	18.45
1170b	Selenium-Bearing		(0.052)	(0.738)	(0.129)	(0.013)	(0.654)	(0.199)	(8.89)	(17.42)
1171	Cr17-Ni11-Ti0.3	121d	0.067	1.8_0	0.018	0.01_3	0.54	0.121	11.2	17.4
1172	Cr17-Ni11-Nb0.6	123c	0.056	1.7_6	0.025	0.01_4	0.59	0.10_5	11.3_5	17.4_0
1267	AISI 446	367	0.093	0.315	0.018	0.015	0.58		0.29	24.14
C1287	AISI 310 Mod.		0.36	1.66	0.029	0.024	1.66	0.58	21.16	23.98
C1288	(A-743)		0.056	0.83	0.023	0.010	0.41	3.72	29.3	19.55
C1289	AISI 414 Mod.		0.014	0.35	0.017	0.021	0.156	0.205	4.13	12.12

Group III (Continued)

SRM	V	Mo	Co	Ti	As	Sn	Al	Nb	Ta	B	Pb	Zr
1151a												
C1151	0.037	0.80	0.032								0.0039	
1152a												
C1152	0.030	0.43	0.22								0.0047	
1153a												
C1153	0.18	0.24	0.127								0.0054	
1154a												
C1154	0.135	0.07	0.38								0.0178	
1155	0.047	2.38	0.101								0.001	
1170b	(0.058)	(0.248)	(0.096)									Se 0.23
1171		0.16_5	0.10	0.34								
1172		0.22	0.12					0.65	<0.001			
1267	0.08											N 0.17
C1287	0.09	0.46	0.31	0.050		N(0.034)	(0.06)	(0.07)	O(0.017)		0.008	(0.006)
C1288	0.086	2.83	0.10	0.012		N(0.028)	(0.0025)	(0.22)	O(0.029)	W(0.2)	0.0041	(0.002)
C1289	0.007	0.82	0.035	0.005		N(0.017)	(0.0016)	(0.10)	O(0.027)		0.0005	(0.001)

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

Specialty Steels

SRM's 1156, Maraging Steel, and 1158, High-Nickel Steel (Invar), are designed primarily for use in optical emission and x-ray spectrometric methods of analysis.

SRM 1156 derives its name from the formation of martensite on age hardening. Alloys of this type are used extensively in submarines, missiles, and aircraft.

SRM 1158 has good impact toughness down to −269 °C and has an extremely low coefficient of expansion between −253 and 203 °C. These properties make this material very useful for cryogenic application. SRM 1158 also serves as a "benchmark" for the production control of high-nickel (40Ni-60Fe) alloys.

		Chemical Composition (Nominal Weight Percent)					
SRM	Type	C	Mn	P	S	Si	Cu
1156	Maraging (Ni 19)	0.023	0.21	0.011	0.012	0.184	0.025
1158	High-Nickel (Ni 36)	0.025	0.468	0.004	0.005	0.194	0.039

SRM	Ni	Cr	Mo	Co	Ti	Al	Zr	B	Ca	V
1156	19.0	0.20	3.1	7.3	0.21	0.047	0.004	0.003	<0.001	
1158	36.03	0.062	0.010	0.008						0.001

High-Temperature Alloys

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.

SRM	Type	Chemical Composition (Nominal Weight Percent)					
		C	Mn	P	S	Si	Cu
1197	M308	(0.045)	(0.047)	(0.008)	(0.002)	(0.13)	
S1198	Incoloy 901 set	(0.048)	(0.49)	(0.006)	(0.002)	(0.38)	(0.012)
	Hastelloy X	(0.039)		(0.008)		(0.54)	
S1199	L 605 set	(0.14)	1.42	(0.005)		0.83	
	S 816	(0.40)	1.34	(0.015)		0.86	
1206-2	René-41	0.21_7	0.030	(0.004)	0.006	0.21_6	0.040
1207-1	Waspaloy(1)	0.043	0.34	0.005	0.009	0.47_2	0.026
1207-2	Waspaloy(2)	0.083	0.29_5	0.005	0.009	0.61_5	0.033
1208-1	Inco 718(1)	0.046	0.38_5	0.003	0.01_1	0.43_4	0.14_7
1208-2	Inco 718(2)	0.022	0.23_0	0.003	0.007	0.08_3	0.077
1244	Inconel 600	0.06	0.3	<0.01	<0.01	0.1	0.3
1245	Inconel 625	0.04	0.2	0.01	<0.01	0.4	0.4
1246	Incoloy 800	0.08	0.9	0.02	<0.01	0.1	0.5
1247	Incoloy 825	0.02	0.4	0.02	<0.01	0.3	1.6

SRM	Ni	Cr	Mo	Co	Ti	Al	Nb	Ta	Fe	W	B
1197	32.6	12.9	3.2_5	(0.07)	2.32	0.41	(<0.02)	Zr0.15	41.9	6.0_8	(0.0059)
S1198	40.1	12.9	6.0_8	0.70	2.59	0.24	(<0.02)	Zr(0.014)	36.2	(0.2)	(0.0064)
	45.7	20.7	9.1_8	0.56	(<0.01)		(<0.02)		23.2	(0.15)	
S1199	10.2	19.9	(<0.02)	51.6	(<0.01)		(<0.02)		0.6_5	15.4	
	20.0	19.9	4.0_0	42.0	(0.03)		3.1_8	1.08	3.19	3.8_6	
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_9			2.09		
1208-1	51.9	17.5	3.2_4	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		
1244	72.6	16	0.2	0.06	0.3	0.3	0.1		9		<0.01
1245	60	22	8.7	0.1	0.3	0.3	3.5		4		<0.01
1246	30	20	0.3	0.08	0.3	0.3	0.1		47		<0.01
1247	43	23	2.7	0.08	0.7	0.06	0.4		27		<0.01

Values in parentheses are not certifed, but are given for information only.

Tool Steels

SRM			Type	Chemical Composition (Nominal Weight Percent)							
				Mn	Si	Cu	Cr	V	Mo	W	Co
436			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)	0.48	0.53		7.79	3.04	1.50	2.8	2.9
438			Mo High Speed (AISI-SAE-M30)	0.20	0.17	0.17	4.66	1.17	8.26	1.7	4.9
439			Mo High Speed (AISI-SAE-M36)	0.18	0.21	0.12	2.72	1.50	4.61	5.7	7.8
440	840	D840	Special W High Speed (Cr2-W13-Co12)	0.15	0.14	0.059	2.12	2.11	0.070	13.0	11.8
441		D841	W High Speed (AISI-SAE-T1)	0.27	0.16	0.072	4.20	1.13	0.84	18.5	

SRM	Type	C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co
1157	Tool (AISI M2)	0.836	0.34	0.011	0.004	0.18	0.088	0.228	4.36	1.82	4.86	6.28	0.028

Robert Watters checks the alignment of the plasma flame image on the entrance mask of the inductively coupled plasma (ICP) spectrometer. A five-millimeter aperature is centered at the observation height of the plasma. This height is chosen to assure the best sensitivity for simultaneous multielement analysis using the ICP.

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 (usually <0.1 mm). These SRM's are finding increased use in calibration with instrumental methods of analysis.

			Chemical Composition (Nominal Weight Percent)							
SRM	Type	Wt/Unit (grams)	C	Mn	P	S	Si	Cu	Ni	O
57a	Refined Silicon	60	0.024	0.015	0.003	0.003	98.55	0.004	0.008	(~0.3)
58a	Ferrosilicon (73% Si)	75	0.014	0.16	0.009	<0.002	73.20	0.024	0.012	(0.20)
59a	Ferrosilicon (50% Si)	50	0.046	0.75	0.016	0.002	48.10	0.052	0.033	
195	Ferrosilicon (75% Si) Hi-Purity	75	0.034	0.17	0.02	<0.002	75.3	0.047	0.032	0.42
64c	Ferrochromium (HC)	100	4.68	0.16	0.020	0.067	1.22	0.005	0.43	
196	Ferrochromium (LC)	100	0.035	(0.282)	0.020	0.003	0.373			
71	Calcium Molybdate	60								
90	Ferrophosphorus	75			26.2					
340	Ferroniobium	100	0.061	1.70	0.036		4.39		Sn 0.063	
68c	Ferromanganese (HC)	100	6.72	80.04	0.19	0.008	0.225			
689	Ferrochromium Silicon	100	0.043	0.32	0.026	0.002	39.5	0.013	0.20	(0.06)

SRM	Cr	V	Mo	Ti	Al	Nb	Zr	Ca	Fe	B	As
57a	0.024	0.013	Pb<0.001	0.040	0.47		0.002	0.17	0.50	0.001	<0.001
58a	0.020	(0.002)	(0.01)	0.051	0.95	Co<0.01	0.002	0.30	25.23	0.0010	
59a	0.08				0.35			0.042	50.05	0.058	
195	0.047	(0.001)	(0.01)	0.037	0.046	Co<0.01	(<0.02)	0.053	23.6	0.001	(0.0024)
64c	68.00	0.15		0.02		Co0.051		N0.045	24.98		
196	70.83	(0.12)									
71			35.29	0.063					1.92		
90											
340				0.89		57.51	Ta3.73				
68c	0.074								12.3		0.021
689	36.4	0.09	Pb(0.004)	0.40	0.049	Co0.034	Bi(<0.003)	N(0.002)	23.2	0.0017	(0.009)

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

Cast Irons (Chip Form)

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 furnished in 150-g units (unless otherwise noted) in the form of chips usually sized between 0.7 to 1.2 mm. They are prepared by lathe cutting of chips with a multiple-tooth cutting tool from thin-wall cylindrical castings especially made for this purpose. SRM's 890, 891, and 892 are provided in the form of granules/powders. 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.

SRM	Type	Chemical Composition (Nominal Weight Percent)							
		C		Mn	P		S	Si	Cu
		Total	Graphitic			Grav	Comb		
3d	White (110 g)	2.54		0.40	0.025		0.052	1.31	0.043
4k	Cast	3.2_2	2.6_5	0.82_5	0.149		0.043	1.33	0.24_3
5L	Cast	2.60	1.98	0.68	0.2804		0.124	1.82	1.01
6g	Cast	2.85	2.01	1.05	0.557		0.124	1.05	0.502
7g	Cast (High Phosphorus)	2.69	2.59	0.612	0.794	0.061	0.060	2.41	0.128
82b	Cast (Ni-Cr)	2.85	2.37	0.745	0.025		0.007	2.10	0.038
107c	Cast (Ni-Cr-Mo)	2.99	1.98	0.480	0.079		0.059	1.21	0.205
115a	Cast (Cu-Ni-Cr)	2.62	1.96	1.00	0.086	0.064	0.065	2.13	5.52
122h	Cast (Car Wheel)	3.52	2.82	0.543	0.311		0.072	0.513	0.028
334	Gray Cast	2.83	(2.3)	(0.82)	(0.14)		0.043	(1.3)	(0.24)
338	White Cast	3.33		(0.76)	(0.054)		0.015	(1.82)	(0.27)
341	Ductile	1.81	1.23	0.92	0.024	0.007	0.007	2.44	0.152
342a	Nodular	1.86	1.38	0.274	0.019		0.006	2.73	0.135
365	Electrolytic Iron	0.0068		0.0056	0.0025		0.0055	0.0080	0.0058
890	High Alloy White Cast (HC0259+V)	2.91		0.62	0.025		0.015	0.67	0.055
891	High Alloy White Cast (Ni-Hard, Type I)	2.71		0.55	0.038		0.029	0.56	0.150
892	High Alloy White Cast (Ni-Hard, Type IV)	3.33		0.76	0.054		0.015	1.83	0.270

(Continued)

SRM	Ni	Cr	V	Mo	Co	Ti
3d	0.025	0.03	(0.002)	(0.007)		(0.003)
4k	0.042	0.116	0.024	0.040	Zn(<0.001)	(0.03)
5L	0.086	0.148	0.034	0.020		0.050
6g	0.135	0.370	0.056	0.035		0.059
7g	0.120	0.048	0.010	0.012		0.044
82b	1.22	0.333	0.027	0.002		0.027
107c	2.20	0.693	0.015	0.83		0.19
115a	14.49	1.98	0.014	0.050		0.020
122h	0.078	0.052	0.041	(0.003)		0.034
334	(0.04)	(0.12)	(0.025)	(0.040)		(0.03)
338	(5.5)	(10.2)	(0.04)		(0.32)	
341	20.32	1.98	0.012	0.010		0.018
342a	0.06	0.058		0.006		0.020
365	0.041	0.007_2	0.0006	0.0050	0.007_2	0.0006
890	0.397	32.4	0.45	0.018	(0.03)	
891	4.48	2.23	0.039	0.27	0.19	(0.01)
892	5.53	10.18	0.041	0.20	0.31	(0.02)

SRM	As	Sn	Al (total)	Mg	N	Fe
3d						
4k	(0.03)	(0.004)	(0.004)	Sb(<0.001)	(0.0016)	Pb(0.001)
5L					0.005	
6g	0.042				0.005	
7g	0.014				0.004	
82b						
107c						
115a						
122h						
334	(0.03)	(0.004)	(0.004)		(0.0017)	
338						
341				0.068		
342a				0.070		
365	(0.0002)	~(0.0002)	(0.0007)	Pb0.000019	0.001	99.90
890	(0.008)		(<0.01)		(0.089)	(61.8)
891	(0.004)	(<0.01)	(0.008)		(0.012)	(88.5)
892	(0.006)	(0.02)	(0.009)		(0.019)	(77.4)

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

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.

The "benchmark" concept was used in preparing three new white irons (1145, 1146, and 1150) with compositions tailored to provide low, nominal, and high values for elements normally specified in cast iron materials, as well as most malleable, ductile, and grey irons. A concentration range for a number of trace elements of interest was provided to enhance the utility of the standards. The planning, preparation, homogeneity testing, and analysis of these SRM's were done through a cooperative Industry-ASTM-NBS program.

These SRM's are chill-cast sections. Details of the preparation and intended use of the SRM's are given in NBS Miscellaneous Publication 260-1.

		Chemical Composition (Nominal Weight Percent)							
SRM	Type	C	Mn	P	S	Si	Cu	Ni	Cr
1138a	Cast Steel (No. 1)	0.11_8	0.35	0.035	0.056	0.25	0.09	0.10	0.13
1139a	Cast Steel (No. 2)	0.79_0	0.92	0.012	0.013	0.80	0.47	0.98	2.1_8
1143a	Blast Furnace (1)	4.08	0.29_6	0.16_4	0.067	1.60	0.13_8	0.11_6	0.16_3
1144a	Blast Furnace (2)	4.32	1.23	0.08_4	0.083	0.18_2	0.09_1	0.06_3	0.029
1145	White Cast Iron	2.85	0.040	0.24	0.21	0.29	0.52	0.59	0.67
1146	White Cast Iron	2.01	1.64	0.55	0.022	3.68	1.49	3.01	2.56
1150	White Cast Iron	3.48	0.81	0.063	0.070	1.24	0.092	0.074	0.95
C1173	Cast Steel 3	0.453	0.174	0.031	0.092	1.38	0.204	4.04	2.63
1173	Ni-Cr-Mo-V Steel	0.423	0.19	0.033	0.092	1.28	0.204	4.06	2.70

SRM	V	Mo	Ti	As	Al	Te	Co
1138a	0.020	0.05	(0.0012)	(<0.005)	(0.067)		
1139a	0.26	0.51	(0.004)	(<0.005)	(0.13)		
1143a	0.018	(0.004)	0.08_7	(0.003)	(0.008)	0.01_6	
1144a	0.02_5	(0.007)	0.32	(0.004)	(<0.005)	0.02_2	
1145	0.11	0.48	0.017				0.058
1146	0.20	1.51	0.20				0.13
1150	0.034	0.074	0.045				0.014
C1173	0.42	1.46	0.037	(0.02)	(0.005)		0.064
1173	0.42	1.50	(0.015)			Nb(0.045)	0.076

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

These SRM's provide materials of known composition for checking the performance of chemical methods of analysis and in calibration with instrumental methods. The aluminum-, magnesium-, and zinc-base alloys are furnished as approximately 0.4 to 1.4 mm 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
85b	Wrought (Chip)	75	0.61	0.18	3.99	0.084	0.211	0.006
87a	Al-Si (Chip)	75	0.26	6.24	0.30	0.57	0.11	<0.01
855	Casting Alloy 356 (fine millings)	30	0.057	7.17	0.13	0.015	0.013	
856	Casting Alloy 380 (fine millings)	30	0.35	9.21	3.51	0.37	0.055	
858	Alloy 6011 (modified) (fine millings)	35	0.48	0.79	0.84	0.0006	0.0011	0.0030
859	Alloy 7075 (fine millings)	35	0.078	0.17	1.59	0.063	0.176	0.0082

SRM	Ti	Sn	Ga	Fe	Pb	Mg	Zn	Be
85b	0.022		0.019	0.24	0.021	1.49	0.030	
87a	0.18	0.05	0.02	0.61	0.10	0.37	0.16	
855	0.15	0.010		0.16	0.015	0.37	0.083	
856	0.068	0.10		0.92	0.10	0.061	0.96	
858	0.042			0.078		1.01	1.04	<0.0001
859	0.041					2.45	5.46	0.0026

Copper-Base Alloys

SRM's 871, 872, 874, 875, 879, and 880 are fine granules produced by a water atomization technique for use primarily in checking chemical methods of analysis. The homogeneity of these materials is exceptionally high, and for certain alloys such as SRM 872, Phosphor Bronze (CDA 544), it is the only form that can readily be prepared to exhibit acceptable homogeneity. For many alloys (for which homogeneity requirements can be met) both granules (or chips) for chemical analysis and solids for optical emission and x-ray fluorescence methods, are desirable.

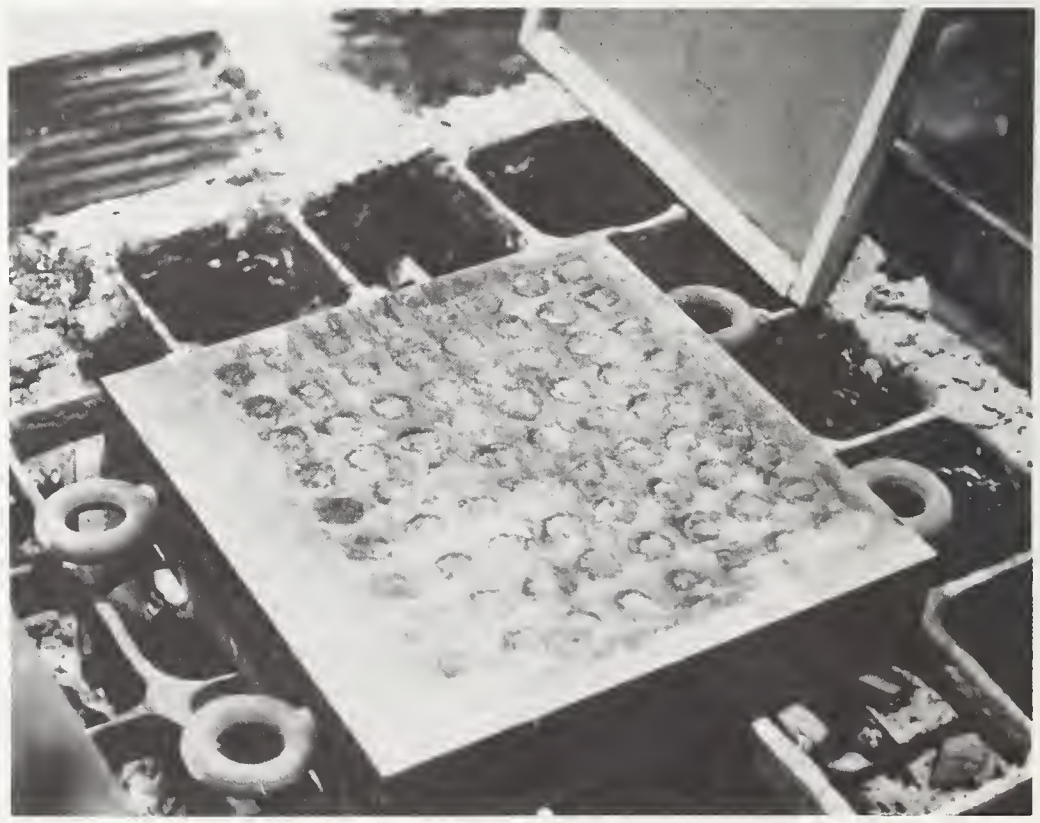
SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent) Cu	Ni	Fe	Zn	Pb
37e	Brass, Sheet	150	69.61	0.53	0.004	27.85	1.00
158a	Bronze, Silicon	150	90.93	0.001	1.23	2.08	0.097
871	Bronze, Phosphor (CDA 521)	100	91.68		<0.001	0.025	0.010
872	Bronze, Phosphor (CDA 544)	100	87.36		0.003	4.0	4.13
874	Cupro-Nickel, 10% (CDA 706)"High-Purity"	100	88.49	10.18	1.22	0.002	<0.0005
875	Cupro-Nickel, 10% (CDA 706)"Doped"	100	87.83	10.42	1.45	0.11	0.0092
879	Nickel Silver (CDA 762)	100	57.75	12.11	0.0020	30.04	0.002
880	Nickel Silver (CDA 770)	100	54.51	18.13	0.004	27.3	0.002
1034	*Unalloyed Copper	rod	(99.96)	(0.6)	(2.0)	(<11)	(0.5)
1035	**Leaded-Tin Bronze Alloy	50	(78.5)	(0.75)	(0.001)	(0.25)	(13.5)

Copper Base Alloys (Continued)

SRM	Mn	Sb	Sn	Cr	P	Ag	Si	Al	Te	Cd	Se
37e			1.00								
158a	1.11		0.96		0.026		3.03	0.46			
871			8.14		0.082						
872			4.16		0.26						
874	0.0020	<0.001	0.007		0.002		(0.0006)			<0.0002	0.00015
875	<0.0007	<0.001	0.009		0.0020		(0.0008)			0.0022	0.0004
879	<0.001										
880	<0.001										
1034	(<0.1)	(0.2)	(<0.2)	(0.3)		(8.1)	(<2)	(<2)	(0.5)	(<1)	(3.3)
1035			(6.8)								

SRM	Bi	O	Co	C	Au	H	S	As	Mg	Ti
37e										
158a										
871										
872										
874	<0.0002	(0.06)		(0.0023)		(0.0016)	(0.0011)	(<0.0006)	(0.0002)	(0.0001)
875	0.003	(0.14)		(0.0035)		(0.004)	(0.0011)	(0.0010)	(0.0010)	(<0.0002)
879										
880										
1034	(0.2)	(363)	(0.02)		(<0.05)		2.8	(0.2)	(<1)	
1035		0.64					22.3		P 0.004	

Values in parentheses are not certified, but are given for information only.
*Values for SRM 1034 are ppm by weight.
**Sulfur value for SRM 1035 is ppm by weight.



One casting provides a grid of seventy-two rough disks for SRM C1146a, White Cast Iron.

Copper "Benchmark"

The copper "benchmark" standards were prepared in a cooperative Industry-ASTM-NBS program and were designed primarily for use in calibration with optical emission methods of analysis. They should also serve in the development of other methods of trace analysis. Twelve different compositions are issued as 25 SRM's. Cu "0" and Cu XI are issued in chip form only. Cu IV is available only in rod form 6.6 mm in diameter and 103 mm long. Cu I, II, III, V, VI, and VII are available both as chips and as rods 6.35 mm in diameter and 103 mm long. Cu VIII, IX, and X are issued as chill-cast and unidirectionally solidified blocks 32 mm square and 19 mm thick. Cu VIII-Cu X are phosphorized copper containing a nominal concentration range from about 10 to 500 ppm for the same 20 trace elements contained in the other copper "benchmark" SRM's, plus five to eight additional elements. These SRM's are also applicable for x-ray fluorescence methods of analysis and, because of deliberate additions of gold and silver (in ratios of 1 to 4), for calibration of fire assay equipment.

			Chemical Composition (Nominal Parts Per Million by Weight)							
SRM	Type	Wt/Unit (grams)	Sb	As	Bi	Cr	Co	Fe	Pb	Mn
393	Unalloyed—Cu "0"	50	0.25	0.41	<0.1	<0.5	0.02	<1	0.039	<0.01
394	Unalloyed—Cu I	50	4.5	2.6	0.35	2.0	0.5	147	26.5	3.7
395	Unalloyed—Cu II	50	8.0	1.6	0.50	6.0	0.3	96	3.25	5.3
396	Unalloyed—Cu III	50	<1	<0.2	0.07	4.3	0.4	143	0.41	7.5
398	Unalloyed—Cu V	50	7.5	25	2.0	(0.3)	2.8	11.4	9.9	(0.3)
399	Unalloyed—Cu VI	50	30	47	10.5	(0.5)	0.5	20.0	114	(0.3)
400	Unalloyed—Cu VII	50	102	140	24.5	(0.5)	0.6	41	128	(0.2)
454	Unalloyed—Cu XI	35	24	46	19		(4)	(50)	66	

SRM	Cu(Wt%)	Ni	Se	Ag	S	Te	Sn	Zn	Al	Cd	Au	Mg
393	99.998	0.05	<0.05	0.10	<1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1
394	99.908	11.7	2.1	50.5	15	0.57	70	405	(<2)	(0.5)	(0.07)	(<1)
395	99.944	5.4	0.60	12.2	13	0.32	1.5	12.2	(<2)	(0.4)	(0.13)	(<1)
396	99.955	4.2	0.50	3.30	9.5	<0.1	0.8	5.0	(<2)	(0.6)	(<0.05)	(<1)
398	99.98	7.0	14	20.1	(11)	11	4.8	24	(<2)	(22)	(0.1)	(<1)
399	99.79	506	(~95)	116.8	(10)	(~50)	(~90)	45	(<2)	(<1)	(4)	(<1)
400	99.70	603	(~250)	181	(9)	(~155)	(~200)	114	(<2)	(<1)	(10)	(<1)
454	99.84	(150)	400	286			2.2	7			7.5	

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

SRM	O	Si	Be	B	Ca	Li	Pa	P	Ti	Zr
393		<0.5	<0.01	<0.01	<0.05	<0.01	<0.05	<0.05	<0.5	<0.5
394	(230)	(<2)								
395	(435)	(<2)								
396	(270)	(<2)								
398	(30)	(<2)								
399	(950)	(<2)								
400	(1025)	(<2)								
454										

Values in parentheses are not certifed, but are given for information only.

Lead-Base Alloys

SRM	Type	Wt/Unit (grams)	(Other Forms)	Chemical Composition (Nominal Weight Percent) Cu	Ni	As	Sn	Sb	Bi	Fe
53e	Bearing Metal (84Pb-10Sb-6Sn)	150	1132	0.054	0.003	0.057	5.84	10.26	0.052	<0.001
127b	Solder (40Sn-60Pb)	150	1131	0.011	0.012	0.01	39.3	0.43	0.06	Ag0.01

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
349	Ni57-Cr20	150	0.08	0.43	0.002	<0.01	0.29	0.006	57.15	19.50
882	Ni66-Cu31-A13	150	0.006	0.0007		0.0014	0.006	31.02	65.25	
864	Inconel, 600		0.06	0.3	<0.01	<0.01	0.1	0.3	72.6	16
865	Inconel, 625		0.04	0.2	0.01	<0.01	0.4	0.4	60	22
866	Incoloy, 800		0.08	0.9	0.02	<0.01	0.1	0.5	30	20
867	Incoloy, 825		0.02	0.4	0.02	<0.01	0.3	1.6	43	23

SRM	V	Mo	W	Co	Ti	Al	B	Fe	Nb	Ta	Zr
349	0.081	4.04	<0.01	13.95	3.05	1.23	0.0046	0.13	<0.01	<0.01	0.081
882					0.57	2.85		0.009			
864		0.2		0.06	0.3	0.3	<0.01	9	0.1		
865		8.7		0.1	0.3	0.3	<0.01	4	3.5		
866		0.3		0.08	0.3	0.3	<0.01	47	0.1		
867		2.7		0.08	0.7	0.06	<0.01	27	0.4		

Trace Elements in Nickel-Base Superalloy

The Gas Turbine Panel of the ASTM-ASME-MPG Joint Committee, through recommendation of its Task Force on Trace Elements in Superalloys, prepared a set of three "Tracealloy" materials, which have the same common matrix. These were given to NBS for "definitive analysis" of: Pb, Bi, Se, Te, and Tl; trace elements that vary over the concentration range of interest. These SRM's 897, 898, and 899 are in the form of fine particles.

		Nominal Trace Composition (Parts Per Million by Weight)				
SRM	Type	Pb	Bi	Se	Te	Tl
897	"Tracealloy" A	11.7	(0.5)	9.1	1.05	0.51
898	"Tracealloy" B	2.5	(1.0)	2.00	0.54	2.75
899	"Tracealloy" C	3.9	(0.3)	9.5	5.9	0.252

	Approximate Base Composition (Weight Percent)											
	C	Cr	Co	Ni	W	Nb	Al	Ti	B	Zr	Ta	Hf
897	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)
898	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)
899	(0.12)	(12.0)	(8.5)	(Bal)	(1.75)	(0.9)	(2.0)	(2.0)	(0.010)	(0.10)	(1.75)	(1.2)

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

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-DC 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.

			Chemical Composition (Nominal Weight Percent)								
SRM	Type	Wt/Unit (grams)	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	0.095	0.11	0.018	0.003	0.55	0.009	0.004	0.079	0.020
673	Oxide 3	25	0.0037	0.006	0.002	0.0003	0.016	0.003	0.001	0.029	0.003

	Nominal Trace Composition (Parts Per Million by Weight)											
SRM	Pb	Se	Bi	As	Sn	Sb	Cd	Ga	Ag	Te	Tl	Zn
671	16	2.0	0.07	(59)	(2.7)	(0.4)	(0.7)	(0.8)	(0.5)	(<0.2)	(<0.1)	(160)
672	38	0.40	0.3	(74)	(4)	(0.5)	(1.7)	(0.4)	(0.3)	(<0.2)	(<0.1)	(140)
673	3.5	0.2	0.06	(0.4)	(<0.5)	(<0.05)	(0.05)	(<0.1)	(<0.1)	(0.4)	(<0.1)	(1.7)

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

Selenium

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	<1	<0.5	<1	N.D.	<0.3	N.D.	<2	<1

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

N.D.=Not detected at limits of detection of <0.3 ppm.

Tin-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)								
			Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	Bearing Metal	170	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	Cu	Mo	Sn	Al	Fe	N
173b	6Al-4V (IN PREP)									
176	5Al-2.5Sn	100	0.015	0.0008	0.003	0.0003	2.47	5.16	0.070	0.010
650	Unalloyed (IN PREP)									
651	Unalloyed (IN PREP)									
652	Unalloyed (IN PREP)									

Zinc-Base Alloys

SRM	Type	Wt/Unit (grams)	Chemical Composition (Nominal Weight Percent)								
			Mn	Cu	Ni	Sn	Al	Cd	Fe	Pb	Ag
94c	Die Casting Alloy	150	0.014	1.01	0.006	0.006	4.13	0.002	0.018	0.006	Mg 0.042
728	Zinc	450		0.00057		(0.000002)		0.000115	0.00027	0.00111	0.00011

Zirconium-Base Alloys

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.

Aluminum "Benchmark"

Aluminum "benchmark" standards were prepared in a cooperative Industry-ASTM-NBS program. These SRM's are intended for use primarily in optical emission and x-ray spectrometric methods of analysis. These materials are also available in the form of chips, for checking chemical methods of analysis (see page 39).

SRM	Type	Size	Chemical Composition (Nominal Weight Percent)								
			Si	Fe	Cu	Mn	Cr	Ni	Zn	Mg	Be
1258	Alloy 6011	35mm D X 19mm thick	0.78	0.079	0.84	0.48	0.0011	0.0006	1.03	0.98	<0.0001
1259	Alloy 7075	35mm D X 19mm thick	0.18	0.205	1.60	0.079	0.173	0.063	5.44	2.48	0.0025

Copper-Base Alloys

A number of copper-base alloy SRM's were prepared to provide for analytical control by rapid instrumental methods in the copper industry. These SRM's are for calibration of optical emission and x-ray spectroscopic equipment. Eight groups were prepared in two forms: chill-cast (with "C" prefix) for the producer (blocks, 31 mm square, 19 mm thick), and wrought for the consumer (disks, 31 mm in diameter and 19 mm thick). Both forms have nearly identical chemical compositions. Consequently, when the supply of one form is exhausted, the other is the recommended replacement. For each of the eight principal copper-base alloys, three SRM's were prepared to comprise a "nominal-composition," and both a low- and high-composition standard. To make the cartridge-brass SRM's more widely applicable, a number of trace elements were purposely added and certified. The beryllium copper SRM's are representative of the nominal chemical composition of three Copper and Brass Research Association (CABRA) alloy designations.

SRM		Type	Chemical Composition (Nominal Weight Percent)							
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1102		Cartridge Brass C	72.85	27.10	0.020	0.011	0.006	0.005	0.007	0.005
1103		Free-Cutting Brass A	59.27	35.72	3.73	0.26	0.88	0.15		
	C1104	Free-Cutting Brass B	61.33	35.31	2.77	0.088	0.43	0.070		
1106	C1106	Naval Brass A	59.08	40.08	0.032	0.004	0.74	0.025		
1107	C1107	Naval Brass B	61.21	37.34	0.18	0.037	1.04	0.098		
1108	C1108	Naval Brass C	64.95	34.42	0.063	0.050	0.39	0.033		
1109	C1109	Red Brass A	82.2	17.43	0.075	0.053	0.10			
1110	C1110	Red Brass B	84.59	15.20	0.033	0.033	0.051	0.053		
1111	C1111	Red Brass C	87.14	12.81	0.013	0.010	0.019	0.022		
1112	C1112	Gilding Metal A	93.38	6.30	0.057	0.070	0.12	0.100		
1113	C1113	Gilding Metal B	95.03	4.80	0.026	0.043	0.064	0.057		
1114	C1114	Gilding Metal C	96.45	3.47	0.012	0.017	0.027	0.021		
1115	C1115	Commercial Bronze A	87.96	11.73	0.013	0.13	0.10	0.074		
1116	C1116	Commercial Bronze B	90.37	9.44	0.042	0.046	0.044	0.048		
1117	C1117	Commercial Bronze C	93.01	6.87	0.069	0.014	0.021	0.020		
1118	C1118	Aluminum Brass A	75.1	21.9	0.025	0.065			2.80	0.010
1119	C1119	Aluminum Brass B	77.1	20.4	0.050	0.030			2.14	0.050
1122	C1122	Beryllium Copper CA-170	97.45	(0.01)	(0.003)	0.16	(0.01)	(0.01)	0.17	
	C1123	Beryllium Copper CA-175	97.10	0.01	(0.001)	0.04	(0.01)	(0.01)	0.02	
1275		Cupro-Nickel (CDA 706)	88.2	0.085	0.006	1.46	0.008	9.76		0.0005
1276		Cupro-Nickel (CDA 715)	67.8	0.038	0.004	0.56	0.023	30.5		0.0004

Copper Base Alloys (Continued)

SRM		As	Be	Bi	Cd	Mn	P	Si	Ag
1102		0.004	0.00003	0.0005	0.0045	0.0045	0.0048	(0.002)	0.0010
1103							0.003		
	C1104						0.005		
1106	C1106					0.005			
1107	C1107								
1108	C1108					0.025			
1109	C1109						0.006		
1110	C1110								
1111	C1111								
1112	C1112						0.009		
1113	C1113						0.008		
1114	C1114						0.009		
1115	C1115						0.005		
1116	C1116						0.008		
1117	C1117						0.002		
1118	C1118	0.007					0.13	0.0021	
1119	C1119	0.040					0.070	0.0015	
1122	C1122		1.75			(0.004)	(0.004)	0.17	(0.005)
	C1123		0.46			(0.002)	(0.002)	0.03	(0.009)
1275		(0.001)		(<0.001)	0.0003	0.42	0.005	(0.001)	(0.004)
1276		(<0.001)		(<0,0001)	0.0002	1.01	0.006	(0.001)	(0.004)

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

SRM		Te	Co	Cr	Se	Mg	B	S	Ti
1102		0.0003							
	C1103								
	C1104								
1106	C1106								
1107	C1107								
1108	C1108								
1109	C1109								
1110	C1110								
1111	C1111								
1112	C1112								
1113	C1113								
1114	C1114								
1115	C1115								
1116	C1116								
1117	C1117								
1118	C1118								
1119	C1119								
1122	C1122		0.220	(0.002)					
	C1123		2.35	(0.001)					
1275		(0.0002)	0.024	(0.0002)	0.0004	0.003	(0.0009)	(0.008)	(0.0002)
1276		(0.0002)	0.045	(0.0002)	0.0005	0.12	(0.0001)	(0.008)	(0.0002)

Copper"Benchmark"

The copper "benchmark" standards were prepared in a cooperative Industry-ASTM-NBS program and were designed primarily for use in calibration with optical emission methods of analysis. They should also serve in the development of other new or improved trace methods of analysis. Twelve different compositions are issued as 25 SRM's Cu "O" and Cu XI is issued in chip form only. Cu IV is available only in rod form 6.60 mm in diameter and 103 mm long. Cu I, II, III, V, VI, and VII are available both as chips and as rods 6.35 mm in diameter and 103 mm long. Cu VIII, IX, and X are issued as chill-cast and unidirectionally solidified blocks 32 mm square and 19 mm thick, Cu VIII-Cu X are phosphorized copper containing a nominal concentration range from about 10 to 500 ppm for the same 20 trace elements contained in the other copper "benchmark" SRM's, plus five to eight additional elements. These SRM's are also applicable for x-ray fluorescence methods of analysis and, because of deliberate additions of gold and silver (in ratios of 1 to 4), for calibration of fire assay equipment.

			Chemical Composition (Nominal Parts Per Million)				
SRM	Type	Form	Cu(Wt%)	Sb	As	Bi	Fe
494	Unalloyed—Cu I	rod	99.91	4.5	2.6	0.35	(~155)
495	Unalloyed—Cu II	rod	99.94	8.0	1.6	0.50	(~100)
496	Unalloyed—Cu III	rod	99.95	<1	<0.2	0.07	(~150)
457	Unalloyed—Cu IV	rod	99.96	0.2	0.2	0.2	2.0
498	Unalloyed—Cu V	rod	99.98	7.4	25	2.0	11
499	Unalloyed—Cu VI	rod	99.79	30	47	10.5	21
500	Unalloyed—Cu VII	rod	99.70	100	140	25	42
C1251	Unalloyed—Cu VIII	disk	99.96	12.6	(8)	(3)	(10)
C1252	Unalloyed—Cu IX	disk	99.89	42	124	20	(40)
C1253	Unalloyed—Cu X	disk	99.42	(132)	244	70	(300)

SRM	Pb	Mn	Ni	Se	Ag	Te	Sn	Zn
494	26.5	3.7	11.7	2.1	50	0.6	70	400
495	3.2	5.3	5.4	0.6	12.2	0.3	1.5	12
496	0.4	7.5	4.2	0.5	3.3	<0.1	0.8	5.0
457	0.5	<0.1	0.6	3.3	8.1	0.5	<0.2	<11
498	10	(0.3)	7.0	14	20.1	11	5	25
499	114	(0.3)	504	(~90)	114	(~50)	(~90)	41
500	128	(0.2)	603	(~250)	176	(~155)	(~200)	111
C1251	7.5	(7)	22	8.6	81.4	(12)	(15)	8.3
C1252	60	(28)	128	46	166.6	(44)	(124)	60
C1253	244	[~300]	(500)	140	503	(193)	(489)	368

Copper "Benchmark" (Continued)

SRM	Al	Cd	Cr	Co	Au	Mg	O	S
494	(<2)	(0.5)	2.0	0.5	(0.07)	(<1)	(230)	15
495	(<2)	(0.4)	6.0	0.3	(0.13)	(<1)	(435)	13
496	(<2)	(0.6)	4.3	0.4	(<0.05)	(<1)	(270)	9
457	(<2)	(<1)	(0.3)	(0.2)	(<0.05)	(<1)	(360)	(4)
498	(<2)	(22)	(0.3)	2.7	(0.1)	(<1)	(30)	(11)
499	(<2)	(<1)	(0.5)	0.5	(4)	(<1)	(950)	(10)
500	(<2)	(<1)	(0.5)	0.5	(10)	(<1)	(1025)	(9)
C1251	[~5]	[~3]	2.8	8.8	15.0	(10)	[~120]	(22)
C1252	[~40]	[~15]	7.4	90	34.9	(20)	[~150]	(29)
C1253	[~160]	[~60]	(187)	(510)	74.4	(80)	[~85]	(50)

Values in parentheses are not certified, but are given for information only.
Figures in brackets are qualitative estimates only.

Lead-Base Alloys

SRM 31.4 mm D×19 mm thick	Type	Other Forms	Chemical Composition (Nominal Weight Percent)							
			Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
1131	Solder Pb60-Sn40	127b	0.011	0.012	0.01	39.3	0.43	0.06	0.01	
1132	Bearing Metal	53e	0.054	0.003	0.057	5.84	10.2	0.052		<0.001

Nickel-Base Alloys

SRM 31 mm D×19 mm thick	Type	Chemical Composition (Nominal Weight Percent)										
		C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Co	Fe
1159	Ni48, balance Fe	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	0.019	0.550	0.003	0.001	0.37	0.021	80.3	0.05	4.35	0.054	14.3

Titanium-Base Alloys

SRM 31 mm D×19 mm thick	Type	Chemical Composition (Nominal Weight Percent) Mn	Cr	Fe	Mo	Al	V
641	8Mn (A)	6.68					
642	8Mn (B)	9.08					
643	8Mn (C)	11.68					
644	2Cr-2Fe-2Mo (A)		1.03	1.36	3.61		
645	2Cr-2Fe-2Mo (B)		1.96	2.07	2.38		
646	2Cr-2Fe-2Mo (C)		3.43	2.14	1.11		
654a*	6Al-4V (B)	(<0.1)	(0.20)	(0.20)	(<0.05)	6.3_4	3.9_5

*31 mm D×6.4 mm thick.
Values in parentheses are not certified, but are given for information only.

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 52.

SRM	Type	Chemical Composition (Nominal Weight Percent) Cu	Al	Mg	Fe	Pb	Cd	Sn	Cr
625	Zinc-base A-ASTM AG 40A	0.034	3.06	0.070	0.036	0.0014	0.0007	0.0006	0.0128
626	Zinc-base B-ASTM AG 40A	0.056	3.56	0.020	0.103	0.0022	0.0016	0.0012	0.0395
627	Zinc-base C-ASTM AG 40A	0.132	3.88	0.030	0.023	0.0082	0.0051	0.0042	0.0038
628	Zinc-base D-ASTM AC 41A	0.611	4.59	0.0094	0.066	0.0045	0.0040	0.0017	0.0087
629	Zinc-base E-ASTM AC 41A	1.50	5.15	0.094	0.017	0.0135	0.0155	0.012	0.008
630	Zinc-base F-ASTM AC 41A	0.976	4.30	0.030	0.023	0.0083	0.0048	0.0040	0.0031
631	Zinc spelter (modified)	0.0013	0.50	(<0.001)	0.005	(0.001)	0.0002	0.0001	0.0001

SRM	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
625	0.031	0.0184	0.017					
626	0.048	0.047	0.042					
627	0.014	0.0029	0.021					
628	0.0091	0.030	0.008					
629	0.0017	0.0075	0.078					
630	0.0106	0.0027	0.022					
631	0.00015	(<0.0005)	(0.002)	0.0023	(0.002)	<0.001	(<0.0005)	(0.0002)

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

Zirconium-Base Alloys

SRM 31 mm D×9.5 mm thick	Type	Hf	C	Chemical Composition (Nominal Weight Percent) Cr	Cu	Fe	Mn	Mo	Ni	N	Si	Ti	W
1234	Unalloyed Zirconium A	46	(80)	(55)	(<10)	(240)	(10)	(2)	(20)	(14)	(40)	(20)	(25)
1235	Unalloyed Zirconium B	95	(170)	(60)	(80)	(850)	(25)	(40)	(65)	(32)	(95)	(90)	(50)
1236	Unalloyed Zirconium C	198	(280)	(250)	(250)	(1700)	(45)	(100)	(140)	(69)	(205)	(185)	(140)
1237	Zircaloy D	31	(100)	(1510)	(<10)	(1650)	(10)	(<10)	(40)	(19)	(35)	(30)	(25)
1238	Zircalloy E	178	(310)	(580)	(60)	(2500)	(60)	(120)	(100)	(72)	(170)	(100)	(95)
1239	Zircalloy F	77	(170)	(1055)	(130)	(2300)	(50)	(45)	(45)	(42)	(95)	(40)	(45)

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

Gases in Metals

Certified for Hydrogen, Oxygen, and Nitrogen

The SRM's are used in the determination of hydrogen, oxygen and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods. SRM's 1095 to 1099 were prepared from the same melt as the "1200" series, (1261a–1265a), see page 26.

SRM	Type	Form	Oxygen (ppm)	Hydrogen (ppm)	Nitrogen (ppm)
352b	Unalloyed titanium for hydrogen	Platelets		50	
354	Unalloyed titanium for hydrogen	IN PREP			
355	Unalloyed titanium	Rod	3031		
357	Unalloyed Zirconium	Wire	(1200)	19	49
358	Unalloyed Zirconium	Wire	(1100)	107	28
1086	Unalloyed Titanium	Chips	(1350)	116	
1087	Unalloyed Titanium	Chips	(840)	57.5	
1088	Unalloyed Titanium	Chips	(1450)	88.5	
1090	Ingot iron	Rod	491		(60)
1091	Stainless steel (AISI 431)	Rod	131		(945)
1092	Vacuum-melted steel	Rod	28		(4)
1093	Valve steel	Rod	60		(4807)
1094	Maraging steel	Rod	4.5		(71)
*1095	AISI 4340 steel	Rod	9		(37)
*1096	AISI 94B17 (Mod)steel	Rod	10.7		40.4
*1097	Cr-V (Mod)steel	Rod	6.6		(41)
*1098	High Carbon (Mod)steel	Rod	10		32
*1099	Electrolytic iron	Rod	61		(13)
1089	Set of 5: 1095, 1096, 1097, 1098, and 1099	Rods			

*Sold in sets as SRM 1089.
Values in parentheses are not certified, but are given for information only.

High-Purity Metals

High-purity metal SRM's are available for purposes of determining impurity elements in high-purity metal materials. They are intended to serve as benchmark standards in the calibration of methods and equipment. They are also expected to be valuable to the development of new or improved methods and techniques for increasing the sensitivity of detection for trace elements in various materials.

The Certificate of Analysis supplied with each SRM gives information on its chemical composition and the values obtained by cooperating laboratories.

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

Platinum is available in wire form both as a high-purity material and as 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 semi-circular bar segments.

SRM 769 is a set of five aluminum rods that have residual resistivity ratios, $\rho(273\ K)/\rho(4\ K)$, ranging from 130 to 11,000. This ratio can be a sensitive indicator of the purity of metals.

SRM	Type	Unit Size	Chemical Compositions (Nominal Parts Per Million by Weight)				
			Cu	Ni	Sn	Pb	Sr
685W*	High-Purity Gold (Wire)	1.4 mm D×102 mm long	0.01				
685R*	High-Purity Gold (Rod)	5.9 mm D×25 mm long	0.1				
680aL1	High-Purity Platinum (Wire)	0.51 mm D×102 mm long	0.1	<1		<1	<0.1
680aL2	High-Purity Platinum (Wire)	0.51 mm D×1.0 m long	0.1	<1		<1	<0.1
681L1	Doped-Platinum (Wire)	0.51 mm D×102 mm long	5.1	0.5		12	11
681L2	Doped-Platinum (Wire)	0.51 mm D×1.0 m long	5.1	0.5		12	11
682*	High-Purity Zinc	Semicircular segments 57 mm D ×19 mm long	0.042		(0.02)		
683*	Zinc Metal	Semicircular segments 57 mm D	5.9		(0.02)	11.1	
769	Electrical Residual Resistivity Ratio	6.4 mm D×55 mm long					

SRM	Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Ti
685W*	[0.1]		0.007	0.3	[2]						
685R*	[0.1]		0.007	0.2	[<2]						
680aL1	<0.1	<1		1.3	4	0.2	<1	<0.2	<0.01		
680aL2	<0.1	<1		1.3	4	0.2	<1	<0.2	0.01		
681L1	2.0	12		5	7	6	9	9	11		
681L2	2.0	12		5	7	6	9	9	11		
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.
Values in parentheses are not certified, but are given for information only.
Values in brackets are subject to greater error since only one method of analysis was employed.

Microanalytical

These SRM's provide a highly homogeneous material at microscopic spatial resolution. They are intended primarily for use in calibration of quantitative electron probe, secondary ion mass spectrometry, spark sources, mass spectrometry, and laser probe microanalytical techniques.

Mineral Glasses for Microanalysis

SRM 470 consists of two mineral glasses that have the following approximate compositions. Details of the measurements on these glasses are in NBS Special Publication 260-74.

	Composition (Nominal Weight Percent)				
Glass	SiO_2	FeO	MgO	CaO	Al_2O_3
K-411	55	15	15	15	
K-412	45	10	20	15	10

Glasses for Microchemical Analysis

Each SRM, 1871 through 1875, consists of three glasses, two with and one without low-concentration constituents. The major constituents of the glasses indicated below were selected so that the average atomic numbers would be different.

SRM	1871	1872	1873	1874	1875
Composition (Nominal Weight Percent)					
PbO	71	59			
SiO_2	29		49		
GeO_2		41			
BaO			47		
ZnO			4		
B_2O_3				75	
AI_2O_3				20	
Li_2O				5	
P_2O_5					80
MgO					9

Cartridge Brass

Cartridge Brass, SRM 478, consists of two specimens: a chill-cast cube with a polished chill-cast face and a wrought right circular cylinder. Both the cube and the cylinder are homogeneous at micrometer levels of spatial resolution for both copper and zinc. Details of the homogeneity testing are in NBS Special Publications 260-10 and 260-65.

Fe-Cr-Ni Alloy

The Fe-Cr-Ni alloy, SRM 479a, is a wafer 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. See NBS Special Publication 260-70 for details of the testing.

Tungsten-20% Molybdenum

The tungsten-20% molybdenum alloy, SRM 480, is a wafer with a core of tungsten-20% molybdenum wire embedded in pure molybdenum onto which pure tungsten has been deposited by electroplating to provide a composite structure. Details on homogeneity characterization are given in NBS Special Publications 260-16 and 260-65.

Gold-Silver

Six color-coded wires comprise 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 percent. See NBS Special Publications 260-28 and 260-65.

Gold-Copper

Six color-coded wires comprise SRM 482, which is similar to the gold-silver set. In both sets special precautions were taken to achieve homogeneity on a microscopic scale. See NBS Special Publications 260-28 and 260-65.

Iron-3.22% Silicon

The iron-3.22% silicon alloy SRM 483, is a platelet characterized for chemical homogeneity of iron and silicon at the micrometer level of spatial resoltion. It is satisfactory for use as a homogeneous material for electron probe microanalysis. See NBS Special Publications 260-22 and 260-65.

		Chemical Composition (Nominal Weight Percent)							
SRM	Type	Au	Cu	Ag	W	Mo	Si	Fe (by difference)	Zn
478	Cartridge Brass (Cu–27% Zn)		72.8_5						27.1_0
479a	Fe-Cr-Ni Alloy				Cr18.1	Ni10.9		71.0	
480	Tungsten-22% Mo Alloy				78.5	21.5			
481	Au 100 A	100.00							
	Au–20% Ag B	80.5		19.96					
	Au–40% Ag C	60.5		39.92					
	Au–60% Ag D	40.03		59.93					
	Au–80% Ag E	22.43		77.58					
	Ag 100 F			100.00					
482	Au 100 A	100.00							
	Au–20% Cu B	80.15	19.83						
	Au–40% Cu C	60.36	39.64						
	Au–60% Cu D	40.10	59.92						
	Au–80% Cu E	20.12	79.85						
	Cu 100 F		100.00						
483	Iron-3.22% Silicon						3.22	96.7–96.8	

SRM	Unit Size
470, 1871–1875	Rods: 1×1×15 mm
478	Cube: 6×6×6 mm; Rod: 6 mm D, 6 mm long
479a	Plate: 4.6 mm D, 1 mm thick
480	Rod: 1 mm D, 1 mm long
481 and 482	Wire: 0.5 mm D, 50 mm long
483	Plate: 3 mm×3 mm×0.28 mm thick

Primary, Working, and Secondary 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
17c	Sucrose	60	Polarimetric Value	([a])
40h	Sodium Oxalate	60	Reductometric Value	99.972
41b	Dextrose (D-glucose)	70	Reductometric Value	([b])
83d	Arsenic Trioxide	60	Reductometric Value	99.9926
84j	Acid Potassium Phthalate	60	Acidimetric Value	99.996
136d	Potassium Dichromate	60	Oxidimetric Value	99.9931
350a	Benzoic Acid	30	Acidimetric Value	99.9958
723a	Tris(hydroxymethyl)aminomethane	50	Basimetric Value	99.9703
949f	Plutonium Metal	0.5	Assay	99.99
950b	Uranium Oxide (U_3O_8)	25	Uranium Oxide Standard Value	99.968
951	Boric Acid	100	Acidimetric and Boron Isotopic Value	100.00
960	Uranium Metal	26	Assay	99.975
985	Potassium Chloride	1	Assay and Isotopic	99.9
987	Strontium Carbonate	1	Assay and Isotopic	99.98
999	Potassium Chloride	60	Assay Standard for:	
			Potassium	99.98
			Chloride	99.99

[a] Sucrose=Moisture <0.01 percent, Reducing Substance <0.02 percent, Ash 0.001 percent.
[b] Dextrose=Moisture 0.07 percent, Ash 0.002 percent.

Microchemical

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 Microanalytical Standards, page 53.

SRM	Type	Wt/Unit (grams)	Elements Certified
140b	Benzoic Acid	2	C,H (IN PREP)
141c	Acetanilide	2	N,C,H
142	Anisic Acid	2	Methoxyl (CH_3O—)
143c	Cystine	2	S,C,H,N
148	Nicotinic Acid	2	N,C,H

(Continued)

2141	Urea	2	N
2142	o-Bromobenzoic Acid	2	Br
2143	p-Fluorobenzoic Acid	2	F
2144	m-Chlorobenzoic Acid	2	Cl

Clinical Laboratory

These SRM's are intended for use in calibrating apparatus and validating analytical methods 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 930D and 931c, see Spectrophotometric Filters, page 96.)

SRM	Type	Associated NBS Publications	Purity %	Wt/Unit
900	Antiepilepsy Drug Level Assay (phenytoin, ethosuximide, phenobarbital, and primidone		4 drugs/3 levels	Set of 4 vials
909	Human Serum		#	Set of 6 vials
910	Sodium Pyruvate		98.7	25 g
911a	Cholesterol		99.8	2 g
912a	Urea		99.9	25 g
913	Uric Acid		99.7	10 g
914	Creatinine		99.8	10 g
915	Calcium Carbonate	SP 260-36	99.9	20 g
916	Bilirubin		99.0	100 mg
917	D-Glucose		99.9	25 g
918	Potassium Chloride	SP 260-63	99.9	30 g
919	Sodium Chloride	SP 260-60	99.9	30 g
920	D-Mannitol		99.8	50 g
921	Cortisol		98.9	1 g
922	Tris(hydroxymethyl) aminomethane		99.9	25 g
923	Tris(hydroxymethyl) aminomethane HCl		99.7	35 g
924	Lithium Carbonate	SP 260-70	100.0	30 g
925	VMA (4-hydroxy-3-methodymandelic acid)		99.4	1 g
926	Bovine Serum Albumin (Powder)		**	5 g
927	Bovine Serum Albumin (7% Solution)		**	10 vials, 2.15 mL ea.
928	Lead Nitrate		100.00	30 g
929	Magnesium Gluconate		100.1	5 g
930D	Glass Filters for Spectrophotometry	SP 260-51	+	Set of 3
931c	Liquid Filters for Spectrophotometry		+	Set of 12 vials

(Continued)

SRM	Type	Associated NBS Publications	Purity %	Wt/Unit
932	Quartz Cuvette for Spectrophotometry	SP 260-32	+	1 each
934	Clinical Laboratory Thermometer	SP 260-48	††	1 each
935	Crystalline Potassium Dichromate (UV Absorbance)Standard	SP 260-54	(99.972)***	15 g
936	Quinine Sulfate Dihydrate (Fluorescence)	SP 260-64	(98.2)***	1 g
937	Iron Metal		99.90	50 g
938	4-Nitrophenol, Clinical		99.75	15 g
998	Angiotensin I (Human)		94.1	500 μg
1590	Stabilized Wine		18.57% by volume at 20 °C	Set of 10 vials
1595	Tripalmitin		99.5	2 g
1599	Anticonvulsant Drug Level Assay (valproic acid and carbamazepine)		2 drugs/ 3 levels	Set of 4 vials
1968	Gallium Melting Point 29.7723 °C	SP 481		1 each
1969	Rubidium Melting Point 38 °C		IN PREP	1 each
1970	Succinonitrile Freezing Point 58 °C		IN PREP	1 each

+ Certified for optical properties (see p. 00).
†† Individually calibrated at 0, 25, 30 and 37 °C. For further information regarding calibration services, call 301-921-2805.
** Conforms to NCCLS specification ACC-1.
*** Apparent purity, certified for optical properties.
# Electrolytes, selected organics.

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 trace constituents.

SRM	1549	1566	1567	1568	1569	1572	1573	1575	1577a
Type	Non-fat Powdered Milk	Oyster Tissue	Wheat Flour	Rice Flour	Brewers Yeast	Citrus Leaves	Tomato Leaves	Pine Needles	Bovine Liver
Unit Size	IN PREP	30 g	80 g	80 g	50 g	70 g	70 g	70 g	50 g
ELEMENT									
Aluminum						92	(0.12%)	545	(2)
Antimony						(0.04)		(0.2)	(0.003)
Arsenic		13.4	(0.006)	0.41		3.1	0.27	0.21	0.047
Barium						21			
Beryllium									
Bismuth									
Boron							(30)		
Bromine		(55)	(9)	(1)		(8.2)	(26)	(9)	(9)
Cadmium		3.5	0.032	0.029		0.03	(3)	(<0.5)	0.44
Calcium		0.15%	0.019%	0.014%		3.15%	3.00%	0.41%	120

(Continued)

SRM	1549	1566	1567	1568	1569	1572	1573	1575	1577a
Type	Non-fat Powdered Milk	Oyster Tissue	Wheat Flour	Rice Flour	Brewers Yeast	Citrus Leaves	Tomato Leaves	Pine Needles	Bovine Liver
Unit Size	IN PREP	30 g	80 g	80 g	50 g	70 g	70 g	70 g	50 g
Cerium						(0.28)	(1.6)	(0.4)	
Cesium						(0.098)			
Chlorine		(1.0%)				(414)			0.28%
Chromium		0.69			2.12	0.8	4.5	2.6	
Cobalt		(0.4)		0.02		(0.02)	(0.6)	(0.1)	0.21
Copper		63.0	2.0	2.2		16.5	11	3.0	158
Europium						(0.01)	(0.04)	(0.006)	
Fluorine		(5.2)							
Gallium									
Iodine		(2.8)				1.84			
Iron		195	18.3	8.7		90	690	200	194
Lathanum						(0.19)	(0.9)	(0.2)	
Lead		0.48	0.020	0.045		13.3	6.3	10.8	0.135
Lithium									
Magnesium		0.128%				0.58%	(0.7%)		600
Manganese		17.5	8.5	20.1		23	238	675	9.9
Mercury		0.057	0.001	0.0060		0.08	(0.1)	0.15	0.004
Molybdenum		(⩽0.2)	(0.4)	(1.6)		0.17			3.5
Nickel		1.3	(0.18)	(0.16)		0.6		(3.5)	
Nitrogen						(2.86%)	(5.0%)	(1.2%)	(10.7%)
Phosphorus		(0.81%)				0.13%	0.34%	0.12%	1.11%
Potassium		0.969%	0.136%	0.112%		1.82%	4.46%	0.37%	0.996%
Rubidium		4.45	(1)	(7)		4.84	16.5	11.7	12.5
Samarium						(0.052)			
Scandium						(0.01)	(0.13)	(0.03)	
Selenium		2.1	1.1	0.4		(0.025)			0.71
Silver		0.89							0.04
Sodium		0.51%	8.0	6.0		160			0.243%
Strontium		10.36				100	44.9	4.8	0.138
Sulfur		(0.76%)				0.407%			0.78%
Tellurium			(⩽0.002)	(⩽0.002)		(0.02)			
Thallium		(⩽0.005)				(⩽0.01)	(0.05)	(0.05)	(0.003)
Thorium		(0.1)					0.17	0.037	
Tin						(0.24)			
Uranium		0.116				(⩽0.15)	0.061	0.020	0.00071
Vanadium		2.3							
Zinc		852	10.6	19.4		29	62		123

Content in μg/g, or where noted in weight percent.
Values in parentheses are not certified, but are given for information on

Analyzed Gases

These SRM's are intended for use in the calibration of apparatus used for the measurement of various components in gas mixtures, and in some cases for particular atmospheric pollutants. Each SRM in accurately certified and is intended primarily for use in monitoring and correcting long-term drifts in instruments used. Each gas is contained in an aluminum cylinder, 870 liters at STP. All cylinders conform to the appropriate DOT specifications.

SRM	Type	Certified Component	Nominal Concentration	
1658a	Methane in Air	CH_4	1	μmole/mole (ppm)
1659a	Methane in Air	CH_4	10	μmole/mole (ppm)
1660a	Methane-Propane in Air	CH_4	4	μmole/mole (ppm)
		C_3H_8	1	μmole/mole (ppm)
1661a	Sulfur Dioxide in Nitrogen	SO_2	500	μmole/mole (ppm)
1662a	Sulfur Dioxide in Nitrogen	SO_2	1000	μmole/mole (ppm)
1663a	Sulfur Dioxide in Nitrogen	SO_2	1500	μmole/mole (ppm)
1664a	Sulfur Dioxide in Nitrogen	SO_2	2500	μmole/mole (ppm)
1665b	Propane in Air	C_3H_8	3	μmole/mole (ppm)
1666b	Propane in Air	C_3H_8	10	μmole/mole (ppm)
1667b	Propane in Air	C_3H_8	50	μmole/mole (ppm)
1668b	Propane in Air	C_3H_8	100	μmole/mole (ppm)
1669b	Propane in Air	C_3H_8	500	μmole/mole (ppm)
1670	Carbon Dioxide in Air	CO_2	0.033	mole percent
1671	Carbon Dioxide in Air	CO_2	0.034	mole percent
1672	Carbon Dioxide in Air	CO_2	0.035	mole percent
1674b	Carbon Dioxide in Nitrogen	CO_2	7.0	mole percent
1675b	Carbon Dioxide in Nitrogen	CO_2	14.0	mole percent
1677c	Carbon Monoxide in Nitrogen	CO	10	ppm
1678c	Carbon Monoxide in Nitrogen	CO	50	ppm
1679c	Carbon Monoxide in Nitrogen	CO	100	ppm
1680b	Carbon Monoxide in Nitrogen	CO	500	ppm
1681b	Carbon Monoxide in Nitrogen	CO	1000	ppm
1683a	Nitric Oxide in Nitrogen	NO	50	ppm
1684a	Nitric Oxide in Nitrogen	NO	100	ppm
1685b	Nitric Oxide in Nitrogen	NO	250	ppm
1686b	Nitric Oxide in Nitrogen	NO	500	ppm
1687b	Nitric Oxide in Nitrogen	NO	1000	ppm
1693	Sulfur Dioxide in Nitrogen	SO_2	50	ppm
1694	Sulfur Dioxide in Nitrogen	SO_2	100	ppm
1696	Sulfur Dioxide in Nitrogen	SO_2	3500	ppm
1805	Benzene in Nitrogen	C_6H_6	0.25	ppm
1806	Benzene in Nitrogen	C_6H_6	10	ppm
1808	Tetrachloroethylene in Nitrogen—IN PREP	C_2Cl_4	0.25	ppm

Analyzed Gases (Continued)

SRM	Type	Certified Component	Nominal Concentration	
2612a	Carbon Monoxide in Air	CO	10	μmole/mole (ppm)
2613a	Carbon Monoxide in Air	CO	20	μmole/mole (ppm)
2614a	Carbon Monoxide in Air	CO	45	μmole/mole (ppm)
2619a	Carbon Dioxide in Nitrogen	CO_2	0.5	mole percent
2620a	Carbon Dioxide in Nitrogen	CO_2	1.0	mole percent
2621a	Carbon Dioxide in Nitrogen	CO_2	1.5	mole percent
2622a	Carbon Dioxide in Nitrogen	CO_2	2.0	mole percent
2623a	Carbon Dioxide in Nitrogen	CO_2	2.5	mole percent
2624a	Carbon Dioxide in Nitrogen	CO_2	3.0	mole percent
2625a	Carbon Dioxide in Nitrogen	CO_2	3.5	mole percent
2626a	Carbon Dioxide in Nitrogen	CO_2	4.0	mole percent
2627	Nitric Oxide in Nitrogen	NO	5	μmole/mole (ppm)
2628	Nitric Oxide in Nitrogen	NO	10	μmole/mole (ppm)
2629	Nitric Oxide in Nitrogen	NO	20	μmole/mole (ppm)
2630	Nitric Oxide in Nitrogen	NO	1500	μmole/mole (ppm)
2631	Nitric Oxide in Nitrogen	NO	3000	μmole/mole (ppm)
2632	Carbon Dioxide in Nitrogen	CO_2	300	ppm
2633	Carbon Dioxide in Nitrogen	CO_2	400	ppm
2634	Carbon Dioxide in Nitrogen	CO_2	800	ppm
2635	Carbon Monoxide in Nitrogen	CO	25	ppm
2636	Carbon Monoxide in Nitrogen	CO	250	ppm
2637	Carbon Monoxide in Nitrogen	CO	2500	ppm
2638	Carbon Monoxide in Nitrogen	CO	5000	ppm
2639	Carbon Monoxide in Nitrogen	CO	1	mole percent
2640	Carbon Monoxide in Nitrogen	CO	2	mole percent
2641	Carbon Monoxide in Nitrogen	CO	4	mole percent
2642	Carbon Monoxide in Nitrogen	CO	8	mole percent
2643	Propane in Nitrogen	C_3H_8	100	ppm
2644	Propane in Nitrogen	C_3H_8	250	ppm
2645	Propane in Nitrogen	C_3H_8	500	ppm
2646	Propane in Nitrogen	C_3H_8	1000	ppm
2647	Propane in Nitrogen	C_3H_8	2500	ppm
2648	Propane in Nitrogen	C_3H_8	5000	ppm
2649	Propane in Nitrogen	C_3H_8	1	mole percent
2650	Propane in Nitrogen	C_3H_8	2	mole percent
2651	Propane in Nitrogen and Oxygen	C_3H_8/O_2	0.01/5.0	mole percent
2652	Propane in Nitrogen and Oxygen	C_3H_8/O_2	0.01/10.0	mole percent
2653	Nitrogen Dioxide in Air	NO_2	250	ppm
2654	Nitrogen Dioxide in Air	NO_2	500	ppm
2655	Nitrogen Dioxide in Air	NO_2	1000	ppm
2656	Nitrogen Dioxide in Air	NO_2	2500	ppm
2657	Oxygen in Nitrogen	O_2	2	mole percent
2658	Oxygen in Nitrogen	O_2	10	mole percent
2659	Oxygen in Nitrogen	O_2	21	mole percent

Permeation Tubes

These SRM's are intended for use in calibrating air pollution monitoring apparatus, and may be used to verify air pollution analytical methods and procedures. Each tube is individually certified.

Sulfur Dioxide

Sulfur dioxide permeation tubes are available in three lengths—2, 5, and 10 centimeters. The permeation rates are certified over the temperature range of 20 to 30 °C. The data in the following table are provided as a guide in the selection of the desired SRM. The concentrations generated by typical tubes (0.28 micrograms per centimeter per minute) at 25 °C and at flow rates of 1.5 and 10 liters per minute are shown below.

SRM	Type	Tube Length (cm)	Permeation Rate (μg/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	0.107	0.0535
1627	Sulfur Dioxide Permeation Tube	2	0.56	0.214	0.0428	0.0214

Nitrogen Dioxide

Nitrogen dioxide permeation device (SRM 1629a) is calibrated at 25.0 °C only. The temperature coefficient given with each tube provides the means to calculate permeation rates at other temperatures near 25 °C. The permeation rates for these tubes are between 0.5 and 1.5 mg/min at 25 °C. A tube with a rate of 1.0 μg/min, in an air-flow of one liter per minute at 25 °C, will produce a concentration of 0.5 ppm of NO_2. (Cannot be shipped by air.)

Benzene

SRM 1911 is a permeation device that is certified for its permeation rate in micrograms of benzene at 25 °C. It is intended for use in the preparation of gases of known benzene content and for the standardization of air pollution an related chemical analyses. A typical permeation rate for this SRM is 35 μg/minute at 25 °C. (Cannot be shipped by air.)

Analyzed Liquids and Solids

These SRM's are intended for use in the analysis of materials for constituents of interest in health or environmental problems. See also: Clinical SRM's page 56, and Industrial Hygiene SRM's page 66

Single Element

SRM	Type	Unit Size	Certified Element		
			Lead	Sulfur	Mercury
1579	Powdered Lead Base Paint	35 g	11.87%		
1618	Vanadium and Nickel in Residual Fuel Oil	IN PREP			
1619	Sulfur in Residual Fuel Oil	100 mL		0.719%	
1620a	Sulfur in Residual Fuel Oil	100 mL		4.504%	
1621b	Sulfur in Residual Fuel Oil	100 mL		0.950%	
1622b	Sulfur in Residual Fuel Oil	100 mL		1.982%	
1623a	Sulfur in Residual Fuel Oil	100 mL		0.240%	
1624a	Sulfur in Distillate Fuel Oil	100 mL		0.141%	
1630	Trace Mercury in Coal	50 g			0.13 μg/g

Single Element (Continued)

SRM	Type	Unit Size	Certified Element		
			Lead	Sulfur	Mercury
1636a	Lead in Reference Fuel	3 vials each	0.03, 0.05 0.07, 2.0 g/gal		
1637a	Lead in Reference Fuel	4 vials each	0.03, 0.05, 0.07 g/gal		
1638a	Lead in Reference Fuel	12 vials each	2.0 g/gal		
1641b	Mercury in Water (μg/mL)	6×20 mL			1.52 μg/mL
1642b	Mercury in Water (ng/mL)	950 mL			1.49 ng/mL
8505	Vanadium in Crude Oil	IN PREP			

Concentrations in weight percent, or as otherwise noted.

Multi-Element

SRM	1632a	1633a	1634a	1635	1643a	1645	1646	1648
Type	Trace Elements in Coal (Bituminous)	Trace Elements in Coal Fly Ash	Trace Elements in Fuel Oil	Trace Elements in Coal (Sub-bituminous)	Trace Elements in Water (ng/g)	River Sediment	Estuarine Sediment	Urban Particulate
Unit Size	75 g	75 g	100 mL	75 g	950 mL	70 g	75 g	2 g
ELEMENT								
Aluminum	(3.1%)	(14%)		(0.32%)		2.26%	6.25%	3.42%
Antimony	(0.6)	(7)		(0.14)		(51)	(0.4)	(45)
Arsenic	9.3	145	(0.12)	0.42	76 ng/g	(66)	11.6	115
Barium		(0.15%)			46 ng/g			(737)
Beryllium		(12)	(0.006)		19 ng/g		(1.5)	
Bromine			(<1)					(500)
Cadmium	0.17	1.0	(0.002)	0.03	10 ng/g	10.2	0.36	75
Calcium	0.23%	1.11%	(16)			(2.9)	0.83%	
Cerium	(30)	(180)		(3.6)			(80)	(55)
Cesium	(2.4)	(11)					(3.7)	(3)
Chlorine			(31)					(0.45%)
Chromium	34.4	196	(0.7)	2.5	17 ng/g	2.96%	76	403
Cobalt	(6.8)	(46)	(0.3)	(0.65)	19 ng/g	10.1	10.5	(18)
Copper	16.5	118		3.6	18 ng/g	109	18	609
Europium	(0.5)	(4)		(0.06)			(1.5)	(0.8)
Fluorine						(0.09%)		
Gallium	(8.5)	(58)		(1.05)				
Germanium							(1.4)	
Hafnium	(1.6)	(7.6)		(0.29)				(4.4)
Indium								(1.0)

Multi-Element (Continued)

SRM	1632a	1633a	1634a	1635	1643a	1645	1646	1648
Type	Trace Elements in Coal (Bituminous)	Trace Elements in Coal Fly Ash	Trace Elements in Fuel Oil	Trace Elements in Coal (Sub-bituminous)	Trace Elements in Water (ng/g)	River Sediment	Estuarine Sediment	Urban Particulate
Unit Size	75 g	75 g	100 mL	75 g	950 mL	70 g	75 g	2 g
Iodine								(20)
Iron	1.11%	9.4%	(31)	0.239%	88 ng/g	11.3%	3.35%	3.91%
Lanthanum						(9)		(42)
Lead	12.4	72.4	2.8	1.9	27 ng/g	714	28.2	0.655%
Lithium							(49)	
Magnesium	(0.1%)	0.455%				0.74%	1.09%	(0.8%)
Manganese	28	(190)	0.19	21.4	31 ng/g	785	375	(860)
Mercury	0.13	0.16	(<0.002)		(<0.2) ng/g	1.1	0.063	
Molybdenum		(29)	(0.12)		95 ng/g		(2)	
Nickel	19.4	127	29	1.74	55 ng/g	45.8	32	82
Phosphorus							0.054%	
Potassium	0.42%	1.88%				1.26%	(1.4%)	1.05%
Rubidium	(31)	131					(87)	(52)
Samarium								(4.4)
Scandium	(6.3)	(40)		(0.63)		(2)	(10.8)	(7)
Selenium	2.6	10.3	0.15	0.9	11 ng/g	(1.5)	(0.6)	27
Silicon		22.8%					(31%)	
Silver					2.8 ng/g			(6)
Sodium	840	0.17%	87	(0.24%)		0.54%	(2%)	0.425%
Strontium		830			239 ng/g			
Sulfur	1.58%		2.85%	0.33%		(1.1)	(0.96%)	(5%)
Tellurium							(0.5)	
Thallium		5.7				1.44	(0.5)	
Thorium	4.5	24.7		0.62		1.62	(10)	(7.4)
Titanium	(0.18%)	(0.8%)		(0.02%)			(0.51%)	(0.40%)
Tungsten								(4.8)
Uranium	1.28	10.2		0.24		1.11		5.5
Vanadium	44	(300)	56	5.2	53 ng/g	23.5	94	140
Zinc	28	220	2.7	4.7	68 ng/g	0.172%	138	0.476%

Values in parentheses are not certified, but are given for information only.
Concentrations in microgram per gram, or where noted weight percent.
All concentrations for SRM 1643a are nanogram per gram.

Organic Constituents

SRM	Type	Unit of Issue
1580	Shale Oil	Set of 5, 2 mL/ampoule
1582	Petroleum Crude Oil	IN PREP
1644	Polynuclear Aromatic Hydrocarbon Generator Columns	Set of 3 columns
1647	Priority Pollutant Polynuclear Aromatic Hydrocarbons (in Acetonitrile)	Set of 5, 1.2 mL/ampoule
1649	Urban Dust/Organics	10 grams
1639	Halocarbons (in methanol) for Water Analysis	Set of 5, 1.5 mL/ampoule

SRM's Certified for Organic Constituents

SRM	1580	1644	1647	1649
Constituents	(μg/g)	(μg/kg)	(μg/mL)	(μg/g)
Anthracene		16.6 to 60.1	3.29	
Benz[a]anthracene		3.38 to 12.8	5.03	2.6
Benzo[a]pyrene	21	0.59 to 2.26	5.3	2.9
Benzo[e]pyrene	18			
Fluoranthene	54		10.1	7.1
o-Cresol	385			
Phenol	407			
Perylene	3.4			
Pyrene	104		9.84	
2,6-Dimethylphenol	175			
Benzo[f]quinoline (5,6-Benzoquinoline)	16			
Naphthalene			22.5	
Acenaphthylene			19.1	
Acenaphthene			21.0	
Fluorene			4.92	
Phenanthrene			5.06	
Chrysene			4.68	
Benzo[b]fluoranthene			5.11	
Benzo[k]fluoranthene			5.02	
Benzo[ghi]perylene			4.01	4.5
Dibenz[a,h]anthracene			3.68	
Indeno[1,2,3-cd]pyrene			4.06	3.3

[1] Range of aqueous concentrations certified also in nmol/L.

Organic Constituents (Continued)

SRM 1639—Certified Concentration of Halocarbons at 23±3 °C.

Compound	Concentration, ng/μL
Chloroform	6235
Chlorodibromomethane	124.6
Bromodichloromethane	389.9
Bromoform	86.5
Carbon tetrachloride	157.0
Trichloroethylene	85.8
Tetrachloroethylene	40.6

Polychlorinated Biphenyls in Oil

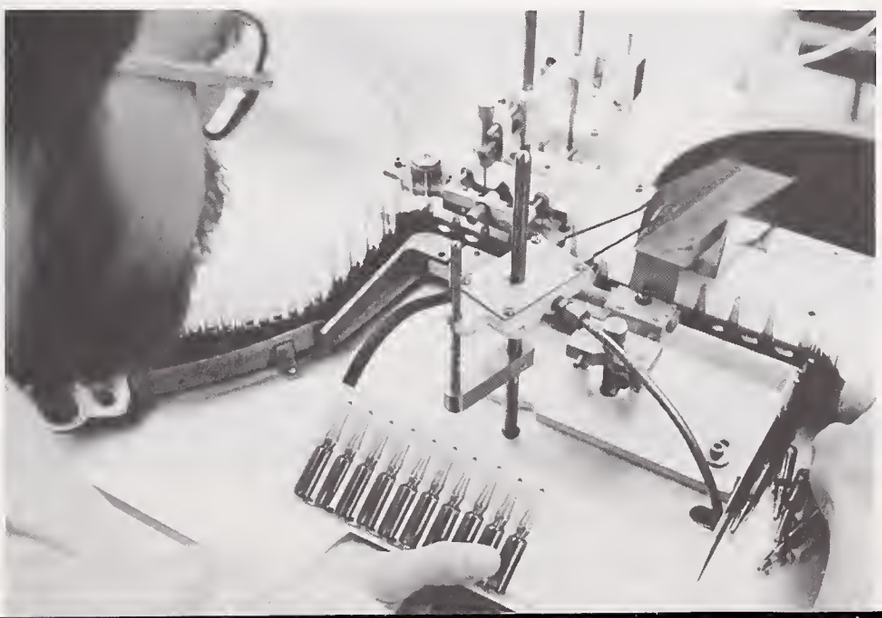
SRM 1581 was developed primarily for use in calibrating instrumentation and validating methodology for the determination of polychlorinated biphenyls (PCB's) in oil. It lists the certified concentrations of Aroclor 1242 and Aroclor 1260 present individually at 100 μg/g (ppm) in motor oil and transformer oil. Additional base oil is supplied to dilute the four certified concentrates.

Sulfur in Coal

This series (SRM's 2682–2685) is intended primarily for use as analytical standards for determination of total sulfur in coal, ash content, and calorific value (BTU/lb). SRM's 2682–2685 are four different coals that were crushed and ground to pass a 60-mesh sieve. Each coal SRM has been analyzed for approximately 30 elements, including carbon, hydrogen and nitrogen. Semi-quantitative data are provided for information.

SRM	Coal Type	Sulfur Wt.%	Furnace Ash Wt.%	HHV2 $MJ \cdot Kg^{-1}$	HHV2 $(BTU \cdot lb^{-1})$
2682	Sub-bituminous	0.47	6.37	27.45	(11800)
2683	Bituminous	1.85	6.85	32.70	(14060)
2684	Bituminous	3.00	11.09	29.68	(12760)
2685	Bituminous	4.62	16.53	28.15	(12100)

NOTE: The calorific values ($MJ \cdot Kg^{-1}$) may decrease upon the aging or normal oxidation of the coals. NBS will continue to monitor these calorific values and report any substantive change to the purchaser.



Dale Friend operates equipment used to seal ampules containing various clinical, biological, and environmental SRM's.

Industrial Hygiene

These SRM's were developed especially for clinical and industrial hygiene analyses, and are the outgrowth of an NBS program to develop standardization and reference materials for toxicology research and for monitoring human exposure to selected toxic elements in the workplace environment.

Freeze-Dried Urine

SRM's 2670, 2671a, and 2672a consists of freeze-dried urine in 30 mL serum bottles. The freeze-dried urine SRM's are to be reconstituted by the addition of 20 mL of pure water to each bottle. Each unit contains a set of four bottles, two bottles each at normal and elevated levels.

SRM	Matrix	Constituent Certified or Determined
2670	Freeze-Dried Urine	Arsenic, Cadmium, Calcium, Chloride, Copper, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Sodium, Zinc
2671a	Freeze-Dried Urine	Fluoride
2672a	Freeze-Dried Urine	Mercury

Materials on Filter Media

These SRM's consist of potentially hazardous materials deposited on filters to be used to determine the levels of these materials in industrial atmosphere.

SRM	Type	Unit Size	Material Certified	Quantity Certified (μg/filter) I	II	III	IV
2673	Sulfate and Nitrate	2 filters at	Sulfate	503	2002	6939	2
	on Filter Media	each level	Nitrate	100	1002	2513	2
2674	Lead on Filter Media	2 filters at each level	Lead	100	303	1505	1.4
2675	Beryllium on Filter Media	Set of 3	Beryllium	0.052	0.25	1.0	
2676b	Metals on Filter Media	Set of 12	Cadmium	0.99	2.49	10.14	(<0.01)
			Lead	7.55	14.9	30.4	(<0.04)
			Manganese	1.88	9.41	18.5	(<0.01)
			Zinc	10.01	49.7	99.5	(0.4)
2679a	Quartz on Filter Media	Set of 4	IN PREP				

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

Respirable Quartz

This SRM consists of quartz powder that is in the respirable size range. It is intended for use in determining the level of quartz in an industrial atmosphere by x-ray diffraction.

SRM	Type	Amount
1878	Alpha Quartz	5 g

Asbestos

This SRM consists of four 3×3 mm sections of a 0.4 mm pore size polycarbonate filter containing chrysotile fibers mixed with an urban dust. It is intended for use in evaluating the techniques used to count and identify chrysotile asbestos fibers in filter samples by transmission electron microscopy.

SRM	Type	Fiber Loading
1876	Chrysotile Asbestos	30 fibers/0.01 mm^2

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.

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	Type	Constituent Certified		
		Element	(Wt. percent)	Wt/Unit (grams)
1075a	Aluminum 2-ethylhexanoate	Aluminum	8.07	5
1051b	Barium cyclohexanebutyrate	Barium	28.7	5
1053a	Cadmium cyclohexanebutyrate	Cadmium	24.8	5
1074a	Calcium 2-ethylhexanoate	Calcium	12.5	5
1078b	Tris(1-phenyl-1,3-butanediono)chromium (III)	Chromium	9.6	5
1055b	Cobalt cyclohexanebutyrate	Cobalt	14.8	5
1080a	Bis(1-phenyl-1,3-butanediono) copper (II)	Copper	16.37	5
1079b	Tris (1-phenyl-1,3-butanediono) iron (III)	Iron	10.45	5
1059c	Lead cyclohexanebutyrate	Lead		5
1061c	Magnesium cyclohexanebutyrate	Magnesium	6.45	5
1062b	Manganous cyclohexanebutyrate	Manganese	13.2	5
1065b	Nickel cyclohexanebutyrate	Nickel	13.89	5
1071b	Triphenyl phosphate	Phosphorus	9.48	5
1076	Potassium Erucate	Potassium	IN PREP	
1066a	Octaphenylcyclotetrasiloxane	Silicon	14.14	5
1077a	Silver 2-ethylhexanoate	Silver	42.60	5
1069b	Sodium cyclohexanebutyrate	Sodium	12.0	5
1070a	Strontium cyclohexanebutyrate	Strontium	20.7	5
1057b	Dibutyltin bis (2-ethylhexanoate)	Tin	22.95	5
1052b	Bis (1-phenyl-1,3-butanediono) oxovanadium (IV)	Vanadium	13.01	5
1073b	Zinc cyclohexanebutyrate	Zinc	16.66	5

Wear-Metals in Oil

These SRM's consist of 10 metallo-organic compounds blended into a base oil. Element values are listed in μg/g.

SRM	1083	1084	1085
Type	Base Oil (IN PREP)	Wear-Metals in Lubricating Oil 100 ppm	Wear-Metals in Lubricating Oil 300 ppm
Unit Size	150 mL	85 mL	85 mL
ELEMENT			
Aluminum		98	296
Chromium		100	298
Copper		98	295
Iron		100	300
Lead		101	305
Magnesium		98	297
Molybdenum		97	292
Nickel		101	303
Silver		(102)	(296)
Titanium		99	

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

Fertilizers

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 (grams)	Certified Composition (Weight Percent) N	P	K
193	Potassium Nitrate	90	13.85		38.66
194	Ammonium Dihydrogen Phosphate	90	12.15	26.92	
200	Potassium Dihydrogen Phosphate	90		22.74	28.76

SRM	Type	Wt/Unit (grams)	Constituent (Nominal Weight Percent) P_2O_5	CaO	SiO_2	F	Fe_2O_3	Al_2O_3	MgO	Na_2O	MnO	K_2O	TiO_2	CO_2	CdO
120B	Rock (Florida)	90	34.57	49.40	4.68	3.84	1.10	1.06	0.28	0.35	0.032	0.12	0.15	2.79	0.002

Ores

These SRM's are intended for use in evaluating the accuracy of assay methods. They are certified for the elements that are of economic interest, and occasionally, have data given for information only. These SRM's are supplied in the form of fine powders, usually less than 0.15 mm.

SRM	79a	180	181	182	183
Type	Fluorspar, customs grade	Fluorspar, high grade	Lithium ore (Spodumene)	Lithium ore (Petalite)	Lithium ore (Lepidolite)
Unit Weight	120 g	120 g	45 g	45 g	45 g
Constituents					
CaF_2	97.39	98.80			
Li_2O			6.39	4.34	4.12
Cu					
Re					
Mo					
Au					
Ag					

SRM	330	331	332	333
Type	Copper, ore mill heads	Copper, ore mill tails	Copper, Concentrate	Molybdenum, Concentrate
Unit Weight	100 g	100 g	50 g	35 g
Constituents				
CaF_2				
Li_2O				
Cu	0.84	0.091	28.4	1.038
Re	0.30 ppm	0.04 ppm	10.2 ppm	0.087
Mo	0.018	0.0022	0.64	55.3
Au	(0.093 ppm)	(0.034 ppm)	(2.14 ppm)	(8.9 ppm)
Ag	(1.37 ppm)	(0.243 ppm)	(38.7 ppm)	(25.0 ppm)

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

Ores

SRM	27f	690	691	692	693	69b	696
Type	Iron Ore, Sibley	Iron Ore, Canada	Iron Oxide reduced	Iron Ore, Labrador	Iron Ore, Nimba	Bauxite, Arkansas	Bauxite, Surinam
Unit Weight	100 g	150 g	100 g	150 g	150 g	60 g	60 g
Constituents							
Al_2O_3	0.82	0.18	1.22	1.41	1.02	48.8	54.5
BaO						(0.008)	(0.004)
Cd							
CdO							
CaO	0.039	0.20	0.63	0.023	0.016	0.13	0.018
Co			0.030			(0.0001)	(0.00009)
Cu			0.032				
Cr_2O_3						0.011	0.047
F							
In							
Total Fe	65.97	66.85	90.8	59.58	65.11		
Fe_2O_3						7.14	8.70
Pb							
MgO	0.019	0.18	0.52	0.035	0.013	0.085	0.012
MnO	0.011	0.23	0.043	0.46	0.091	0.110	0.004
P	0.041	0.011	0.006	0.039	0.056		
P_2O_5						0.118	0.050
K_2O	0.008	0.0030		0.039	0.0028	0.068	0.009
SiO_2	4.17	3.71	3.7	10.14	3.87	13.43	3.79
Ag							
Na_2O	0.012	0.003	0.186	0.008	0.0028	0.025	(0.007)
S	0.005	0.003	0.008	0.005	0.005		
SO_3						0.63	0.21
TiO_2	0.019	0.022	0.27	0.045	0.035	1.90	2.64
U							
V_2O_5						0.028	0.072
WO_3							
Zn							
ZnO						0.0035	0.0014
ZrO_2						0.29	0.14
Loss on Ignition						27.2	29.9
Moisture							

Ores (Continued)

SRM	697	698	699	120b	277	113a	329	25d	670
Type	Bauxite Dominican	Bauxite Jamaican	Alumina (Reduction Grade)	Phosphate Rock, Florida	Tungsten Concentrate	Zinc Concentrate	Zinc Concentrate	Manganese Ore	Rutile Ore
Unit Weight	60 g	60 g	60 g	90 g	100 g	100 g	100 g	(IN PREP)	(IN PREP)
Constituents									
Al_2O_3	45.8	48.2		1.06					
BaO	(0.015)	(0.008)			Ta(0.20)				
Cd						0.78	0.14		
CdO				0.002					
CaO	0.71	0.62	0.036	49.40	Ca(0.37)	1.1_9	0.08		
Co	(0.0013)	(0.0045)				(0.11)	(0.009)		
Cu						0.31	0.13_2		
Cr_2O_3	0.100	0.080	0.0002		Nb(1.0)				
F				3.84		Ni(0.07)	Ni(0.006)		
In							0.019		
Total Fe					(7.4)	2.08	12.9_4		(*)
Fe_2O_3	20.0	19.6	0.013	1.10					
Pb					(0.07)	2.80	6.0_6		
MgO	0.18	0.058	0.0006	0.20		0.75	0.16_5		
MnO	0.41	0.38	0.0005	0.032	Mn(10.0)			Mn(*)	
P					(0.03)			(*)	
P_2O_5	0.97	0.37	0.0002	34.57					
K_2O	0.062	0.010		0.12					
SiO_2	6.81	0.69	0.014	4.68	Si(0.85)	(1.54)	(0.61)	Si(*)	Si(*)
Ag						0.046_7	0.0089		
Na_2O	(0.036)	(0.015)	0.59	0.35					
S					(0.25)	30.6	(31.7)		
SO_3	10.13	0.22			O_2(21.4)				
TiO_2	2.52	2.38		0.15	Ti(2.2)				Ti(*)
U				128.4 μg/g					
V_2O_5	0.063	0.064	0.0005		Mo(0.06)				
WO_3					67.4				
Zn						$57._3$	$45._5$		
ZnO	0.037	0.029	0.013		Sn(0.54)				
ZrO_2	0.065	0.061							Zr(*)
Ga_2O_3			0.010						
Li_2O			0.002						
Loss on Ignition	22.1	27.3							
Moisture						0.008	0.4_5		

Values in parentheses are not certified, but are given for information only.
*SRM in preparation; values to be certified.

SRM	1c	88a	70a	99a	97a	98a	81a	165a
Type	Limestone, argillaceous	Limestone, dolomitic	Feldspar, potash	Feldspar, soda	Clay, flint	Clay, plastic	Glass sand	Glass sand, (low iron)
Unit Weight	50 g	50 g	40 g	40 g	60 g	60 g	75 g	75 g
Constituents								
Al_2O_3	1.3	0.19	17.9	20.5	38.79	33.19	0.66	0.059
BaO			0.02	0.26	0.07_5	0.03		
CaO	50.3	30.1_5	0.11	2.14	0.11	0.31		
Cr_2O_3					0.03	0.03	46 μg/g	(1.1 μg/g)
CO_2		46.6						
FeO								
Fe_2O_3	0.55	0.28	0.07_5	0.06_5	0.45	1.34	0.082	0.012
Li_2O					0.11	0.070		
MgO	0.42	21.3		0.02	0.15	0.42		
MnO	0.025	0.03						
P_2O_5	0.04	0.01		0.02	0.36	0.11		
K_2O	0.28	0.12	11.8	5.2	0.50	1.04		
Rb_2O			0.06					
SiO_2	6.84	1.20	67.1	65.2	43.67	48.94		
Na_2O	0.02	0.01	2.5_5	6.2	0.037	0.082		
SrO	0.030	0.010			0.18	0.039		
TiO_2	0.07	0.02	0.01	0.007	1.90	1.61	0.12	0.011
ZrO_2					0.063	0.042	0.034	0.006
Loss on Ignition	39.9	46.7	0.40	0.26	13.32	12.44		

SRM	154b	278	688	76a	77a	78a
Type	Titanium dioxide	Obsidian rock	Basalt rock	Burnt Refractory (Al_2O_3–40%)	Burnt Refractory (Al_2O_3–60%)	Burnt Refractory (Al_2O_3–70%)
Unit Weight	90 g	35 g	60 g	75 g	75 g	75 g
Constituents						
Al_2O_3		14.15	17.36	38.7	60.2	71.7
BaO						
CaO		0.983		0.22	0.05	0.11
Cr_2O_3						
CO_2						
FeO			7.64			
Fe_2O_3		2.04	10.35	1.6_0	1.0_0	1.2
Li_2O				0.042	0.2_5	0.12
MgO				0.52	0.38	0.70
MnO		0.052	0.167			

Rocks, Minerals, and Refractories (Continued)

SRM	154b	278	688	76a	77a	78a
Type	Titanium dioxide	Obsidian rock	Basalt rock	Burnt Refractory (Al_2O_3 – 40%)	Burnt Refractory (Al_2O_3 – 60%)	Burnt Refractory (Al_2O_3 – 70%)
Unit Weight	90 g	35 g	60 g	75 g	75 g	75 g
Constituents						
P_2O_5		0.036	0.134	0.12_0	0.092	1.3
K_2O		4.16	0.187	1.33	0.09_0	1.22
Rb_2O						
SiO_2		73.05	48.4	54.9	35.0	19.4
Na_2O		4.84	2.15	0.07	0.037	0.078
SrO				0.037	0.009	0.25
TiO_2	99.74	0.245	1.17	2.0_3	2.6_6	3.2_2
ZrO_2				0.15	0.21	0.31
Loss on Ignition				(0.34)	(0.22)	(0.42)

SRM	103a	198	199
Type	Chrome Refractory	Silica Refractory	Silica Refractory
Unit Weight	60 g	45 g	45 g
Constituents			
Al_2O_3	29.96	0.16	0.48
BaO			
CaO	0.69	2.71	2.41
Cr_2O_3	32.06		
CO_2			
FeO	12.43		
Fe_2O_3		0.66	0.74
Li_2O		0.001	0.002
MgO	18.54	0.07	0.13
MnO	0.11	0.008	0.007
P_2O_5	0.01	0.022	0.015
K_2O		0.017	0.094
Rb_2O			
SiO_2	4.63		
Na_2O		0.012	0.015
SrO			
TiO_2	0.22	0.02	0.06
ZrO_2	0.01	<0.01	0.01
Loss on Ignition		0.21	0.17

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

Glasses

SRM	89	91	92	93a	620	621	1830	1831
Type	Lead-Barium	Opal	Low-Boron	High-Boron	Soda-Lime, Flat	Soda-Lime, Container	Soda-Lime, Float	Soda-Lime Sheet
Unit Size	45 g	45 g	45 g	Wafer 32 mm D ×6 mm	3 platelets 35×35 ×3 mm	3 disks 38 mm D ×5 mm	3 platelets 38×38 ×6 mm	3 platelets 37×37 ×3 mm
Constituent	Chemical Composition (Nominal Weight Percent)							
SiO_2	65.35	67.50	(75.0)	80.8	72.8	71.13	73.07	73.08
PbO	17.50	0.10						
Al_2O_3	0.18	6.01		2.28	1.80	2.76	0.12	1.21
Fe_2O_3	0.049	0.079		0.028	0.043	0.040	0.121	0.087
ZnO		0.08	(0.2)					
MnO	0.088	(0.008)						
TiO_2	0.01	0.019		0.014	0.018	0.014	0.011	0.019
ZrO_2	0.005	0.009		0.042		0.007		
CaO	0.21	10.49	(8.3)	0.01	7.11	10.71	8.56	8.20
BaO	1.40					0.12		
MgO	0.03	(0.008)	(0.1)	0.005	3.69	0.27	3.90	3.51
K_2O	8.40	3.24	(0.6)	0.014	0.41	2.01	0.04	0.33
Na_2O	5.70	8.47	(13.1)	3.98	14.39	12.74	13.75	13.32
B_2O_3			0.70	12.56				
P_2O_5	0.23	0.023						
As_2O_5	0.36	0.10						
As_2O_3	0.03	0.09			0.056	0.030		
SO_3	0.03				0.28	0.13	0.26	0.25
R_2O_3			(1.5)					
Cl	0.05	0.015		0.06				
F		5.73						
Loss on Ignition	0.32		(0.42)					

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

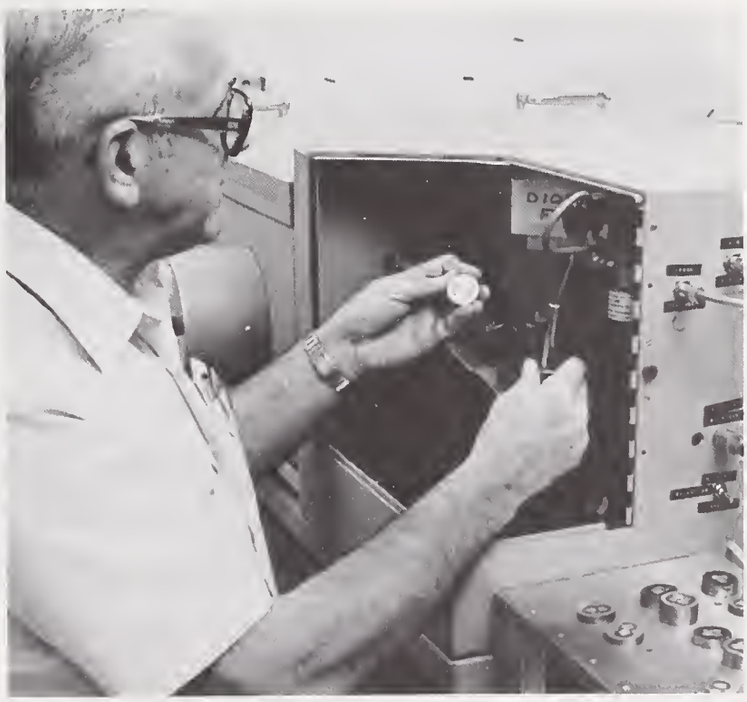
Carbides

SRM	Type	Wt/Unit (grams)	Total Carbon (Wt. %)
276a	Tungsten Carbide	75	6.11

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.

SRM	633	634	635	636	637	638	639	1880	1881
Type	RED	GOLD	BLUE	YELLOW	PINK	GREEN	CLEAR	BLACK	WHITE
Unit Weight	15 g	15 g	15 g	15 g	15 g	15 g	15 g	15 g	15 g
Constituent	Chemical Composition (Nominal Weight Percent)								
CaO	64.5_0	62.5_8	59.8_3	63.5_4	66.0_4	62.0_9	65.7_6	63.13	58.67
SiO_2	21.8_8	20.7_3	18.4_1	23.2_2	23.0_7	21.4_8	21.6_1	19.82	22.25
Al_2O_3	3.7_8	5.2_1	6.2_9	3.0_2	3.2_8	4.4_5	4.2_8	5.02	4.19
Fe_2O_3	4.20	2.84	2.61	1.61	1.80	3.55	2.40	2.91	4.68
SO_3	2.2_0	2.2_1	7.0_7	2.3_1	2.3_8	2.3_4	2.4_8	3.37	3.65
MgO	1.0_4	3.3_0	1.2_3	3.9_5	0.6_7	3.8_3	1.2_6	2.69	2.62
K_2O	0.17	0.42	0.45	0.59	0.25	0.59	0.06	0.91	1.17
TiO_2	0.24	0.29	0.32	0.18	0.21	0.25	0.32	0.23	0.23
Na_2O	0.64	0.15	0.07	0.11	0.15	0.13	0.65	0.28	0.04
SrO	0.31	0.12	0.21	0.04	0.09	0.07	0.15	0.06	0.11
P_2O_5	0.24	0.10	0.17	0.08	0.24	0.06	0.08	0.29	0.09
Mn_2O_3	0.04	0.28	0.09	0.12	0.06	0.05	0.08	0.08	0.26
F	0.08	0.08	0.04	0.06	0.04	0.04	0.02	0.10	0.09
ZnO	0.01	0.02	0.01	0.03	0.01	0.10	0.01	0.01	0.01
Cr_2O_3	0.01	0.08	0.01	0.01	0.01	0.01	0.01		
Ignition loss	0.7_5	1.6_2	3.2_4	1.1_6	1.6_9	0.9_5	1.0_0	1.38	2.01
Total	100.06	100.00	100.03	100.00	99.97	99.97	100.16	100.30	100.07



John Norris removes a ferrous SRM from the stand of a controlled waveform spark emission polychrometer. Analytical results for multiple burn spots are used to assess SRM homogeneity.

Trace Elements

The SRM's listed below were designed for trace chemical analysis, specifically for calibrating instruments and evaluating analytical techniques and procedures used to determine trace elements in various inorganic matrices. In addition many SRM's certified for chemical composition have one or more constituents certified at or below the 100 μg/g level. Some SRM's in the following categories may be of use in trace analytical work:

Steels (pages 19-38); High-Purity Metals (page 52); Nonferrous Alloys (pages 39-51); Environmental Standards (page 59); and Biological Standards (page 57).

SRM	607	610–611	612–613	614–615	616–617
Type	Trace Elements in Potassium Feldspar	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass
Concentration Range		500 ppm	50 ppm	1 ppm	0.02 ppm
Wafer Thickness		610 3 mm 611 1 mm	612 3 mm 613 1 mm	614 3 mm 615 1 mm	616 3 mm 617 1 mm
Unit of Issue	5 g	6 Wafers	6 Wafers	6 Wafers	6 Wafers
Element			Nominal Concentrations (ppm)		
Antimony				(1.06)	(0.078)
Barium			(41)		
Boron		(351)	(32)	(1.30)	(0.20)
Cadmium				(0.55)	
Cerium			(39)		
Cobalt		(390)	(35.5)	(0.73)	
Copper		(444)	(37.7)	1.37	(0.80)
Dysprosium			(35)		
Erbium			(39)		
Europium			(36)	(0.99)	
Gadolinium			(39)		
Gallium				(1.3)	(0.23)
Gold		(25)	(5)	(0.5)	(0.18)
Iron		458	51	(13.3)	(11)
Lanthanum			(36)	(0.83)	(0.034)
Lead		426	38.57	2.32	1.85
Manganese		485	(39.6)		
Neodymium			(36)		
Nickel		458.7	38.8	(0.95)	
Potassium		(461)	(64)	30	29
Rubidium	523.90	425.7	31.4	0.855	0.100
Samarium			(39)		
Scandium				(0.59)	(0.026)
Silver		(254)	22.0	0.42	
Strontium	65.485	515.5	78.4	45.8	41.72

Trace Elements (Continued)

SRM	607	610 – 611	612 – 613	614 – 615	616 – 617
Type	Trace Elements in Potassium Feldspar	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass	Trace Elements in Glass
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)			

In addition to the elements listed above, the glass SRM's contain the following 25 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Te, Tb, Tm, Sn, W, V, Y, and Zr.
Note: Glass—Nominal Composition: 72% SiO_2, 12% CaO, 14% Na_2O, and 2% Al_2O_3.
Values in parentheses are not certified, but are given for information only.

Nuclear Materials

Special Nuclear Materials

These SRM's are available to Department of Energy contractors, Nuclear Regulatory Commission, or State Licensees, and foreign governments that have entered into an agreement of cooperation with the U.S. Government regarding the use of these materials. Purchase orders and requests for information regarding ordering procedures, availability, and shipment of these SRM's should be directed to:

NBS Special Nuclear Standard Reference Materials
U.S. Department of Energy
New Brunswick Laboratory, D-350
9800 South Cass Avenue
Argonne, IL 60439
(312) 272-2485
FTS: 972-2485

Plutonium Assay

SRM	Identification (Batch Name)	Constituent Certified	Element Weight* (g)	(Weight Percent)
945	Plutonium Metal, standard matrix	Impurities	5	99.9
949f	Plutonium Metal Assay	Plutonium Content	0.5	99.99

*Nominal weight

Plutonium Isotopic

SRM	Identification (Batch Name)	Element Weight (g)	Certified Isotopes (Atom Percent)					
			^{238}Pu	^{239}Pu	^{240}Pu	^{241}Pu	^{242}Pu	^{244}Pu
946	Plutonium Sulfate Tetrahydrate	0.25	0.232	84.464	12.253	2.477	0.574	
947	Plutonium Sulfate Tetrahydrate	0.25	0.278	77.089	18.610	2.821	1.202	
948	Plutonium Sulfate Tetrahydrate	0.25	0.010	91.736	7.922	0.299	0.0330	
996	Plutonium—Spike	0.001	0.005	0.034	0.677	0.092	1.325	97.867

Uranium Assay

SRM	Identification (Batch Name)	Constituent Certified	Element Weight (g)	(Weight Percent)
950b	Uranium Oxide	U_3O_8	25	99.968
960	Uranium Metal	U	26	99.975
993	Uranium—235 Spike (solution)	U-235	0.1	99.8195
995	Uranium—233 Spike (solution)	U-235	0.005	99.9245
969	Uranium Oxide—IN PREP (for NDA measurements)			Set of 5 enrichments 0.3, 0.7, 2.0, 3.0, 4.5%

Uranium Isotopic

SRM	Uranium Oxide (U_3O_8)	Wt (grams)	Certified Isotopes (Atom Percent) ^{234}U	^{235}U	^{234}U	^{238}U
U-0002	Depleted	1.0	0.00016	0.01755	<0.00001	99.9823
U-005a	Depleted—IN PREP					
U-010	Enriched	1.0	0.00541	1.0037	0.00681	98.984
U-015	Enriched	1.0	0.00850	1.5323	0.0164	98.443
U-020a	Enriched—IN PREP					
U-030a	Enriched—IN PREP					
U-050	Enriched	1.0	0.0279	5.010	0.0480	94.915
U-100	Enriched	1.0	0.0676	10.190	0.0379	89.704
U-150	Enriched	1.0	0.0993	15.307	0.0660	84.528
U-200	Enriched	1.0	0.1246	20.013	0.2116	79.651
U-350	Enriched	1.0	0.2498	35.190	0.1673	64.393
U-500	Enriched	1.0	0.5181	49.696	0.0755	49.711
U-750	Enriched	1.0	0.5923	75.357	0.2499	23.801
U-800	Enriched	1.0	0.6563	80.279	0.2445	18.820
U-850	Enriched	1.0	0.6437	85.137	0.3704	13.848
U-900	Enriched	1.0	0.7777	90.196	0.3327	8.693
U-930	Enriched	1.0	1.0812	93.336	0.2027	5.380
U-970	Enriched	1.0	1.6653	97.663	0.1491	0.5229

Radiation Dosimetry

This SRM is a cobalt-in-aluminum alloy (wire form) to serve as a neutron density monitor standard. Accurate determination of thermal neutron densities is essential in irradiation tests to obtain a basis for comparison of densities within and among reactors. SRM 953 is intended for use in providing data for the design of reactors, understanding the mechanisms of radiation damage, and for use in using neutron activation analysis. The wire is 0.5 mm in diameter and 1 meter long.

SRM	Identification (Batch Name)	Cobalt Content (Weight Percent)
953	Neutron density monitor wire (Co in Al)	0.116
8505	Vanadium in Crude Oil—IN PREP	

◀ *Therese Butler aspirates a solution of an SRM into the flame atomic absorption (AA) spectrometer. Major and minor elements are determined in a variety of SRMs using flame AA, while trace elements are determined using electrothermal atomization AA.*

▲ *After rough castings are separated from the original grid, individual disks of SRM C1146a, White Cast Iron, are polished for use in optical emission and x-ray spectrometric analysis.*

Fission Track Glass

These SRM's containing uranium at four concentration levels, will aid laboratories, performing fission track analyses, in interlaboratory comparisons of data and in monitoring neutron fluences. The fission track glass standards are certified for neutron flux ($n \cdot cm^{-2} \cdot sec^{-1}$) that induced uranium fission in selected wafers. The materials were irradiated in the NBS 10 Megawatt Research Reactor, at two different neutron energies.

Each SRM unit contains four unirradiated glass wafers and two irradiated wafers.

SRM	Uranium Content ng/g	^{235}U (Atom Percent)	NBS Pneumatic Tube Facility/ Irradiation Time (sec.)
961	461.5	0.2376	RT–3/8
			RT–4/12
962a	IN PREP		
963a	IN PREP		
964	0.0721	0.616	RT–3/360
			RT–4/540

Stable Isotopic

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 intended for use in the assessment of small variations in the isotopic composition of the elements, and for the evaluation of mass discrimination effects encountered in the operation of mass spectrometers.

SRM	Isotopic Reference Standards	Element Certified	Wt/Unit (grams)
951	Boric Acid	Boron	100
952	Boric Acid, 95% Enriched ^{10}B	Boron	0.25
975	Sodium Chloride	Chlorine	0.25
976	Copper Metal	Copper	0.25
977	Sodium Bromide	Bromine	0.25
978	Silver Nitrate	Silver	0.25
979	Chromium Nitrate	Chromium	0.25
980	Magnesium Metal	Magnesium	0.25
*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
985	Potassium Chloride, assay and isotopic	Potassium	1.0
987	Strontium Carbonate, assay and isotopic	Strontium	1.0
989	Rhenium, assay and isotopic	Rhenium	pkg. (50)
990	Silicon, assay and isotopic	Silicon	wafer, 3 cm D
			×0.2 cm
991	Lead–206 Spike, assay and isotopic	Lead	15

*Sold as a set containing SRM 981, 982, and 983.

Special Nuclear Containers

SRM	Type	Size
9940	Special Nuclear Container, DOT 6M	13 gallon
9941	Special Nuclear Container	55 gallon
9942	Special Nuclear Container, Type A	10 gallon
9943	Special Nuclear Container, Type A	55 gallon

NOTE: These special packaging materials may be necessary to fill your order, depending upon Department of Energy, Department of Transportation, and Nuclear Regulatory Commission shipping requirements.

Sally Harrison stores biological samples in a liquid nitrogen freezer as part of the joint NBS/EPA Pilot Environmental Specimen Bank program.

Certified Physical Properties Standards

Ion Activity

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

pH

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 hydrogen phthalate	4.004	60
186Ic	Potassium dihydrogen phosphate	6.863	30
186IIc	Disodium hydrogen phosphate	7.415	30
187b	Sodium Tetraborate Decahydrate (Borax)	9.183	30
188	Potassium hydrogen tartrate	3.557	60
189	Potassium tetroxalate	1.679	65
191a	Sodium bicarbonate	10.011	25
192a	Sodium carbonate		30
922	Tris(hydroxymethyl)aminomethane	7.699	25
923	Tris(hydroxymethyl)aminomethane hydrochloride		35

Ralph Veale inspects SRM 2083, Socketed Ball Bar Set, which is used to assist in testing coordinate measuring machines. SRM 2083 conforms to specifications of "Methods for Performance Evaluation of Coordinate Measuring Machines."

pD

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 (at 25°C)	Wt/Unit (grams)
2186I	Potassium dihydrogen phosphate	7.428	30
2186II	Disodium hydrogen phosphate		30
2191	Sodium bicarbonate	10.736	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
2203	Potassium Fluoride	pF	125

Scanning Electron Microscope (SEM)

This SRM is for use in calibrating the magnification scale and for evaluating the performance of an SEM. SRM 484c has spacings of 1, 2, 3, 5 and 50 mm and can be used to calibrate the magnification scale of an SEM from 1000 to 20,000 X to an accuracy of 5 percent or better. This standard is a metallographic cross-section of alternate layers of electro-deposited gold and nickel, encapsulated in copper-filled epoxy, and mounted within a section of stainless steel tubing. If the surface of this SRM were etched by de-sputtering, it would be useful for calibrating optical microscopes.

SRM 2069 consists of graphitized natural fibers that have smooth and uniform edges. Two bundles of the fibers are mounted on an SEM specimen mount for easy use. (Additional fibers are included for use with different mounts.) These fibers have high contrast against the clear background in the center of the mount. A scan of the SEM electron beam across an edge of a fiber will give a CRT trace that will provide a quantitative indication of the performance.

SRM	Type	Size
484c	SEM Magnification Standard	11 mm D, 6.5 mm high
2069	SEM Performance Standard	12 mm D, 3 mm peg

Optical Microscope Linewidth-Measurement

These SRM's are for use in calibrating optical microscopes used to measure the widths of opaque lines and clear spaces on integrated-circuit photomasks. They can also be used to calibrate line spacings and line-to-space ratios. The accuracy of a measured linewidth or line spacing is ± 0.05 mm or better. Recommended procedures are provided with each SRM for the adjustment and calibration of measurement systems using transmitted illumination, including filar, image shearing, and video micrometer. They are not recommended for use with partially transmitting materials or in reflected light with opaque materials and it should not be used in a scanning electron microscope. SRM's 474 and 475 are made with anti-reflective chromium on a borosilicate glass substrate. SRM 476 is made with bright chromium.

SRM	Type	Spacings	Size
474	Linewidth Measurement Standard	0.5 to 12 μm	6.35×6.35×0.15 cm
475	Linewidth Measurement Standard	0.5 to 12 μm	6.35×6.35×0.15 cm
476	Linewidth Measurement Standard	0.5 to 12 μm	6.35×6.35×0.15 cm

The magnetic type thickness gages have a specimen size of 30×30 mm 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.

These SRM's 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. 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. The ferrite contents having magnetic properties similar to those of the various coating thickness SRM's have been established by other laboratories.

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. These SRM's have a specimen size of 15×15 mm.

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

		Nominal Coating Thickness	
SRM	Unit Size	micrometer	milliinch (mil)
1361b	Set of 4	2.5	0.1
		12	0.5
		25	1.0
		50	2.0
1362a	Set of 4	40	1.6
		80	3.1
		140	5.5
		200	7.9

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

SRM	Unit Size	Nominal Coating Thickness	
		micrometer	milliinch (mil)
1363a	Set of 4	250	9.8
		400	16
		500	20
		650	26
1364a	Set of 4	820	32
		1000	39
		1500	59
		2000	79
1359	Set of 4	50	2
		140	5.5
		500	20
		820	32
1360	Set of 4	2.5	0.1
		6	0.2
		12	0.5
		20	0.8

Magnetic Coating on Magnetic Substrate (Nickel on Steel)

SRM	Unit Size	Nominal Coating Thickness	
		micrometer	milliinch (mil)
1365a	Set of 4	3	0.1
		9	0.4
		15	0.6
		20	0.8
1366a	Set of 4	25	1.0
		35	1.4
		40	1.6
		50	2.0

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

SRM	Unit Size	Nominal Coating Thickness	
		micrometer	milliinch (mil)
1367a	Set of 4	3	0.1
		9	0.4
		16	0.6
		25	1.0

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

SRM	Unit Size	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness	
			micrometer	microinch
1398a	Set of 4	1.5	0.8	30
		3.0	1.5	60
		6.0	3	120
		14.0	7	280

Gold Coating on Nickel

SRM	Unit Size	Nominal Coating Weight (mg/cm^2)	Nominal Coating Thickness	
			micrometer	microinch
1379	Set of 1	0.35	0.175	7
1380	Set of 1	0.55	0.275	11
1399b	Set of 4	1.5	0.8	30
		3.0	1.5	60
		6.0	3	120
		14.0	7	280

Glass

Chemical Resistance (Durability) of Glass

These SRM's are certified for use in checking test methods and for calibrating equipment used to determine the resistance of glass containers to chemical attack. The values given in the table represent the volume of fiftieth-normal sulfuric acid used to titrate to the methyl-red end point the alkaline extract from a crushed sample of glass after exposure to high-purity water at 121 °C.

SRM	Type	Unit of Issue	mL of N/50 H_2SO_4
622	Soda-lime-silica	2.2 kg	7.67
623	Borosilicate	2.2 kg	0.34

Electrical Properties of Glass

SRM 624 is certified over the range of 250 to 350 °C for use in checking test methods and for calibrating equipment used to determine the dc volume resistivity of glass in accordance with ASTM C657. SRM 774 is certified over the range 100 to 10,000 Hz for use in checking methods for the determination of dielectric constant and ac loss characteristics of insulating materials in accordance with ASTM D150.

SRM	Type	Unit of Issue	Approximate Value
624	Lead-silica, for dc resistivity	200 kg	$\log_{10} \rho$~9.9 Ω·cm
774	Lead-silica, for dielectric constant, 5×5×2.5 cm	block	K~7.47

Glass Viscosity

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 for use in checking the performance of high-temperature viscosity equipment (rotating cylinders) and low-temperature viscosity equipment (fiber elongation, beam-bending, parallel-plates, etc.)

	Temperature (°C) at Viscosity (poises)										
SRM	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
711	1327.1	1072.8	909.0	794.7	710.4	645.6	594.3	552.7	518.2	489.2	464.5
717	1545.1	1248.8	1059.4	927.9	831.2	757.1	698.6	651.1	611.9	579.0	550.9

Glass Viscosity Fixpoints

SRM	Type of Glass	Unit of Issue	Softening Point °C	Annealing Point °C	Strain Point °C
709	Extra Dense Lead	500 g	384	328	311
710	Soda Lime-Silica, type 523/586	900 g	724	546	504
711	Lead-Silica, type 617/366	1.3 kg	602	432	392
712	Mixed Alkali Lead Silicate 1/4 in patties (6 pcs.)	225 g	528	386	352
713	Dense Barium Crown 620/603 1 3/8 in diam×5/8 in thick gobs (4 pcs.)	225 g	738	631	599
714	Alkaline Earth Alumina Silicate 1/4 in diam cane (16 pcs.—6 in long)	225 g	908	710	662
715	Alkali-Free Aluminosilicate 1/4 in diam cane (13 pcs.—6 in long)	200 g	961	764	714
716	Neutral, 1/2 in diam cane (6 pcs.—6 in long)	250 g	794	574	530
717	Borosilicate, 4.2 cm×4.2 cm×12.5 cm bar	450 g	720	516	471

Relative Stress Optical Coefficient

Three glasses have been certified for relative stress optical coefficient. These glasses will be used to check calibrations of instruments to measure this property, especially by the methods of test proposed by ASTM C770. The glasses are in rectangular-shaped bars.

SRM	Type of Glass	Unit of Issue	Relative Stress Optical Coefficient at $\lambda = 546.1$ nm	
708	Lead-Silica, A	625 g	Glass A	C= 2.857 Brewsters, $10^{-12} m^2/N$
	Borosilicate, B	275 g	Glass B	C= 3.652 Brewsters, $10^{-12} m^2/N$
709	Extra dense Lead	500 g		C=–1.359 Brewsters, $10^{-12} m^2/N$

Glass Liquidus Temperature

This SRM is certified for use in checking test methods and for calibrating equipment used to determine the liquidus temperature of glass by the gradient furnace methods in accordance with ASTM C829.

SRM	Type	Unit of Issue	Temperature, °C
773	Soda-lime-silica, for liquidus temperature 2.5×2.5×0.6 cm	60 g	990

Elasticity

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	Polycrystalline Alumina	12.7×1.27×0.32 cm

Microhardness

These SRM's are for use in calibrating and checking the performance of microhardness testers. These test blocks were made by electroforming the test metal on a steel substrate. The hardness numbers are certified at loads of 25, 50, and 100 gram-force for both Vickers and Knoop indenters.

SRM	Type	Hardness	Size
1894	Bright Copper	125 KHN	12.5 mm square
1895	Bright Nickel	550 KHN	12.5 mm square

Density

SRM 217c is certified for density (air saturated at 1 atm) at 20, 25, and 30 °C, and may be used to calibrate pycnometers and density balances.

SRM's 1840 and 1841 are certified for density at 20 °C and may be used to determine the density of solids and liquids by means of hydrostatic weighing.

SRM	Type	Density 20 °C g/cm^3	Amount
217c	2,2,4 Trimethylpentane	0.692	25 mL
1840	Silicon	2.329	100 g
1841	Silicon	2.329	200 g
1825	Borosilicate Glass	2.3	IN PREP
1826	Soda-Lime Glass	2.5	IN PREP
1827	Lead-Silica Glass	3.2	IN PREP

Molecular Weight

Polymer

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.

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, $M_w \approx 179{,}300$, $M_w/M_n \approx 1.07$	5
706	Polystyrene, broad molecular weight distribution, $M_w \approx 257{,}800$, $M_w/M_n \approx 2.1$	18
1475	Polyethylene, linear, $M_w \approx 52{,}000$, $M_w/M_n \approx 2.9$	50
1476	Polyethylene, branched	50
1478	Polystyrene, narrow molecular weight distribution, $M_w \approx 37{,}400$, $M_w/M_n \approx 1.04$	2
1479	Polystyrene, narrow molecular weight distribution, $M_w \approx 1{,}050{,}000$	2
1482	Polyethylene, linear, $M_w \approx 13{,}600$	1
1483	Polyethylene, linear, $M_w \approx 32{,}100$	1
1484	Polyethylene, linear, $M_w \approx 119{,}600$	1

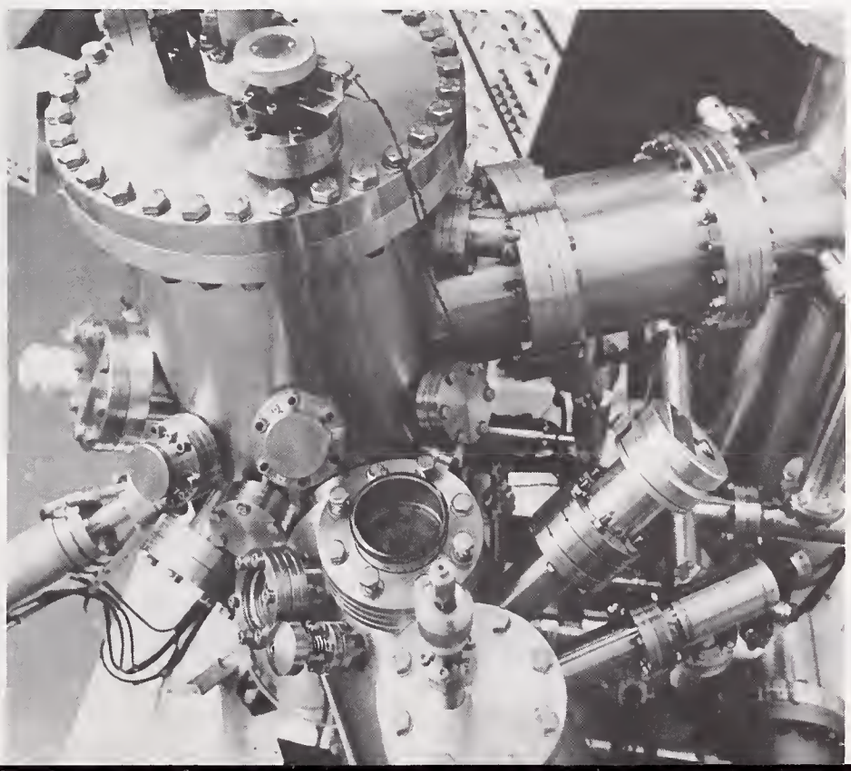
Polymer (Continued)

Property	Method	705	706	1475	1476	1478	1479	1482	1483	1484
Molecular Weight:										
Weight Average	(Light Scattering)	X	X	X			X	X	X	X
	(Sedimentation Equilibrium)	X	X			X				
	(Gel Permeation Chromatography-GPC)			X						
Number Average	(Osmometry)	X				X		X	X	X
	(GPC)			X						
Molecular Weight Distribution	(GPC)			X						
Limiting Viscosity Number	(Capillary Viscometer)					X				
Toluene 25 °C										
Benzene 25 °C		X	X							
Benzene 35 °C		X								
Cyclohexane 35 °C		X	X							
1-Chloronaphthalene 130 °C				X	X			X	X	X
1,2,4-trichlorobenzene 130 °C				X	X			X	X	X
Decahydronaphthalene 130 °C				X	X					
Melt Flow	(ASTM)			X	X					
Density	(ASTM)			X	X					
Heat Capacity	(Adiabatic)	X		X						

Rheology

This SRM is intended for the calibration and checking of instruments used in polymer technology and science for the determination of rheological properties of polymer melts or solutions. It is certified for Rate of Shear, Viscosity, and First Normal Stress Difference at 25 °C.

SRM	Type	Unit size
1490	Polyisobutylene Solution in Cetane	250 mL



Scanning electron microscopes can be calibrated with an accuracy of five percent or better in the 1,000 to 20,000 magnification range with SRM 484c, SEM Magnification Standard. SRM 2069, SEM Performance Standard, is used in evaluating performance of SEM's.

Superconductive Thermometric Fixed Point Devices

Each device is composed of small cylinders of high purity material mounted in a threaded copper stud and enclosed by a mutual inductance coil set. SRM 767a is intended to provide fixed points on the 1976 Provisional 0.5 to 30 K Temperature Scale (EPT-76). Both SRM's 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	Material	Nominal Temperature (K)
767a	Superconductive Thermometric Fixed Point Device	Niobium	9.3
		Lead	7.2
		Indium	3.4
		Aluminum	1.2
		Zinc	0.9
		Cadmium	0.5
768	Superconductive Thermometric Fixed Point Device (Low)	Gold-Indium	0.205
		Gold-Aluminum	0.157
		Iridium	0.098
		Beryllium	0.024
		Tungsten	0.015

Freezing Point

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.

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

Secondary 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
743	Mercury	–38.841	680

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

Melting Point

SRM	Type	Temperature °C	Wt/Unit (grams)
742	Alumina, 99.9+%	2053	10
1968	Gallium, 99.9999+%	29.7723	25
1969	Rubidium	38	IN PREP

NBS calibrates liquid in glass, thermocouple, and resistance thermometers. For information, call 301-921-2805.

Calorimetric

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 calorie by the equation: 4.184 joule = 1 calorie.

Combustion Calorimetric

SRM	Type	Approximate Heat of Combustion	Unit Amount
39i	Benzoic Acid	26.4 KJ/g	30 g
217c	2,2,4-Trimethylpentane	47.7	25 mL
2152	Urea	−10.5	30 g

Solution Calorimetric

SRM	Type	Wt/Unit (grams)
724a	Tris(hydroxymethyl)aminomethane (Hydrochloric Acid and Sodium Hydroxide Solution Calorimetry)	50
1654	α-Quartz (Hydrofluoric Acid Solution Calorimetry)	25
1655	Potassium Chloride (Water Solution Calorimetry	30

Heat Source Calorimetric

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

Calorimetric (Continued)

Enthalpy and Heat Capacity

SRM	Type	Temperature Range (K)	Unit Size
705	Polystyrene, powder	10–350	5 g
720	Sapphire, (synthetic Al_2O_3) small rods	0–2250	15 g
781–D1	Molybdenum, sintered rod	273.15–2800	10 cm×0.32 cm D
781–D2	Molybdenum, sintered rod	273.15–2800	10 cm×0.64 cm D
782	Tungsten, rod	273–1200	10 cm×0.32 cm D
1475	Polyethylene, powder	5–360	50 g

Vapor Pressure

These SRM's are intended for use in the testing and calibration of vapor pressure measurent apparatus and techniques.

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

Thermal Conductivity

SRM's 1450b and 1451 are intended for use in calibrating and verifying guarded hot-plate apparatus (ASTM C177) and heat-flow meters (ASTM C518) used to determine the thermal resistance of thermal insulation materials. SRM's 1460 through 1468 cover the high to low conductivity range of metals and are useful in intercomparing and calibrating thermal conductivity apparatus.

SRM	Type	Dimension (mm)	Temperature Range (K)	Conductivity at 293 K (w/m•K)
1450b	Fibrous Glass Board	60×60×2.54	260–330	0.03
1451	Fibrous Glass Batt	60×60×2.54	260–330	0.039
1460	Stainless Steel	6.4 D, 50 length	5–1200	14.1
1461	Stainless Steel	12.7 D, 50 length	5–1200	14.1
1462	Stainless Steel	34 D, 50 length	5–1200	14.1
1463	Electrolytic Iron	6.4 D, 50 length	6–1000	77.9
1464	Electrolytic Iron	31.7 D, 50 length	6–1000	77.9
1465	Sintered Tungsten	3.2 D, 50 length	4–3000	173
1466	Sintered Tungsten	6.4 D, 50 length	4–3000	173
1467	Arc-Cast Tungsten	8.3 D, 50 length	4–3000	173
1468	Arc-Cast Tungsten	10.2 D, 50 length	4–3000	173

Thermal Expansion

These SRM's cover the temperature range from 20 to 1800 K having coefficients of thermal expansion over the range of 0.5 to 17×10^{-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
736a	Copper (IN PREP)	20–800	6.4	51
737	Tungsten	80–1800	6.4	51
738	Stainless Steel	293–750	6.4	51
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

These SRM's are 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 D, 3 meters long
1967	Platinum, High-Purity (99.999+%)	Wire: 0.51 mm D, 1 meter long

Magnetic

Magnetic Susceptibility

These SRM's are intended for use in the calibration of instruments used to measure magnetic susceptibility.

SRM	Type	Form/Unit
763-1	Aluminum	Cylinder 3 mm diameter × 3 mm
764-1	Platinum	Cylinder 3 mm diameter × 3 mm
765-1	Palladium	Cylinder 3 mm diameter × 3 mm
766-1	Manganese Fluoride	Cube 3 × 3 × 3 mm

Magnetic Moment

This SRM is intended for the calibration of instruments used to measure magnetic moment.

SRM	Type	Size
772	Nickel Sphere	2.4 mm D

Paramagnetic Resonance

This SRM is intended for use in electron paramagnetic resonance (EPR) measurements for determining the number of active paramagnetic centers in a test sample. This SRM consists of two pieces of synthetic ruby.

SRM	Type	Form
2601	Crystalline Al_2O_3; Cr^{3+} (Ruby), Set of two pieces	1.5×1.5×0.5 mm 0.5×0.5×4 mm

Optical

Spectrophotometric

Filters for Spectrophotometry and Luminescence

The spectrophotometric SRM's are intended primarily for use in verifying the accuracy of the transmittance scale of spectrophotometers. The luminescence SRM provides relative emission spectra to determine spectral responsivity and to verify the accuracy of spectrofluorimeters. All of these SRM's provide a means of interlaboratory comparison of data.

Glass Filters: SRM 930D
This SRM consists of three neutral glass filters. The glass filters have transmittances of approximately 10, 20, and 30 percent. Each filter is individually calibrated and certified for absorbance and transmittance at wavelengths of 440, 465, 546.1, 590, and 635 nm. The 546.1 nm wavelength coincides with the mercury emission line. Unit: Set of 3 filters, 4 holders.

Liquid Filters: SRM 931C
These filters are absorbance standards for use in ultraviolet and visible spectrophotometry. This SRM consists of three sets of four vials, each containing a blank solution and three solutions of different concentrations of an absorbing liquid. Each vial contains approximately 10 mL of solution. The net absorbances are certified for each concentration at wavelengths 302, 395, 512, and 678 nm. Unit: Set of 12 vials.

Quartz Cuvette: SRM 932
This SRM is an all-quartz rectangular parallelepiped cuvette designed to fit the holder of conventional spectrophotometers. The distances between the parallel, optically-transparent windows are measured at 10 positions along the vertical axis. The cuvettes range in pathlength between 9.97 and 10.03 mm, and the inner surfaces of the opposite windows are parallel within ±0.002 mm. Each cuvette is certified for pathlength and parallelism of the windows to within ±0.0005 mm. Unit: 1 each.

Potassium Dichromate: SRM 935
This SRM consists of crystalline potassium dichromate of established purity certified for use as an ultraviolet absorbance standard. Solutions made with this SRM in 0.001 N perchloric acid are certified for their apparent specific absorbances, ϵ_a, at 23.5 °C and wavelengths of 235, 257, 313, 345, and 350 nm. Unit: 15 grams.

Quinine Sulfate Dihydrate: SRM 936
This SRM consists of powdered quinine sulfate dihydrate of known purity certfied for use as a spectrofluorimetric emission standard. A solution made with this SRM in 0.1 N perchloric acid is certified for its molecular emission spectrum, E(g) at 25.0 °C over the wavelength range of 375.0 to 675 nm. Unit: 1 gram.

Didymium-Oxide Glass Filters: SRM's 2009 and 2010
These wavelength SRM's are for use in checking the wavelength scale of spectrophotometers between 400 and 760 nm for bandpasses between 1.5 and 10.5 nm. SRM 2009 is approximately 1 cm wide by 3 cm high and is supplied in a holder which fits in the place of a standard analytical cuvette. SRM 2010 is in the form of a square approximately 5.1 cm by 5.1 cm.

Spectrophotometric (Continued)

Glass Filter: SRM 2030
This SRM consists of one neutral glass filter. It is intended as a reference source for one-point verification of the transmittance and absorbance scales of spectrophotometers at a wavelength of 465 nm and a nominal 30 percent transmittance. Unit: 1 filter, 2 holders.

Metal-on-Quartz Filters: SRM 2031
This SRM consists of three filters mounted in metal holders and an empty holder; all holders are equipped with shutters. Two of the filters have an evaporated layer of semitransparent metal sandwiched between two quartz plates that have been assembled by optical contact. The third filter consists of two clear quartz plates assembled by the same technique. Each filter is individually calibrated at 250, 300, 340, 400, 465, 546, 590, and 635 nm. Unit: Set of 3 filters, 4 holders.

Potassium Iodide: SRM 2032
This SRM consists of crystalline KI of established purity for use as a stray light standard in the ultraviolet. Aqueous solutions made with this material are certified for their specific absorbance at 23.5 °C over a wavelength range from 240 to 280 nm. Unit: 25 grams.

Potassium Iodide with Attenuator: SRM 2033
SRM 2033 consists of the same material used for SRM 2032 plus a reference beam attenuator for extending the dynamic range of the stray light test.

SRM	Type	Unit
930D	Glass Filters for Spectrophotometry	Set: 3 filters, 4 holders
931c	Liquid Filters for Spectrophotometry	Set: 12 vials
932	Quartz Cuvette for Spectrophotometry	1 each
935	Crystalline Potassium Dichromate for Use as an Ultraviolet Absorbance Standard	15 grams
936	Quinine Sulfate Dihydrate	1 gram
2009	Didymium-oxide glass	1 filter in holder
2010	Didymium-oxide glass	51×51 mm
2030	Glass Filter for Transmittance Measurement	1 filter, 2 holders
2031	Metal-on-Quartz Filters for Spectrophotometry	Set: 3 filters, 4 holders
2032	Potassium Iodide for Use as a Stray Light Standard	25 grams
2033	Potassium Iodide with Attenuator for Use as Stray Light Standard	IN PREP

For further information regarding calibration services, call 301-921-2805.

Reflectance

These SRM's are intended primarily for calibration of the reflectance scale of integrating sphere reflectometers used in evaluating materials for solar energy collectors and for calibration of reflectometers used in evaluating the appearance of polished metals and metal plated objects.

Specular Spectral Reflectance

SRM's 2003a and 2008a are first-surface mirrors of vacuum deposited aluminum and gold, respectively on glass that are certified for near-normal reflectance over the wavelength range of 250 to 2500 nm. SRM's 2023, 2024 and 2025 are second-surface mirrors of vacuum deposited aluminum on a fused quartz plate and covered with a second plate of fused quartz. These mirrors are also certified for near-normal reflectance from 250 to 2500 nm and for a few wavelengths at 15, 30, 45 and 60 degrees from normal. SRM 2025 has a small angle between the front and rear surfaces.

SRM	Type	Size
2003a	First Surface, Aluminum on Glass	5.1 cm D
2008a	First Surface, Gold on Glass	5.1 cm D
2023	Second Surface, Aluminum on Fused Quartz	5.1×5.1 cm
2024	Second Surface, Aluminum on Fused Quartz	2.5×10.2 cm
2025	Second Surface, Aluminum on Fused Quartz with wedge	2.5×10.2 cm

For further information regarding calibration services, call 301-921-2805.

Directional-Hemispherical Reflectance

SRM's 2015 and 2016 are made from opal glass and are certified for near-normal reflectance from 400 to 750 nm. SRM's 2019a and 2020 are white ceramic tiles certified from 350 to 2500 nm. SRM's 2021 and 2022 are black porcelain enamel squares certified from 280 to 2500 nm. These last four SRM's are primarily certified for near-normal reflectance but are also certified for reflectance at a few wavelengths at 15, 30, 45 and 60 degrees from normal.

SRM	Type	Size
2015	Opal Glass	2.5×5.0×0.64 cm
2016	Opal Glass	10×10×0.64 cm
2019b	White Ceramic Tile	5.1×5.1×0.81 cm
2020	White Ceramic Tile	3.8×7.6×0.81 cm
2021	Black Porcelain Enamel	5.1×5.1×0.20 cm
2022	Black Porcelain Enamel	2.5×2.5×0.20 cm

For further information regarding calibration services, call 301-921-2805.

Samuel Jones examines SRM 475, Optical Microscope Linewidth Measurement Standard, used in calibrating optical microscopes that measure linewidths from 0.5 to 10 μm.

Refractive Index

SRM's 211c and 217c are certified for refractive index at 20, 25 and 30 °C, from 435.8 to 667.8 nm for seven wavelengths, and are available in 5 and 25 mL ampoules.

SRM's 1820 and 1822 are certified for refractive index at thirteen wavelengths from 404.7 nm to 706.5 nm. These SRM's are designed for calibrating refractometers and certifying refractive index immersion liquids, and should provide a basis for accurate measurements of refractive index and dispersion. They consist of two rectangular glass slabs: one slab has polished faces and is to be used to check the performance of a refractometer; the second slab is unpolished and can be broken into fragments to certify the refractive index of immersion liquids by microscope methods.

SRM 1823 consists of two silicone liquids that are chemically and thermally stable. The liquids are miscible and span the refractive index range of a variety of glasses and glass fibers that are examined microscopically by immersion techniques. Used independently, the liquids are suitable for the calibration of refractometers. These liquids are certified for refractive index at ten wavelengths from 435.8 to 667.8 nm, at temperatures of 20, 40, 60, and 80 °C.

SRM	Type	n^{20}
211c	Toluene	1.497
217c	2,2,4-Trimethylpentane	1.391
1820	Glass (Borosilicate)	1.488
1822	Glass (Soda-Lime)	1.518
1823–I	Silicone Liquid (I)	1.518
1823–II	Silicone Liquid (II)	1.559

NBS uses its research reactor for a variety of research work, including the analysis of environmental and biological SRM's. Thomas Gills inserts a sample into the reactor.

Optical Rotation

These SRM's are intended for use in calibrating or checking polarimetric apparatus. In aqueous solution the optical rotation of SRM 17c is certified at three wavelengths, while that of SRM 41b is certified at two wavelengths. SRM 41b is also certified at one wavelength in a dimethyl sulfoxide solution.

SRM	Type	Optical Rotation In Aqueous Solution	Unit Size
17c	Sucrose	712 mrad	60 g
41b	Dextrose	1091 mrad	70 g

Radioactivity

Information regarding radioactivity SRM's 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 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.

The stated uncertainties of the older standards are, in general, an estimate of the standard deviation added to an estimate of maximum possible systematic error. The total uncertainties for more recent standards are based on the 99-percent confidence interval for the random uncertainty, with the same estimate of systematic error.

The amount of a radionuclide in an SRM, at a specified time, is stated as (1) the number of atoms (or the mass, for radium standards), (2) the activity, or "decays per second", or (3) the emission rate of a particular radiation, depending on the method of calibration or the intended use. For solution standards, the quantity is usually specified per gram of liquid, with the supposition that users will gravimetrically dispense or dilute the material to duplicate their usual counting conditions. The active portion of gamma-ray "point-source" standards is usually restricted to the central few millimeters of a low-mass, low-Z support in order to minimize scattering. Standards of alpha-particle-emitting radionuclides are deposited or plated on metal backings.

The unit for activity has traditionally been the curie (Ci), but simpler relations between activity, emission rate, and counting rate result if the current SI (International System of Units) unit "1 per second" is used. This is symbolized as "s^{-1}" and has been given the special name becquerel (Bq). The relationship between the curie and the becquerel is $1\ Ci = 3.7 \times 10^{10}$ Bq.

Many SRM's are measured and certified in terms of emission rate. If the fraction of radioactive decays which give rise to a specific radiation is known, the emission rate for that radiation can be deduced from the measured activity, and conversely, the activity may be deduced from the measured emission rate. Suggested values for probabilities per decay for the more intense radiations usually accompany each SRM, or can be obtained from the Radioactivity Group. In this catalog αs^{-1}, $\beta^- s^{-1}$, $\beta^+ s^{-1}$, $Kx s^{-1}$, and γs^{-1} are used for the emission rates of alpha particles, negatrons, 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.

Note: Certain radionuclides are not economical to maintain in stock because of short half lives or low demand. When sufficient demand exists, based on letters of inquiry, these materials are prepared and those

who have expressed interest are notified of their availability. If you need any radionuclides not listed, contact the Radioactivity Section, Room C114, Radiation Physics Building, National Bureau of Standards, Washington, DC 20234 (Telephone: 301-921-2665).

In addition, chemically stable solutions of most radionuclides, including those no longer issued by NBS or that are currently out of stock, may be sumbitted to NBS for calibration as described in "Calibration and Related Measurement Services of the National Bureau of Standards," NBS Special Publication 250 (1980). Requests for these tests should be submitted, with full source information for approval of suitability, to the Radioactivity Section.

Alpha-Particle, Beta-Particle, Gamma-Ray, and Electron-Capture Solution

SRM	Radionuclide	Approximate activity, per gram, at time of calibration (month/year) (Bq s^{-1})		Approx. Mass of Solution (g)	Overall Uncertainty (%)
4229	Aluminum-26	39	11/71	4.6	±1.1
4251B*	Barium-133	5×10^5	1/82	5	1.4
4245	Carbon-14	4×10^5	5/74	5	1.0
4246	Carbon-14	4×10^4	5/74	5	0.9
4250B*	Cesium-134	2×10^6	4/82	5	1.2
4233B*	Cesium-137, Barium-137 m	7×10^5	8/79	5.1	1.4
4943	Chlorine-36	1×10^4	4/62	3	2.3
4422L*	Chlorine-36	4×10^4	4/80	5.1	1.6
4915D*	Cobalt-60	6×10^5	5/80	5	0.7
4370B*	Europium-152	2×10^5	6/79	5	1.5
4926C	Hydrogen-3	3×10^3	9/78	18	0.6
4947	Hydrogen-3	1×10^5	9/78	4	1.0
4361	Hydrogen-3	1.3	9/78	490	0.9
4949B	Iodine-129	7×10^3	1/82	1	1.9
4257*	Manganese-54	6×10^5	4/79	5	1.0
4226*	Nickel-63	2×10^6	5/68	4.1	1.0
4331*	Plutonium-239	6 $s^{-1}g^{-1}$	3/75	2	1.0
4338*	Plutonium-240	18 $s^{-1}g^{-1}$	4/80	5	1.0
4334B*	Plutonium-242	27 $s^{-1}g^{-1}$	5/79	5	0.9
4945D*	Strontium-89	5×10^4	11/82	5	1.5
4288*	Technetium-99	4×10^4	11/82	5	1.6
Long-Lived Mixed Radionuclide:					
4276B*	Antimony-125	1.2×10^4	6/83	5	
	Europium-154	1.5×10^4	6/83		
	Europium-155	7×10^3	6/83		

*License certification is required by NBS for these radionuclides.

Alpha-Particle Point-Source

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

SRM	Radionuclide	Approx. α-particle-emission rate into 2π geometry and/or approx. activity at time of calibration (month/year)		Overall uncertainty (%)
4904F*	Americium–241	30 to $1.3\times10^{4}s^{-1}$	2/82	1.0 to 1.3
4907*	Gadolinium–148	6×10^{2} to $3\times10^{4}s^{-1}$	8/79	0.7 to 1.6
4906B	Plutonium–238	4×10^{2} to $4\times10^{4}s^{-1}$	7/78	0.7 to 2.2

*License certification is required by NBS for these radionuclides.

Radiocarbon Dating and Ground Water Studies

Contemporary Standard for Carbon–14 Dating Laboratories

SRM	Material	Description
4990C	Oxalic Acid	One-half pound of oxalic acid taken from specially prepared material for use as a common contemporary standard against which world-wide measurements can be compared.

Low-Level Tritiated-Water Standard

SRM	Material	Description
4361	Hydrogen–3	Contains 490 grams of $^{3}H–H_2O$ in a flame-sealed bottle. The radioactivity concentration was 1.312 Bq g^{-1}, as of the date of the most recent gas-counting measurement—September 3, 1978. The total uncertainty in this value is 0.85%.

Melody Smith calibrates SRM 930D, Glass Filters for Spectrophotometry. This SRM is a reference source for the verification of the transmittance and absorbance scales of spectrophotometers.

Gaseous Radioactivity

SRM	Radionuclide	Approximate activity or radioactivity concentration at time of calibration (month/year)		Approx. Vol. (cm^3)	Approx. Pressure (atm)	Overall Uncertainty (%)
4935C	Krypton-85	5×10^7 $s^{-1}mol^{-1}$	3/74	10	1	±0.9
4235*	Krypton-85	1×10^7 s^{-1}	11/74	3	1	1.2
4308C	Krypton-85	1.6×10^6 s^{-1}	11/79	30	0.3	3.1
4309G*	Xenon-127	3×10^6 s^{-1}	11/82	30	0.3	2.1
4307I*	Xenon-133	2×10^6 s^{-1}	time of dispatch	30	0.3	2.2
4415LI*	Xenon-133	1.5×10^8 s^{-1}	time of dispatch	5	0.1	1.5
Mixed-Radionuclide Gas:						
4310B*	Krypton-85			30	1	2.5
	Xenon-127					1.7
	Xenon-133					1.6

*License certification is required by NBS for these radionuclides.

Gamma-Ray and X-Ray Point-Source

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, and thorium SRM's. SRM 4213, americium-241 is 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. SRM 4206c, thorium-228, is 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	Principal Photon Energy (MeV)	Approximate activity, s^{-1}, at time of calibration (except MRN) (month/year)		Overall Uncertainty (%)
4213*	Americium-241	0.060	3×10^5	2/70	±2.8
4241B*	Barium-133	0.081	8×10^4	1/81	1.4
4200B	Cesium-137, Barium-137m	0.662	4×10^4	9/79	1.6
4207	Cesium-137, Barium-137m	0.662	3×10^5	9/79	1.6
4218E*	Europium-152	0.122 to 1.408	5×10^4 to 5×10^5	11/82	1.5
4997E	Manganese-54	0.835	3×10^5	4/79	1.0
4201B	Niobium-94	0.702 to 0.871	5×10^3	4/70	1.5
4206C*	Thorium-228	2.615	8×10^4	11/80	2.0
Long-Lived Mixed Radionuclide:					
4275B	Antimony-125-Tellurium-125m,	0.027 to 1.274	5×10^4	9/80	
	Europium-154		6×10^4		
	Europium-155		3×10^4		

*License certification is required by NBS for these radionuclides.

Low-Energy-Photon Point-Source

These SRM's consist of a thin-layer deposit of the radionuclide on a thin stainless steel or platinum foil cemented to a monel disk.

SRM	Radionuclide	Principal Photon Energy (MeV)	Approx. emission rate at time of calibration (month/year)		Overall Uncertainty (%)
4266	Vanadium-49	0.0045	2×10^{4}	2/81	±2.3
			K-$\times s^{-1}$ steradian^{-1}		
4260C	Iron-55	0.0059	2×10^{4}	11/82	1.8
			K-$\times s^{-1}$ steradian^{-1}		
4264B	Tin-121m, Antimony-121	0.0372	5×10^{2} s^{-1}	11/82	3.0

Radium-226 Solution

Radon Analysis

These samples are contained in flame-sealed glass ampoules.

SRM	Nominal Radium Content (g) (month/year)		Approx. Mass of Solution (g)	Overall Uncertainty (%)
4952B	Blank Solution	8/76	20	±68
4953C	10^{-8}	4/78	10.3	1.3

Gamma-Ray Solution

These samples are contained in flame-sealed glass ampoules.

SRM	Nominal Radium Content (g) (month/year)		Approx. Mass of Solution (g)	Overall Uncertainty (%)
4956	2×10^{-7}	9/67	5.1	±4.4
4957	5×10^{-7}	9/67	5.1	1.8
4958	1×10^{-6}	9/67	5.1	1.8
4959	2×10^{-6}	9/67	5.1	1.3
4960	5×10^{-6}	9/67	5.1	1.3
4961	1×10^{-5}	9/67	5.1	1.1
4962	2×10^{-5}	9/67	5.1	1.1
4963	5×10^{-5}	9/67	5.1	1.1
4964B	1×10^{-4}	6/65	5.2	0.5

Environmental Natural Matrix Standards for Traceability Tests

SRM 435OB—Columbia River Sediment
This material was collected from a river downstream from a nuclear reactor facility. Concentrations of fission and activation products are elevated over typical world-wide levels. $^{239/240}$Pu and ^{241}Am are very homogeneously distributed through the sample and are in soluble chemical forms. Inhomogeneity is 3 percent or better for other radionuclides.

SRM 4351—Human Lung
This material contains radioactivity concentrations on the order of 10^{-4} Bq g^{-1}. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum. There is significant inhomogeneity in $^{239/240}$Pu which is unavoidable because plutonium was taken into the lungs in particulate form. Assessments of accuracy of measurement technique can be improved by averaging over several samples.

SRM 4352—Human Liver
This material contains radioactivity concentrations on the order of 10^{-4} Bq g^{-1}. It has been freeze-dried, cryogenically ground, homogenized, and packed in a glass bottle under vacuum.

SRM 4353—Rocky Flats Soil Number 1
This material was collected within 13 centimeters of the soil surface at Rock Flats, CO. ^{239}Pu and ^{241}Am concentrations are about an order of magnitude higher than typical world-wide levels. Approximately 10 percent of the plutonium is in a refractory chemical state. The material also contains "hot" particles and a statistical method is provided for dealing with these. Inhomogeneities, excluding hot particles, are on the order of 3 percent or better.

SRM 4355—Peruvian Soil
This material, which has been the subject of a trace-element study, has non-measurable radioactivity concentrations for many fallout radionuclides and can be used as a blank or for sensitive tests of radioanalytical procedures at low-radioactivity concentrations for other radionuclides. The results of the trace-element study are given for 57 elements.

RM 45B—River Sediment
This material contains radioactivity concentrations of roughly an order of magnitude greater than SRM 435OB. The values, however, are uncertified although the inhomogeneity is better than 3 percent for all radionuclides. This material can be used for routine checking for reproducibility of results after tests have been performed with SRM 435OB.

Radiopharmaceutical

SRM	Radionuclide	Half Life		Approximate Radioactivity at Time of Dispatch	Overall Uncertainty
4400LF*	Chromium-51	27.704	d	1×10^{6}	±1.8
4408LC*	Cobalt-57	270.9	d	8×10^{5}	1.6
4416LD*	Gallium-67	78.26	hr	3×10^{6}	1.7
4421L*	Gold-195	183	d	5×10^{5}	2.3
4405LB*	Gold-198	2.696	d	4×10^{6}	1.7
4417LC*	Indium-111	2.83	d	3×10^{6}	1.3
4414LC*	Iodine-123	13.2	hr	6×10^{7}	1.5
4407LH*	Iodine-125	60.14	d	8×10^{5}	2.0
4401LI*	Iodine-131	8.04	d	1×10^{6}	1.7
4411LB*	Iron-59	44.529	d	8×10^{5}	1.5
4420L*	Lead-203	52.05	hr	3×10^{6}	1.7
4418L*	Mercury-203	46.60	d	1×10^{6}	1.0
4412LH*	Molybdenum-99, Technetium-99m	66.0	hr	2×10^{6}	1.8
4406LG*	Phosphorus-32	14.29	d	1×10^{6}	1.4
4409LD*	Selenium-75	119.8	d	1×10^{6}	2.5

Radiopharmaceutical (Continued)

SRM	Radionuclide	Half Life		Approximate Radioactivity at Time of Dispatch	Overall Uncertainty
4403LB*	Strontium-85	64.84	d	1×10^{6}	1.4
4410HI*	Technetium-99m	6.02	hr	2×10^{9}	1.8
4404LF*	Thallium-201	3.044	d	2×10^{6}	2.0
4402LC*	Tin-113, Indium-113m	115.1	d	8×10^{5}	3.1
4415LI*	Xenon-133	5.245	d	5×10^{8} s^{-1} total	1.4
4419LB*	Ytterbium-169	32.01	d	2×10^{6}	2.5

*License certification is required by NBS for these radionuclides.

Special Nuclear Material Packaging

SRM	Type	Description
9910	Special Nuclear Material Package	Lead Container, 2 1/2×6 inches

NOTE: This material may be necessary to fill your order, depending upon Department of Energy, Department of Transportation, and Nuclear Regulatory Commission shipping requirements.

Catalyst Package for Lubricant Oxidation

SRM 1817 is intended primarily for use in evaluating the oxidation stability of lubricating oils, i.e., automotive crankcase lubricants. The SRM contains: (1) an oxidized/mitrated fuel fraction, (2) a metal naphthenate mixture, and (3) distilled water. The metal naphthenate mixture has the following weight percentages of metal naphthenates: lead-82, iron-7, copper-4, manganese-3.5, and tin-3.5. SRM 1817 is available as a kit of 5 ampoules of each of the three components. The fuel and metal catalysts are sealed under inert atmosphere to ensure their stabilities.

Metallurgical

SRM 493 is intended for calibration x-ray diffraction equipment to determine the relative amounts of iron carbide in steel. SRM's 485a, 486, 487, and 488 are intended for the calibration of x-ray diffraction equipment used in determining the amount of reatined austenite in ferrous materials.

SRM	Type	Form
485a	Austenite in Ferrite 5%	Disk
486	Austenite in Ferrite 15%	Disk
487	Austenite in Ferrite 30%	Disk
488	Austenite in Ferrite 2%	Disk
493	Spheroidized Iron Carbide (Fe_3C) in Ferrite	Wafer: 29×29×2.4 mm

Mössbauer

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 Mössbauer isomer shift data.

SRM	Type	Form
493	Spheroidized Iron Carbide (Fe_3C) in Ferrite	Wafer: 29×29×2.4 mm
1541	Iron Foil	Foil: 2.5 cm×2.5 cm×23 μm

Abrasive Wear

SRM 1857 is a D-2 tool steel block that is issued for use in the dry sand/rubber wheel abrasion test according to ASTM G65, Procedure A.

SRM	Type	Form
1857	D–2 Tool Steel	2 blocks; 7.8×25×76 mm

Pitting or Crevice Corrosion

SRM 1890 is a 316L stainles steel rod that is issued for use in evaluating the pitting or crevice corrosion of surgical implant materials according to ASTM F746.

SRM	Type	Form
1890	316L Stainless Steel Rod and Teflon Collar	4 sets; 6.4 mm D, 25.4 mm long

X-ray Fluorescent Emission Target

This SRM is intended for use in determining the detector window absorption in semiconductor x-ray spectrometers according to ANSI-IEEE Standard STO 759. When excited by a ^{55}Fe source this glass target will emit fluorescent x-rays in the range 1.0 to 5.2 keV.

SRM	Type	Form	Unit Size
477	Glass Fluorescence Source	Disk	2×25 mm D

X-ray Diffraction

SRM's 640a, 674, and 675 are powdered materials to be used as internal standards for powder diffraction measurements. The lattice parameter of SRM 640a has been accurately determined at 25.0 °C using a high angle goniometer and the NBS tungsten and silver internal standards. The weighted average of the lattice parameter, uncorrected for refraction, is 5.430825 Å. SRM 674 is a set of five oxides for use in the quantitative analysis (intensity measurement) of materials. SRM 675 (synthetic fluorophlogopite) is a large d-spacing standard. The lattice parameter is 9.98104 Å.

SRM	Type	Unit Size
640a	Silicon Powder	10 g
674	Powder Diffraction Intensity	
	Al_2O_3 (α-alumina)	10 g
	CeO_2	10 g
	Cr_2O_3	10 g
	TiO_2 (rutile)	10 g
	ZnO	10 g
675	Powder Diffraction (Mica)	5 g

Gas Transmission

SRM 1470 is for use in the measurement of gas transmission rates using a volumetric method (ASTM D1434), manometric method (ASTM D1434), or coulometric method (ASTM D3985) of measurement. The permeances of nitrogen, oxygen, carbon dioxide, and helium through this polyester film at 296.15 K are 0.0421, 0.352, 1.722, and 13.79 $pmol \cdot s^{-1} \cdot Pa^{-1}$, respectively.

SRM	Type	Unit Size
1470	Polyester Plastic Film for Gas Transmission (CO_2, He, N_2, and O_2)	15 sheets, 23 cm square

Reference Fuel

SRM's 1815 and 1816 are high purity liquids intended for use in maintaining the integrity of the octane rating of motor and aviation fuels as specified in the ASTM Manual for Rating Motor, Diesel and Aviation Fuels.

Electrical Resistivity and Conductivity

Metals

These SRM's are useful in evaluating methods of measuring electrical resistance over wide temperature ranges.

SRM	Type	Temperature Range	Resistivity at 293 K	Form
1460	Stainless Steel	5 to 1200 K	80.5 μΩ·cm	Rod; 6.4 mm D, 50 mm long
1461	Stainless Steel	5 to 1200 K	80.5 μΩ·cm	Rod; 12.7 mm D, 50 mm long
1462	Stainless Steel	5 to 1200 K	80.5 μΩ·cm	Rod; 34.0 mm D, 50 mm long
1463	Iron	6 to 1000 K	10.1 μΩ·cm	Rod; 6.4 mm D, 50 mm long
1464	Iron	6 to 1000 K	10.1 μΩ·cm	Rod; 31.7 mm D, 50 mm long
1465	Tungsten	4 to 3000 K	5.4 μΩ·cm	Rod; 3.2 mm D, 50 mm long
1466	Tungsten	4 to 3000 K	5.4 μΩ·cm	Rod; 6.4 mm D, 50 mm long
1467	Tungsten	4 to 3000 K	5.4 μΩ·cm	Rod; 8.3 mm D, 50 mm long
1468	Tungsten	4 to 3000 K	5.4 μΩ·cm	Rod; 10.2 mm D, 50 mm long

Silicon

These SRM's are intended for use in calibrating four-probe, two-probe, and eddy-current test methods.

SRM	Type	Resistivity	Form
1521	111 p–Type Silicon	0.1 and 10 Ω·cm	2 wafers, 51 mm D
1522	111 n–Type Silicon	25, 75, and 180 Ω·cm	3 wafers, 51 mm D
1523	100 and 111 p–Type Silicon	0.01 and 1 Ω·cm	2 wafers, 51 mm D
2526	111 p–Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	15 to 20 slices
2527	111 n–Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	15 to 20 slices
2528	100 p–Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	15 to 20 slices
2529	100 n–Type Silicon, Spreading Resistance	0.001 to 200 Ω·cm	15 to 20 slices

Glass

This SRM is useful in evaluating the ASTM C657 method of determining the dc volume resistivity of glasses.

SRM	Type	Resistivity	Form
624	Lead-Silica Glass	7.6 GΩ·cm	50×50×25 mm

Residual Resistivity Ratio

This SRM is a set of five aluminum rods that are intended for use in checking four-terminal dc and eddy current decay techniques. The residual resistivity ratio, $\rho(273\ K)/\rho(4\ K)$, is a sensitive indicator of purity and of the mechanical state of a material.

SRM	Type	RRR Values	Form
769	Aluminum	130, 683, 1205, 2650, and 11,000	6.4 mm D, 52 mm long

Conductivity

These SRM's are intended for use in the calibration of eddy current conductivity meters and of secondary electrical conductivity standards. Eddy current measurements are used in nondestructive inspection of conducting materials and in the sorting of alloys for composition and heat treatment.

SRM	Type	Conductivity	Form
1860	Aluminum	60% IACS	44×44×9.5 mm
1861	Aluminum-Copper Alloy	47% IACS	44×44×9.5 mm
1862	Aluminum-Magnesium Alloy	41% IACS	44×44×9.5 mm
1863	Aluminum-Copper Alloy	30% IACS	44×44×9.5 mm

Nondestructive Evaluation

SRM 1850 is intended for use in checking the performance of liquid dye penetrants and dye penetrant crack detection techniques. It is a test block that contains four synthetic cracks approximately 0.2, 0.5, 1, and 2 μm wide.

SRM	Type	Unit
1850	Penetrant Test Block	1 each

Engineering Type Standards, Research Materials, and Special Reference Materials

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 Materials

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	Pounds
386h	Styrene-butadiene 1500	34 kg	75
388L	Butyl	34 kg	75
1495	Butyl (Low Viscosity)	34 kg	75

Rubber Compounding Materials

SRM	Type	Wt/Unit	Pounds
370e	Zinc Oxide	8 kg	17.6
371g	Sulfur	6 kg	13.2
372h	Stearic Acid	3.2 kg	7.1
373f	Benzothiazyl disulfide	2 kg	4.4
375g	Channel Black	28 kg	61.6
378b	Oil Furnace Black	28 kg	61.6
382a	Gas Furnace Black	32 kg	70.6
383a	Mercaptobenzothiazale	3.2 kg	7.1
384d	N-tertiary-Butyl-2-benzothiazolesulfenamide	3.2 kg	7.1

David Kelley measures the width of the indentation on SRM's 1893-6, Microhardness Test Block, used to calibrate microhardness indenters.

Reference Magnetic Tapes

These SRM's are 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
1600	Secondary standard magnetic tape-computer amplitude reference	Cassette
3200	Secondary standard magnetic tape-computer amplitude reference	Reel/600 feet
3210	Secondary standard flexible disk cartridge-computer amplitude reference	Flexible disk
3216	Secondary standard magnetic tape-computer amplitude reference	Cartridge
6250	Secondary standard high density magnetic tape-computer amplitude reference	Reel/2400 feet

Centerline Drawings for Optical Character Recognition-B Characters

This SRM is an exact copy of the centerline drawings that uniquely define each printed character shape and size used in constant strokewidth Style B Optical Character Recognition (OCR-B) applications in accordance with one or more of the following standards: American National Standard X3.49-1975, Character Set for Optical Character Recognition (OCR-B); Federal Information Processing Standards Publication 32-1974, Optical Character Recognition Character Sets; European Computer Manufacturers Association Standard ECMA-II for the Alphanumeric Character Set OCR-B for Optical Recognition, 3rd Edition, 1975; and Draft International Standard ISO/DIS 1073/II, Alphanumeric Character Sets for Optical Recognition.

This standard contains information on the nominal size, strokewidth, tolerance, and relative position of characters.

SRM	Size	OCR-B Characters
1901	I	118

The standard being examined by David Kelley is SRM 1850, Penetrant Test Block. The sensitivity and performance of liquid dye penetrants and dye penetrant crack detection systems, as well as other systems and devices for surface defect detection may be checked by using this SRM.

Sizing

Particle Size

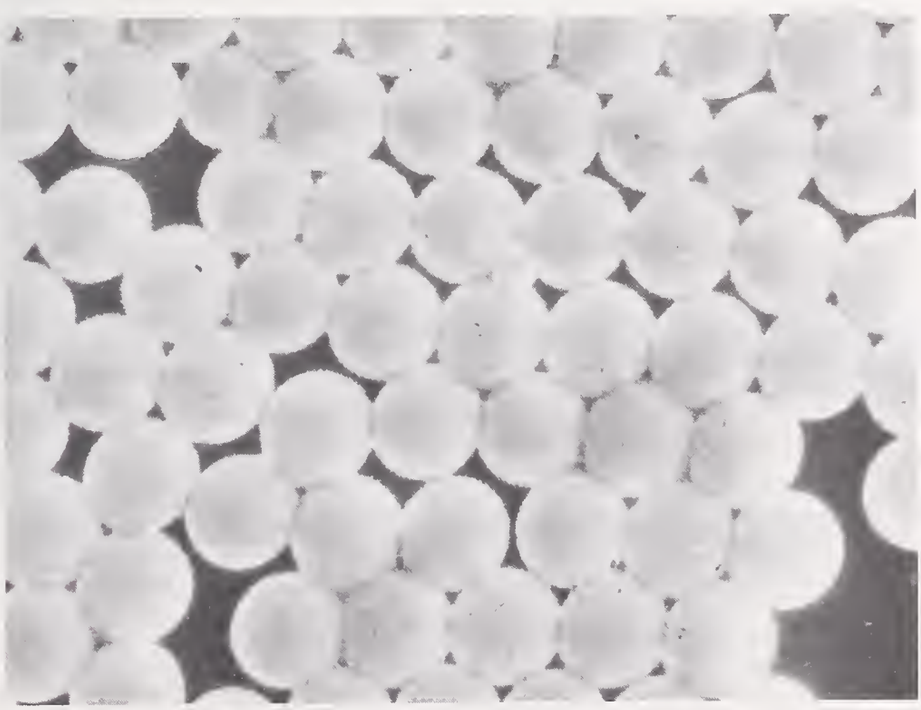
SRM's 1003a and 1690 can be used to calibrate various types of particle size measuring instruments including both light and electrical zone flow-through counters. SRM's 1004, 1017a, 1018a, and 1019a are intended for use in calibrating test sieves.

SRM	Type		Size (μm)	Sieve No.	Wt/Unit
1003a	Glass Spheres		5–50		IN PREP
1004	Glass Spheres		34–120	400–140	63 g
1017a	Glass Spheres	for calibrating	100–310	140–50	84 g
1018a	Glass Spheres	sieves	225–780	60–25	74 g
1019a	Glass Spheres		650–1900	25–12	200 g
1690	Polystyrene Spheres (0.5% wt. concentration in water)		~0.9		5 mL vial
1691	Polystyrene Spheres		~0.3		IN PREP

Cement Turbidimetric and Fineness

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.

SRM	Type	Certification	Unit
114n	Portland Cement	Residue on 45 μm, electroformed sieve wet method	Set of 20 vials
		Surface area (Wagner turbidimeter)	
		Surface area (Air-permeability)	



SRM 1690, Nominal One Micrometer Polystyrene Spheres, is a primary particle size reference standard used for calibration of particle size measuring instruments including microscopes.

Color

These SRM's are available to illustrate a characteristic color for each of the ISCC-NBS color-name blocks in NBS Special Publication 440, COLOR: Universal Language and Dictionary of Names. SRM 2106 consists of 251 color chips on 18 constant-hue centroid color charts, and constitutes a supplement to SP 440. SRM 2107 combines SRM 2106 with SP 440 to form a complete color kit. The 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. (Note: SP 440, may be purchased separately from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.)

SRM	Type	Unit of Issue
2106	Centroid Color Charts	Set: 18 Charts
2107	Color Kit	Set: SRM 2106 and SP 440

Light-Sensitive Papers and Plastic Chips

Light-Sensitive Papers

Standard light-sensitive paper and booklets of standards 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 inches. The booklet contains six strips of 1 1/4 in wide that have been faded by exposure in the NBS master lamp. A copy of NBS Special Publication 260-41, which describes the preparation and use of the materials, is furnished with each booklet.

SRM	Type	Unit of Issue
700d	Light-sensitive paper	Pkg. of 100 pieces—2 5/8 in × 3 1/4 in
701d	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 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
703	Light-sensitive plastic chips	Package of 5 chips 0.060 in thick

X-ray and Photographic

SRM 1001 is a calibrated x-ray film step tablet of 17 steps that cover the optical density range from 0 to 4. SRM 1008 is a calibrated photographic step tablet of 21 steps that cover the optical density range from 0 to 4.

Both step tablets are individually calibrated and certified for diffuse transmission density in conformance with conditions specified for American National Standard Diffuse Visual Transmission Density, D_t (90; 3000 K: $\leqslant 10°$; V), in "ANSI PH 2.19-1976, American National Standard for Diffuse and Doubly Diffuse Transmission Measurements (Transmission Density)."

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 2061 is a calibrated reflection step tablet having 12 steps that cover the optical density range from 0 to 2 on gray scale paper from white to black. It is intended primarily for use in photographic applications requiring color balance or separation.

SRM 2061 is calibrated using methods that conform to conditions specified for American National Standard Annular 45°; 0° Absolute Visual Reflection Density, Type 3000 K, $D_{Ra}(g_a$; 3000 K: $\leqslant 5°$; V) in ANSI PH 2.17-1977.

SRM	Type	Unit
1001	X-ray Film Step Tablet (0–4)	1 tablet, 17 steps
1008	Photographic Step Tablet (0–4)	1 tablet, 21 steps
1010a	Microcopy Resolution Test Chart	Set of 5 charts
2061	Reflection Step Tablet	1 tablet, 12 Steps

For further information regarding calibration services, call 301-921-2805.

Surface Flammability

SRM 1002c, Hardboard Sheet, is issued for checking the operation of radiant panel test equipment in accordance with the procedures outlined in ASTM Standard E162-78.

SRM	Type	Certification	Unit of Issue
1002c	Hardboard Sheet	Flame Spread Index, I=153 Heat Evolution Factor, Q=36.5	Set of 4: 6×18×1/4 inch

Smoke Density Chamber

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
1006b	Non-flaming Exposure Condition (α-cellulose)	Dm (corr.)=183±25	3 sheets
1007a	Flaming Exposure Condition (plastic)	Dm (corr.)=17850(t)-132	3 sheets

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

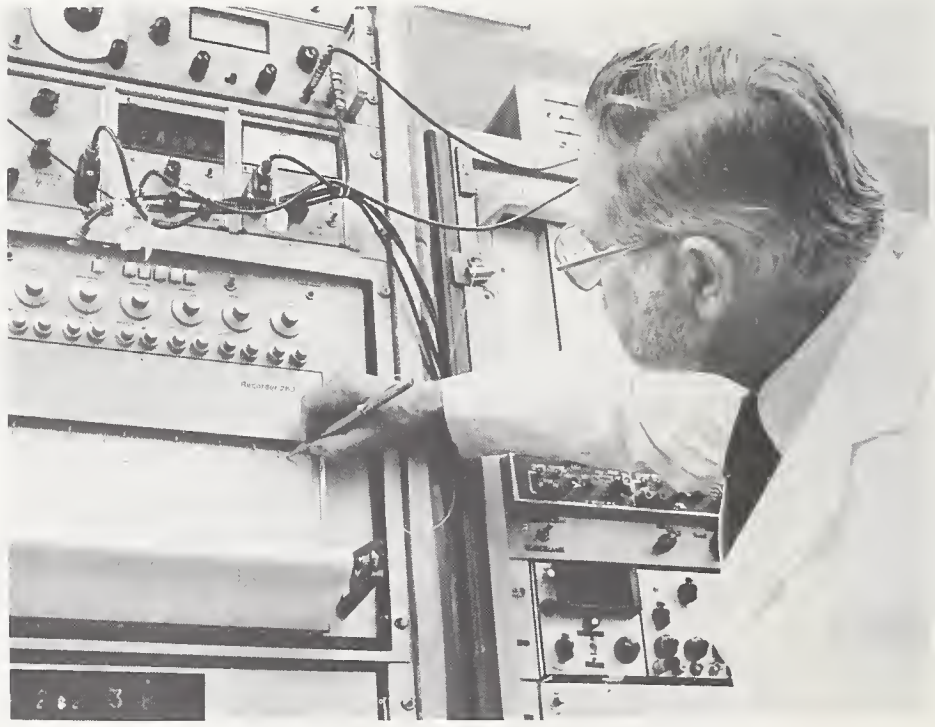
Research Materials (RM's) are distinct from the Standard Reference Materials (SRM's) issued by NBS. The distinction between RM's and SRM's is in the information supplied with them and the purpose for which they are used. Unlike SRM's, RM's are not issued with Certificates of Analysis; rather they are accompanied by a "Report of Investigation," the sole authority of which is the author of the report. RM's are intended primarily to promote scientific or technical research on a particular material. One of the principal reasons for issuing an RM is to provide a 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. The following materials are available:

RM 1C—Ultra-Purity Aluminum Single Crystal Cubes
These cubes 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. Unit of issue: 1 cm on a side.

RM 1R—Ultra-Purity Aluminum Polycrystalline Rods
These rods 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. Unit of issue: 4.2 mm in diameter and 25.4 mm long.

RM 5—Copper Heat Capacity Test Specimen
This material is intended for use in the comparison of heat capacity results from different laboratories and as a test specimen for heat capacity measurement below 25 K. It may also be useful at higher temperatures. RM

SRM 3200, Secondary Standard Magnetic Tape, Computer Amplitude Reference, is used for calibrating the output signal amplitude from computer tape recordings and reproducing systems. James Park notates readings during the production of this SRM.

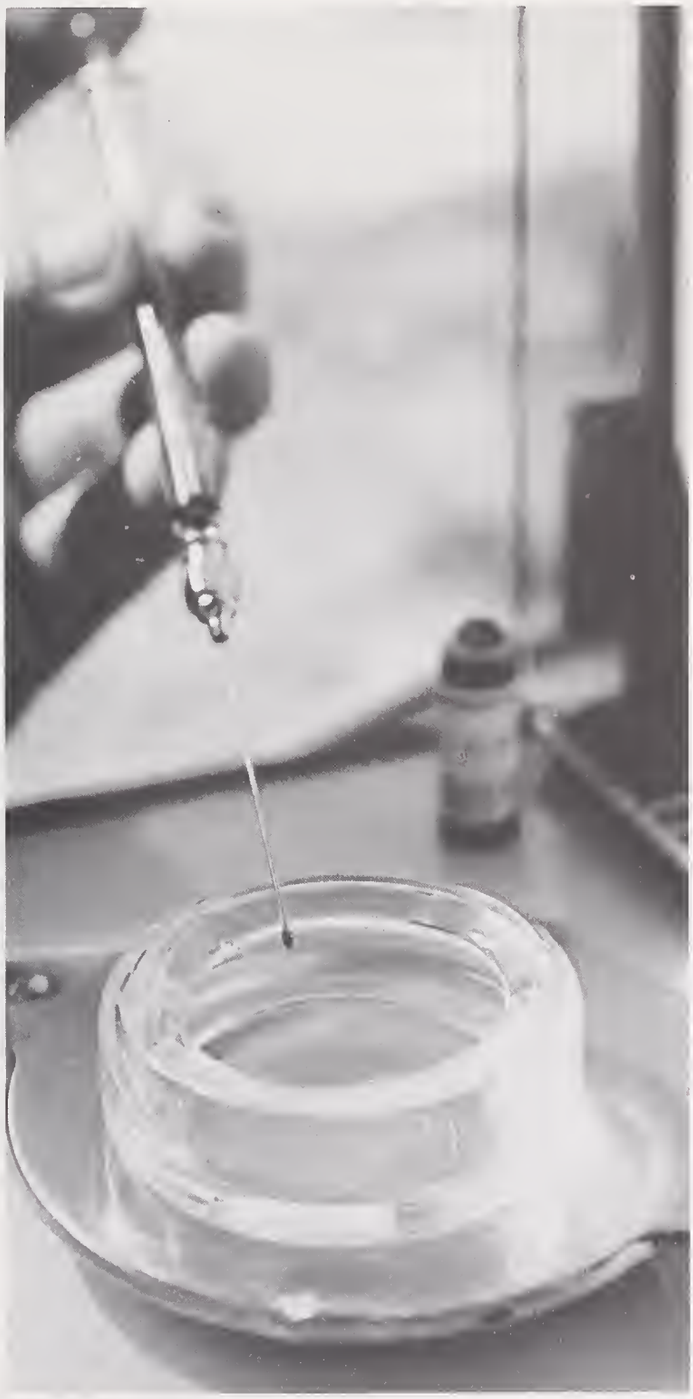


5 is available as a rod of high purity polycrystalline copper. Unit of issue: 19 mm in diameter and 120 mm long.

RM 31—Glass Fibers for Microanalysis
This monogeneous vitreous solid contains known, low-concentration additions of several elements which were developed for electron probe microanalysis (EMPA) and secondary ion mass spectrometry (SIMS). This RM contains ten compositions of various oxides. Unit of issue: set of 10.

RM 45b—Homogeneous River Sediment
This specimen is a freeze-dried river sediment intended for use in testing radiochemical procedures for the assay of radioactivity in sediments and soils. Unit of issue: 100 g.

RM 50—Albacore Tuna
This material is intended to be used in the measurement of elements present at trace concentration. It has been issued as a lyophilized (freeze-dried) marine biological tissue sample in an attempt to satisfy many of the analytical requirements for a base-line marine reference material. The Report of Investigation provides uncertified informational data on mercury, selenium, zinc, arsenic, lead, and a number of other elements of interest to marine scientists. Unit of issue: two 35 g cans.



Kevin Rutledge analyzes SRM 1817, Catalyst Package for Lubricant Oxidation. This SRM evaluates the oxidation stability of lubricating oils, i.e. automotive crackcase lubricants. SRM 1817 stimulates the chemical environment in an operating engine, specifically under the ASTM sequence IIID engine test conditions.

Special Reference Materials

Special Reference Materials (GM's) are 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.

Differential Thermal Analysis

GM's 754, 757, 758, 759, 760, and 761 have been issued by NBS in cooperation with the International Confederation of Thermal Analysis as standards for calibrating differential thermal analysis, differential scanning calorimetry, and thermogravimetry equipment under operating conditions.

GM	Material		Peak Temp. (°C)	Unit
754	Polystyrene	(glass transition)	~105 °C	10 g
757	1,2-Dichloroethane	(melting point)	~–32 °C	4 mL
	Clycohexane			
		(transition point)	~–83 °C	4 mL
		(melting point)	~+ 7 °C	
	Phenyl Ether	(melting point)	~ 30 °C	4 mL
	o-Terphenyl	(melting point)	~ 58 °C	5 g
758	Potassium Nitrate	(transition point)	~128 °C	10 g
	Indium	(melting point)	~157 °C	3 g
	Tin	(melting point)	~232 °C	3 g
	Potassium Perchlorate	(transition point)	~300 °C	10 g
	Silver Sulfate	(transition point)	~430 °C	3 g
759	Potassium Perchlorate	(transition point)	~300 °C	10 g
	Silver Sulfate	(transition point)	~430 °C	3 g
	Quartz	(transition point)	~573 °C	3 g
	Potassium Sulfate	(transition point)	~583 °C	10 g
	Potassium Chromate	(transition point)	~665 °C	10 g
760	Quartz	(transition point)	~573 °C	3 g
	Potassium Sulfate	(transition point)	~583 °C	10 g
	Potassium Chromate	(transition point)	~665 °C	10 g
	Barium Carbonate	(transition point)	~810 °C	10 g
	Strontium Carbonate	(transition point)	~925 °C	10 g
761	Permanorm 3	(magnetic transition)	~259 °C	1 g
	Nickel	(magnetic transition)	~353 °C	1 g
	Mumetal	(magnetic transition)	~381 °C	1 g
	Permanorm 5	(magnetic transition)	~454 °C	1 g
	Trafoperm	(magnetic transition)	~750 °C	1 g

Melting Point

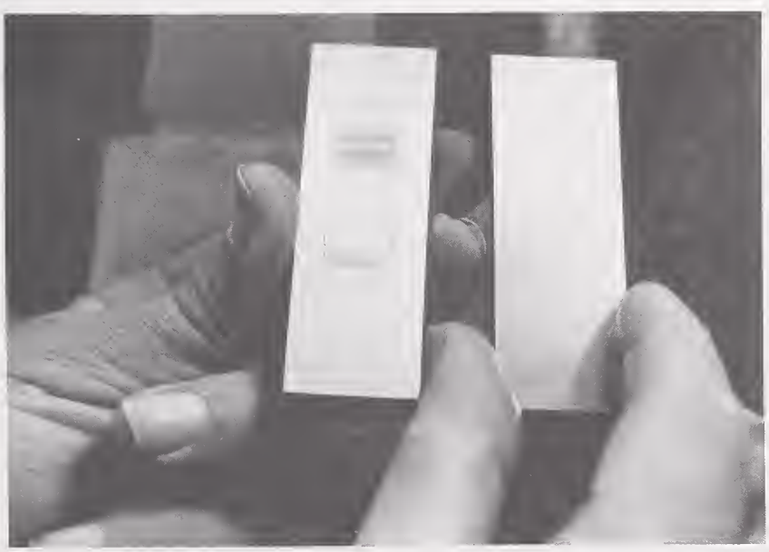
GM 8000 is issued by NBS in cooperation with the Office of Reference Materials at the National Physical Laboratory (NPL) in Teddington, England. This set of ten highly purified substances is intended for use in the calibration of thermometry used in the determining the melting points of samples in glass capillary tubes. Both the meniscus point and the liquefaction point for each substance are certified by NPL.

GM	Type	Melting Point	Amount
8000	4-Nitrotoluene	~ 52 °C	1 g
	Naphthalene	~ 80	1 g
	Benzil	~ 95	1 g
	Acetanilide	~114	1 g
	Benzoic Acid	~122	1 g
	Diphenylacetic Acid	~147	1 g
	Anisic Acid	~183	1 g
	2-Chloroanthraquinone	~210	1 g
	Carbazole	~246	1 g
	Anthraquinone	~285	1 g

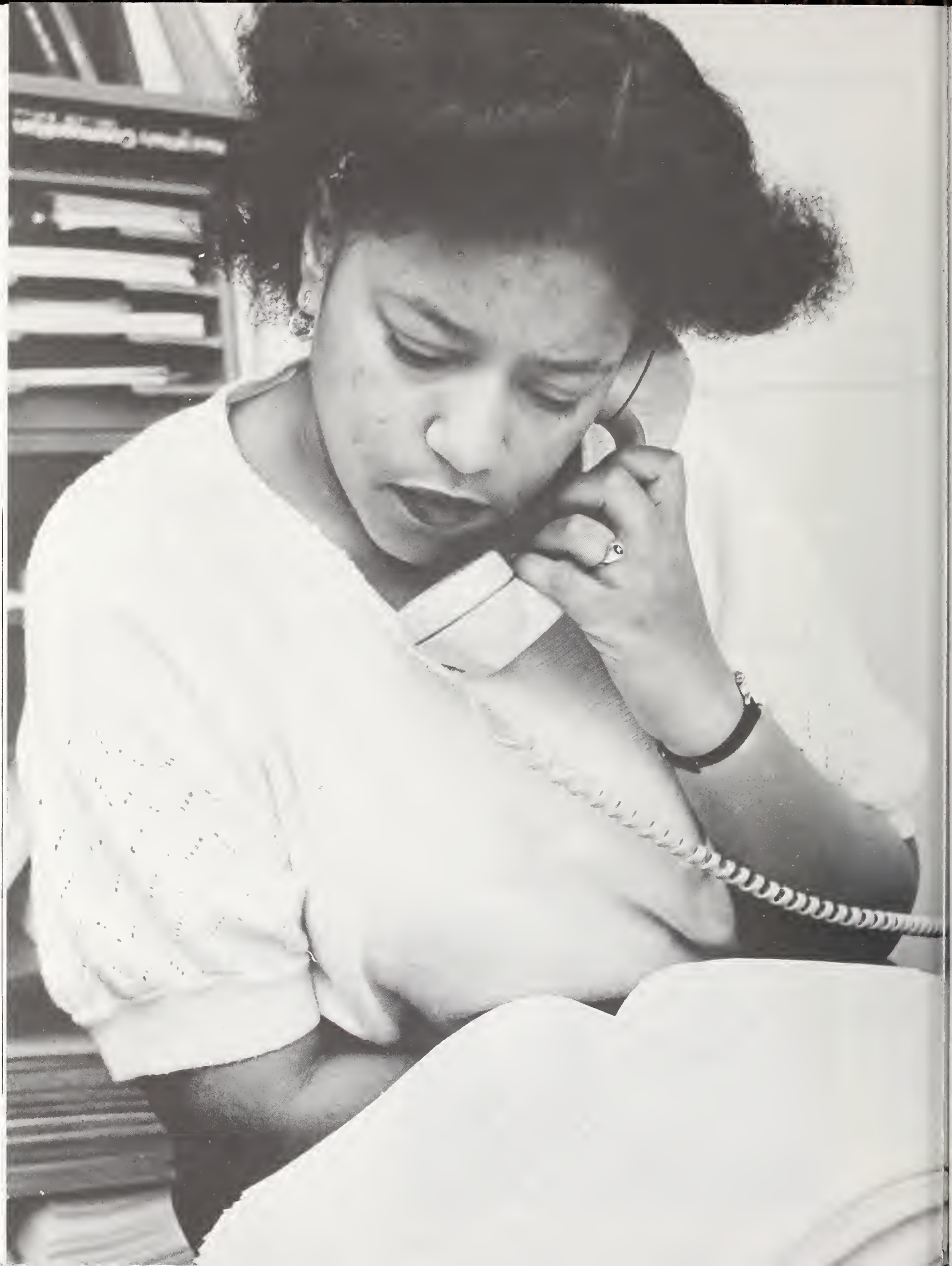
Specific Surface Area of Powders

GM's 8001 through 8008 are issued by NBS in cooperation with the Office of Reference Materials at the National Physical Laboratory (NPL) in Teddington, England. These materials are intended for use in the calibration and checking of instruments for determining the specific surface area of powders by BET.

GM	Type	Surface Area	Amount
8001	Graphitized Carbon Black	11 $m^2 \cdot g^{-1}$	10 g
8002	Graphitized Carbon Black	71	10 g
8003	Non-Porous Silica	166	10 g
8004	Meso-Porous Silica	286	10 g
8005	Alpha Alumina	2.1	50 g
8006	Alpha Alumina	0.3	50 g
8007	Alpha Alumina	0.1	50 g
8008	Alpha Alumina	0.8	50 g



Tool Steel Abrasive Wear Standard, SRM 1857, is intended for use with the dry sand/ rubber wheel abrasion wear method as described in ASTM Standard Practice G65-81, Procedure A.



Additional Information

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 Related Measurement Services

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 Related Measurement Services of the National Bureau of Standards. [Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 (1982 edition) for $6.00].

These services are performed at the National Bureau of Standards Washington laboratories (Gaithersburg, MD) or the National Bureau of Standards laboratories in Boulder, CO.

An abbreviated list of the services offered under this program is given below. For information concerning services not listed below or in NBS Special Publication 250 contact:

Office of Measurement Services
National Bureau of Standards
Washington, DC 20234
Telephone: (301) 921-2805

Washington Services

AC-DC Wattmeters; AC Resistors; Calibrators and Voltmeters (up to 10 Hz)	301-921-2727
Acoustic Measurements	301-921-3607
Aerodynamics	301-921-3684
Angular	301-921-2216
Complex Standards of Length and Diameter	301-921-2216
Data Converters	301-921-2727
Dosimetry for High-dose Applications	301-921-2201
Dosimetry for High-energy Electron Beams	301-921-2361
Electrical Instruments (AC-DC)	301-921-2216
Flatness, Straightness, and Roundness	301-921-2216
Fluid Quantity and Flow Rate Meters	301-921-3681
Force Transducers and Force Measurement Systems	301-921-3884
Gamma-ray and Beta-particle Sources	301-921-2361
Humidity Measurements	301-921-3748
Image Optics and Photography	301-921-2791

Jocelyn Washington is able to respond to customer inquiries about the 1,000 SRM's available from the Office of Standard Reference Materials.

Washington Services (Continued)

Impedance Measurements	301-921-2715
Laboratory Thermometers	301-921-2087
Length	301-921-2216
Length and Diameter Dimensional Metrology	301-921-2216
Mass	301-921-2461
Near and Vacuum Ultraviolet Radiometric Standards	301-921-2356
Photometric Standards	301-921-3613
Neutron Sources and Dosimetry Standardization	301-921-2767
Precision Apparatus	301-921-2715
Pressure and Vacuum Measurements	301-921-2121
Radiation Thermometry	301-921-3613
Radioactivity	301-921-2665
Radiometric Standards	301-921-3613
Resistance Measurements	301-921-2715
Resistance Thermometers	301-921-2757
Spectrophotometric Standards	301-921-2453
Surface Texture	301-921-2159
Thermocouples and Thermocouple Materials	301-921-2069
Ultrasonic Measurements	301-921-3646
Vibration Measurements	301-921-3607
Voltage, Current, and Power Measurement Devices	301-921-3121
Voltage Measurements	301-921-2715
Volume and Density	301-921-2681
X-ray and Gamma-ray Measuring Instruments	301-921-2361

Boulder Services

All measurement services available in Boulder should be directed to:

Measurement Services Clerk
National Bureau of Standards
Boulder, CO 80303
Telephone: (303) 497-3753

Cryogenics
Electromagnetic Quantities
- Attenuation
- Fields
- Impedance or Admittance
- Laser Parameters
- Noise Temperature (Effective)
- Phase Shift
- Power Measurements
- Voltage

Time and Frequency

Computerized data allows Patricia Brletic to provide information on the availability of an SRM to a telephone customer.

Office of Weights and Measures

The NBS Office of Weights and Measures (OWM) operates a Prototype Examination Program which provides for an evaluation of (1) prototype weighing and measuring devices to determine compliance with the requirements of NBS Handbook 44, "Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices," (2) standards to determine compliance with the requirements of NBS Handbook 105-1, 105-2, 105-3 "Specifications and Tolerances for Reference Standard and Field Standard Weights and Measures." This program may be used by manufacturers and weights and measures officials in determining the acceptability of devices for commercial use or the suitability of reference and field standards. For information on programs of NBS and the States, contact:

Office of Weights and Measures
A359, Physics Building
National Bureau of Standards
Washington, DC 20234
(301) 921-2401

Proficiency Sample Programs

General information about the Proficiency Sample Programs may be obtained from:

Proficiency Sample Program
National Bureau of Standards
Washington, DC 20234
(301) 921-3481

Information is available for the following programs:

Proficiency Sample Programs for Hydraulic Cements and Portland Cement Concrete
Proficiency Sample Programs for Soils, Aggregates, and Bituminous Materials
Inspection of Cement and Concrete Testing Laboratories
Inspection of Soils and Bituminous Testing Laboratories

Roger Brown, Carleton Fisher, and James Fort pack SRM shipments for worldwide distribution.

As part of the preparation stage of an SRM, Helen Tyler carefully measures material on a scale before it is bottled and labeled.

Customer orders are sorted, screened, and entered into the computer system by Sandra Barber (front) and Jocelyn Washington (rear).

Structural Engineering—High Capacity Testing Machine

The research and testing facilities for structural engineering include a 53-MN (12 million-lbf) capacity universal testing machine believed to be the largest in the world. A significant addition to the nation's facilities for research and testing in the field of large structures, this unique machine is available to do work for the entire technological community upon consideration of requests on a case-by-case basis. This hydraulically operated machine is a vertical, four screw type with the main fixed platen flush wit the floor. It is capable of applying 53-MN (12×10^6 lbf) in compression to test specimens up to 17 m (58 ft) in height and 27 MN (6×10^6 lbf) in tension to specimens up to 16 m (53 ft) in length. To extend the versatility of the machines, the reinforced concrete foundation incorporates a floor tie-down system which can accommodate test specimens for transverse loading up to 27 m (90 ft) in length. Calibration of all load ranges indicates that they exhibit error generally no greater than 0.5 percent of the applied load. For more information please contact:

Structural Engineering Program
B168, Building Research
National Bureau of Standards
Washington, DC 20234
(301) 921-3471

Accreditation of Testing Laboratories

General information about the National Voluntary Laboratory Accreditation Program (NVLAP) or application packages may be obtained from:

Laboratory Accreditation Manager
Room B141, Technology Building
National Bureau of Standards
Washington, DC 20234
(301) 921-3431

Information is available for the following specific testing areas:

Program for Thermal Insulation Materials
Program for Freshly Mixed Field Concrete
Program for Carpet
Program for Solid Fuel Room Heaters
Program for Personnel Dosimeters Processors
Program for Electromagnetic Calibration Services
Program for Window and Door Products
Acoustical Testing Services

Stanley Rasberry, chief of the Office of Standard Reference Materials, and William Reed, deputy chief, discuss matters important to the SRM program.

Lee Kieffer, project manager, Thomas Gills, production manager, and William Reed, deputy chief, coordinate the development of each SRM from conception to final product.

National Center for Standards and Certification Information

The National Center for Standards and Certification Information (NBS-NCSCI) maintains a reference collection of some 240,000 engineering and related standards issued by U.S. technical societies, professional organizations, and trade associations; State purchasing offices; U.S. Federal Government agencies; and major foreign national and international standardizing bodies. NBS-NCSCI publishes general and special indexes of standards. Information services which are free consist of searching Key-Word-In-Context (KWIC) Indexes to determine whether there are any published standards, specifications, codes, test methods, or recommended practices for a given item or product. Inquiries should be directed to:

National Center for Standards and Certification Information
Room B166, Technology Building
National Bureau of Standards
Washington, DC 20234
(301) 921-2587

National Standard Reference Data System

The National Standard Reference Data System (NSRDS) is a nationwide program established to compile and critically evaluate quantitative physical science data and assure its availability to the technical community. The program publishes compilations of critically evaluated data, critical reviews of experimental techniques, 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 bimonthly newsletter is available on request. Inquiries or requests for further information should be directed to:

Office of Standard Reference Data
A323, Physics Building
National Bureau of Standards
Washington, DC 20234
(301) 921-2104

Foreign orders are processed by Ruth Meyer, who also answers inquiries regarding foreign shipments and overdue accounts.

The management of the computer system is handled by Lee Klein, data processing manager. This system is able to process a normal customer order in three days.

Guide of Requesting Development of Standard Reference Materials

The National Bureau of Standards has the function to develop, produce, and distribute Standard Reference Materials (SRM's) that provide a basis for comparison of measurements on materials and that aid in the control of production processes. To perform 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.

NBS currently has over 1000 SRM's available, about 100 new ones in preparation, and requests for the preparation of many others.

In developing an NBS-SRM, the candidate material must meet one or more of the criteria listed below.

1. The SRM must permit users to attain more accurate measurements.
2. The production of the SRM elsewhere is not economically or technically feasible.
3. The SRM would be an industry-wide standard for commerce from a neutral source not otherwise available.
4. NBS production of the SRM would provide continued availability from a common source for a highly characterized material that is important to science, industry, or government.

NBS has recognized and responded to the need to enlarge the scope of the program 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. However, the demand for new SRM's greatly exceeds the Bureau's capacity to produce and certify these materials. Consequently, requests for new SRM's that would have limited use, or for which the need is not very great, are deferred in favor of requests that clearly show a critical need. To determine which requests are to receive top priority, NBS needs and heavily relies upon the information supplied by industry, either through its own representatives or through interested organizations, such as the American National Standards Institute, American Nuclear Society, American Petroleum Institute, American Society for Testing and Materials, etc.

Accordingly, while the Bureau welcomes all requests for the development of new SRM's, both the Bureau and industry would be helped if such requests are accompanied by information that will permit an objective assessment of the urgency and importance of proposed new reference materials.

Requests for the development and new Standard Reference Materials should include as much of the information listed below as possible.

1. Short title of the proposed Standard Reference Material.
2. Purpose for which the SRM would be used.
3. Reasons why the SRM is needed.
4. Special characteristics and/or requirements for the material. Include additional requirements and reasons, if more than one SRM is necessary for standardization in this area.
5. Your estimate of the possible present and future (6–10 year) demand for such an SRM in your own operations and elsewhere. (National and international estimates are very useful.)
6. Whether such an SRM, or a similar one, can be produced by, or obtained from a source other than NBS. If so, give reasons to justify its preparation by NBS.
7. Miscellaneous pertinent information to aid justification for the SRM, such as: (a) an estimate of the range of application, monetary significance of the measurement affected, 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.

Requests should be sent to:

Office of Standard Reference Materials
National Bureau of Standards
B311, Chemistry Building
Washington, DC 20234

Dolly Downs prepares the certificates that are supplied with each SRM. This certificate provides the customer with all pertinent information about the SRM, its intended use, and method of certification.

Certified Reference Materials From Other Sources

Sources of certified reference materials (CRM's) are now world wide. The International Organization for Standardization (ISO), through its Council Committee on Reference Materials (REMCO), has prepared an international Directory of Certified Reference Materials. Inquiries may be directed to:

Dr. M. Parkany
Secretary for REMCO
International Organization for Standardization
1, Rue de Varembe
Case Postale 56
1211 Geneva 20
Switzerland

In the period 1972–83, the International Union of Pure and Applied Chemistry (IUPAC), through its Commission on Physicochemical Measurements and Standards, prepared and issued a catalog of CRM's that are useful for the realization of physicochemical properties. It also has prepared a number of related documents. Information may be obtained by writing:

Dr. K. N. Marsh
Chairman, IUPAC Commission I.4
Physicochemical Measurements and Standards
The University of New England
Armidale, NSW
Post Code 2361
Australia

The current IUPAC edition is: *Physicochemical Measurements: Catalogue of Reference Materials from National Laboratories*, Revised 1976, Pure & Appl. Chem., 48, 503-414 (1976).
Major government and national laboratories which supply CRM's are listed below:

Country	National Laboratory
Australia	Commonwealth Scientific and Industrial Research Organization National Standards Laboratory University Grounds, City Road Chippendale, NSW 2008 Australia
Brazil	Instituto de Pesiquisas Technologicas do Estado de Sao Paulo S/A—IPT Divisao de Quimica e Engenharia Quimica Nucleo de Padroes Analiticos Caixa Postal 7141 01000 Sao Paulo SP Brazil
Canada	Canadian Certified Reference Materials Project C/O Mineral Sciences Laboratories, CAMNET Canada Centre for Mineral and Energy Technology 555 Booth Street Ottawa, Ontario K1A OG1 Canada
France	Bureau National de Metrologie (B.N.M.) 8-10, Rue Crillon 75194 Paris Cedex 04 France or Service des Materiaux de Reference (S.M.R.) 1, Rue Gaston Boissier 75015 Paris France

(Continued)

Germany (West)	Bundesanstalt fur Materialprufung (BAM) Unter den Eichen 87 D-1000 Berlin 45 Germany, F.R. Physikalisch-Technishe Bundesanstalt (PTB) Bundesallee 100 D-3300 Braunschweig Germany, F.R.
Hungary	National Office of Measures P.O. Box 19 H-1531 Budapest Hungary
Japan	Standards Department Agency of Industrial Science and Technology Ministry of International Trade and Industry 3-1, Kasumigaseki 1, Chiyodaku, Tokyo Japan
Netherlands	Institute for Physical Chemistry TNO Utrechtseweg 48, P.O. Box 108 Zeist Netherlands Rijks Institute voor Volkgezondheid P.O. Box 1 Bilthoven Netherlands
Poland	Division of Physico-Chemical Metrology National Board for Quality Control and Measures 2, Elektoralna Street Warsaw Poland
South Africa	South African Bureau of Standards Private Bag X191 Pretoria, Transvaal 0001 Republic of South Africa
United Kingdom	National Physical Laboratory Office of Reference Materials Teddington, Middlesex TW11 OLW United Kingdom British Standards Institution 10 Blackfriars Street Manchester, M3 5DT United Kingdom
United States	National Bureau of Standards Office of Standard Reference Materials B311, Chemistry Building Washington, DC 20234 USA U.S. Department of Energy New Brunswick Laboratory 9800 South Cass Avenue, D-350 Argonne, IL 60439 USA Center for Disease Control Atlanta, GA 30333 USA

(Continued)

USSR	Gosstandart 9, Leninsky Prospekt 117049 Moscow USSR
Multinational	Community Bureau of Reference (BCR) Directorate General XII, CEE 200, Rue de la Loi B-1049 Brussels Belgium Central Bureau of Nuclear Measurements Commission of the European Communities Geel Establishment Steenweg op Retie B-2440 Geel Belgium International Atomic Energy Agency Analytical Quality Control Services Laboratory Seibersdorf P.O. Box 590 A-1011 Vienna Austria WHO Collaborating Centre for Chemical Reference Substances Apotekens Centrallaboratorium Box 3045 S-171 03 Solna Sweden World Health Organization CH-1211 Geneva 27 Switzerland

Claudia Engel processes foreign orders, handles paperwork for special methods of payment, and prepares invoices for mailing to customers.

Other NBS Publications in the 260 Series

Hudson, C. H., ed., Catalog of NBS Standard Reference Materials (1984-85 edition), NBS Spec. Publ. 260 (January 1984).

Michaelis, R. E., and Wyman, L. L., Standard Reference Materials: Preparation of White Cast Iron Spectrochemical Standards, NBS Misc. Publ. 260-1 (June 1964). COM74-11061**

Michaelis, R. E., Wyman, L. L., and Flitsch, R., Standard Reference Materials: Preparation of NBS Copper-Base Spectrochemical Standards, NBS Misc. Publ. 260-2 (October 1964). COM7411063**

Michaelis, R. E., Yakowitz, H., and Moore, G. A., Standard Reference Materials: Metallographic Characterization of an NBS Spectrometric LowAlloy Steel Standard, NBS Misc. Publ. 260-3 (October 1964). COM74-11060**

Hague, J. L., Mears, T. W., and Michaelis, R. E., Standard Reference Materials: Sources of Information, NBS Misc. Publ. 260-4 (February 1965). COM74-11059

Alvarez, R., and Flitsch, R., Standard Reference Materials: Accuracy of Solution X-Ray Spectrometric Analysis of Copper-Base Alloys, NBS Misc. Publ. 260-5 (March 1965). PB168068**

Shultz, J. I., Standard Reference Materials: Methods for the Chemical Analysis of White Cast Iron Standards, NBS Misc. Publ. 260-6 (July 1965). COM74-11068**

Bell, R. K., Standard Reference Materials: Methods for the Chemical Analysis of NBS Copper-Base Spectrochemical Standards, NBS Misc. Publ. 260-7 (October 1965). COM74-11067**

Richmond, M. S., Standard Reference Materials: Analysis of Uranium Concentrates at the National Bureau of Standards, NBS Misc. Publ. 260-8 (December 1965). COM74-11066**

Anspach, S. C., Cavallo, L. M., Garfinkel, S. B., Hutchinson, J. M. R., and Smith, C. N., Standard Reference Materials: Half Lives of Materials Used in the Preparation of Standard Reference Materials of Nineteen Radioactive Nuclides Issued by the National Bureau of Standards, NBS Misc. Publ. 260-9 (November 1965). COM74-11065**

Yakowitz, H., Vieth, D. L., Heinrich, K. F. J., and Michaelis, R. E., Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards II: Cartridge Brass and Low-Alloy Steel, NBS Misc. Publ. 260-10 (December 1965). COM7411064**

Napolitano, A., and Hawkins, E. G., Standard Reference Materials: Viscosity of Standard Lead-Silica Glass, NBS Misc. Publ. 260-11 (November 1966). NBS Misc. Publ. 260-11**

Yakowitz, H., Vieth, D. L., and Michaelis, R. E., Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards III: White Cast Iron and Stainless Steel Powder Compact, NBS Misc. Publ. 260-12 (September, 1966). NBS Misc. Publ. 260-12**

Spijkerman, J. L., Snediker, D. K., Ruegg, F. C., and DeVoe, J. R., Standard Reference Materials: Mossbauer Spectroscopy Standard for the Chemical Shift of Iron Compounds, NBS Misc. Publ. 260-13 (July 1967). NBS Misc. Publ. 260-13**

Menis, O., and Sterling, J. T., Standard Reference Materials: Determination of Oxygen in Ferrous Materials - SRM 1090, 1091, and 1092, NBS Misc. Publ. 260-14 (September 1966). NBS Misc. Publ. 260-14**

Passaglia, E., and Shouse, P. J., Standard Reference Materials: Recommended Method of Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light, NBS Misc. Publ. 260-15 (June 1967). (Replaced by NBS Spec. Publ. 260-41.)

Yakowitz, H., Michaelis, R. E., and Vieth, D. L., Standard Reference Materials: Homogeneity Characterization of NBS Spectrometric Standards IV: Preparation and Microprobe Characterization of W-20% MO Alloy Fabricated by Powder Metallurgical Methods, NBS Spec. Publ. 260-16 (January 1969). COM74-11062**

Catanzaro, E. J., Champion, C. E., Garner, E. L., Marinenko, G., Sappenfield, K. M., and Shields, W. R. Standard Reference Materials: Boric Acid; Isotopic and Assay Standard Reference Materials, NBS Spec. Publ. 260-17 (February 1970). Out of Print.

Geller, S. B., Mantek, P. A., and Cleveland, N. G., Standard Reference Materials: Calibration of NBS Secondary Standard Magnetic Tape (Computer Amplitude Reference) Using the Reference Tape Amplitude Measurement "Process A", NBS Spec. Publ. 260-18 (November 1969). (See NBS Spec. Publ. 260-29.)

Paule, R. C., and Mandel, J., Standard Reference Materials: Analysis of Interlaboratory Measurements on the Vapor Pressure of Gold (Certification of Standard Reference Material 745). NBS Spec. Publ. 260-19 (January 1970). PB190071**

Paule, R. C., and Mandel, J., Standard Reference Materials: Analysis of Interlaboratory Measurements on the Vapor Pressures of Cadmium and Silver, NBS Spec. Publ. 260-21 (January 1971). COM74-11359**

Yakowitz, H., Fiori, C. E., and Michaelis, R. E., Standard Reference Materials: Homogeneity Characterization of Fe-3 Si Alloy, NBS Spec. Publ. 260-22 (February 1971). COM74-11357**

Napolitano, A., and Hawkins, E. G., Standard Reference Materials: Viscosity of a Standard Borosilicate Glass, NBS Spec. Publ. 260-23 (December 1970). COM71-00157**

Sappenfield, K. M., Marinenko, G., and Hague, J. L., Standard Reference Materials: Comparison of Redox Standards, NBS Spec. Publ. 260-24 (January 1972). COM72-50058**

Hicho, G. E., Yakowitz, H., Rasberry, S. D., and Michaelis, R. E., Standard Reference Materials: A Standard Reference Material Containing Nominally Four Percent Austenite, NBS Spec. Publ. 260-25 (February 1971). COM74-11356**

Martin, J. F., Standard Reference Materials: National Bureau of Standards-US Steel Corporation Joint Program for Determining Oxygen and Nitrogen in Steel, NBS Spec. Publ. 260-26 (February 1971). SN003-00300786-2*

Garner, E. L., Machlan, L. A., and Shields, W. R., Standard Reference Materials: Uranium Isotopic Standard Reference Materials, NBS Spec. Publ. 260-27 (April 1971). COM74-11358**

Heinrich, K. F. J., Myklebust, R. L., Rasberry, S. D., and Michaelis, R. E., Standard Reference Materials: Preparation and Evaluation of SRM's 481 and 482 GoldSilver and Gold-Copper Alloys for Microanalysis, NBS Spec. Publ. 260-28 (August 1971). COM71-50365**

Geller, S. B., Standard Reference Materials: Calibration of NBS Secondary Standard Magnetic Tape (Computer Amplitude Reference) Using the Reference Tape Amplitude Measurement "Process A-Model 2," NBS Spec. Publ. 260-29 (June 1971). COM71-50282

Gorozhanina, R. S., Freedman, A. Y., and Shaievitch, A. B. (translated by M. C. Selby), Standard Reference Materials: Standard Samples Issued in the USSR (A Translation from the Russian). NBS Spec. Publ. 260-30 (June 1971). COM71-50283**

Hust, J. G., and Sparks, L. L., Standard Reference Materials: Thermal Conductivity of Electrolytic Iron SRM 734 from 4 to 300 K, NBS Spec. Publ. 260-31 (November 1971). COM7150563**

Mavrodineanu, R., and Lazar, J. W., Standard Reference Materials: Standard Quartz Cuvettes, for High Accuracy Spectrophotometry, NBS Spec. Publ. 260-32 (December 1973). SN003-003-01213-1*

Wagner, H. L., Standard Reference Materials: Comparison of Original and Supplemental SRM 705, Narrow Molecular Weight Distribution Polystyrene, NBS Spec. Publ. 260-33 (May 1972). COM72-50526**

Sparks, L. L., and Hust, J. G., Standard Reference Materials: Thermoelectric Voltage, NBS Spec. Publ. 260-34 (April 1972). COM72-50371**

Sparks, L. L., and Hust, J. G., Standard Reference Materials: Thermal Conductivity of Austenitic Stainless Steel, SRM 735 from 5 to 280 K, NBS Spec. Publ. 260-35 (April 1972.) COM72-50368**

Cali, J. P., Mandel, J., Moore, L. J., and Young, D. S., Standard Reference Materials: A Reference Method for the Determination of Calcium in Serum, NBS SRM 915, NBS Spec. Publ. 260-36 (May 1972). COM72-50527**

Shultz, J. I., Bell, R. K., Rains, T. C., and Menis, O., Standard Reference Materials: Methods of Analysis of NBS Clay Standards, NBS Spec. Publ. 260-37 (June 1972). COM72-50692**

Richmond, J. C., and Hsia, J. J., Standard Reference Materials: Preparation and Calibration of Standards of Spectral Specular Reflectance, NBS Spec. Publ. 260-38 (May 1972). COM72-50528**

Clark, A. F., Denson, V. A., Hust, J. G., and Powell, R. L., Standard Reference Materials: The Eddy Current Decay Method for Resistivity Characterization of High-Purity Metals, NBS Spec. Publ. 260-39 (May 1972). COM72-50529**

McAdie, H. G., Garn, P. D., and Menis, O., Standard Reference Materials: Selection of Thermal Analysis Temperature Standards Through a Cooperative Study (SRM 758, 759, 760), NBS Spec. Publ. 260-40 (August 1972). COM72-50776**

Wood, L. A., and Shouse, P. J., Standard Reference Materials: Use of Standard Light-Sensitive Paper for Calibrating Carbon Arcs Used in Testing Textiles for Colorfastness to Light, NBS Spec. Publ. 260-41 (August 1972). COM72-50775**

Wagner, H. L., and Verdier, P. H., eds., Standard Reference Materials: The Characterization of Linear Polyethylene, SRM 1475, NBS Spec. Publ. 260-42 (September 1972). COM7250944**

Yakowitz, H., Ruff, A. W., and Michaelis, R. E., Standard Reference Materials: Preparation and Homogeneity Characterization of an Austenitic Iron-Chromium-Nickel Alloy, NBS Spec. Publ. 260-43 (November 1972). COM73-50760**

Schooley, J. F., Soulen, R. J., Jr., and Evans, G. A., Jr., Standard Reference Materials: Preparation and Use of Superconductive Fixed Point Devices, SRM 767, NBS Spec. Publ. 260-44 (December 1972). COM73-50037**

Greifer, B., Maienthel, E. J., Rains, T. C., and Rasberry, S. D., Standard Reference Materials: Powdered Lead-Based Paint, SRM 1579, NBS Spec. Publ. 260-45 (March 1973). COM73-50226**

Hust, J. G., and Giarratano, P. J., Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials: Austenitic Stainless Steel, SRM's 735 and 798, from 4 to 1200 K, NBS Spec. Publ. 260-46 (March 1975). SN003-003-01278-5*

Hust, J. G., Standard Reference Materials: Electrical Resistivity of Electrolytic Iron, SRM 797, and Austenitic Stainless Steel, SRM 798, from 5 to 280 K, NBS Spec. Publ. 26047 (February 1974). COM74-50176**

Mangum, B. W., and Wise, J. A., Standard Reference Materials: Description and Use of Precision Thermometers for the Clinical Laboratory, SRM 933 and SRM 934, NBS Spec. Publ. 260-48 (May 1974). SN003-003-01278-5*

Carpenter, B. S., and Reimer, G. M., Standard Reference Materials: Calibrated Glass Standards for Fission Track Use, NBS Spec. Publ. 260-49 (November 1974). SN003-003-01344-7*

Hust, J. G., and Giarratano, P. J., Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials: Electrolytic Iron, SRM's 734 and 797 from 4 to 1000 K, NBS Spec. Publ. 260-50 (June 1975). SN003-003-01425-7*

Mavrodineanu, R., and Baldwin, J. R., Standard Reference Materials: Glass Filters As a Standard Reference Material for Spectrophotometry; Selection; Preparation; Certification; Use-SRM 930, NBS Spec. Publ. 260-51 (November 1975). SN003-003-01481-8*

Hust, J. G., and Giarratano, P. J., Standard Reference Materials: Thermal Conductivity and Electrical Resistivity Standard Reference Materials 730 and 799, from 4 to 3000 K, NBS Spec. Publ. 260-52 (September 1975). SN003-003-01464-8*

Durst, R. A., Standard Reference Materials: Standardization of pH Measurements, NBS Spec. Publ. 260-53 (December 1975, Revised). SN003-003-01551-2*

Burke, R. W., and Mavrodineanu, R., Standard Reference Materials: Certification and Use of Acidic Potassium Dichromate Solutions as an Ultraviolet Absorbance Standard, NBS Spec. Publ. 260-54 (August 1977). SN003-003-01828-7*

Ditmars, D. A., Cezairliyan, A., Ishihara, S., and Douglas, T. B., Standard Reference Materials: Enthalpy and Heat Capacity; Molybdenum SRM 781, From 273 to 2800 K, NBS Spec. Publ. 260-55 (September 1977). SN003-003-01836-8*

Powell, R. L., Sparks, L. L., and Hust, J. G., Standard Reference Materials: Standard Thermocouple Material, Pt.-27: SRM 1967, NBS Spec. Publ. 260-56 (February 1978). SN0003-003-018864*

Cali, J. P. and Plebanski, T., Guide to United States Reference Materials, NBS Spec. Publ. 260-57 (February 1978). SN003-003-01883-0*

Barnes, J. D. and Martin, G. M., Standard Reference Materials: Polyester Film for Oxygen Gas Transmission Measurements. SRM 1470, NBS Spec. Publ. 260-58 (June 1979). SN003-003-02077-0*

Chang, T. and Kahn, A. H., Standard Reference Materials: Electron Paramagnetic Resonance Intensity Standard: SRM 2601, NBS Spec. Publ. 260-59 (August 1978). SN003-003-01975-5*

Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., and Moody, J. R., Standard Reference Materials: A Reference Method for the Determination of Sodium in Serum, NBS Spec. Publ. 260-60 (August 1978). SN003-003-01978-0*

Verdier, P. H., and Wagner, H. L., Standard Reference Materials: The Characterization of Linear Polyethylene (SRM 1482, 1483, 1484), NBS Spec. Publ. 260-61 (December 1978). SN003-003-02006-1*

Soulen, R. J., and Dove, R. B., Standard Reference Materials: Temperature Reference Standard for Use Below 0.5 K (SRM 768). NBS Spec. Publ. 260-62 (April 1979). SN003-003-02047-8*

Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., Machlan, L. A., and Gramlich, J. W., Standard Reference Materials: A Reference Method of the Determination of Potassium in Serum. NBS Spec. Publ. 260-63 (May 1979). SN003-003-02068*

Velapoldi, R. A., and Mielenz, K. D., Standard Reference Materials: A Fluorescence Standard Reference Material Quinine Sulfate Dihydrate (SRM 936), NBS Spec. Publ. 260-64 (January 1980). SN003-003-02148-2*

Marinenko, R. B., Heinrich, K. F. J., and Ruegg, F. C., Standard Reference Materials: Micro-Homogeneity Studies of NBS Standard Reference Materials, NBS Research Materials, and Other Related Samples. NBS Spec. Publ. 260-65 (September 1979). SN003-003-02114-1*

Venable, W. H., Jr., and Eckerle, K. L., Standard Reference Materials: Didymium Glass Filters for Calibrating the Wavelength Scale of Spectrophotometers (SRM 2009, 2010, 2013). NBS Spec. Publ. 260-66 (October 1979). SNOO3-003-02127-0*

Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., Murphy, T. J., and Gramlich, J. W., Standard Reference Materials: A Reference Method for the Determination of Chloride in Serum, NBS Spec. Publ. 260-67 (November 1979). SN003-003-02136-9*

Mavrodineanu, R. and Baldwin, J. R., Standard Reference Materials: Metal-On-Quartz Filters as a Standard Reference Material for Spectrophotometry-SRM 2031, NBS Spec. Publ. 260-68 (April 1980). SN003-003-02167-9*

Velapoldi, R. A., Paule, R. C., Schaffer, R., Mandel, J., Machlan, L. A., Garner, E. L., and Rains, T. C., Standard Reference Materials: A Reference Method for the Determination of Lithium in Serum, NBS Spec. Publ. 260-69 (July 1980). SN003-003-02214-4*

Marinenko, R. B., Biancaniello, F., Boyer, P. A., Ruff, A. W., DeRobertis, L., Standard Reference Materials: Preparation and Characterization of an Iron-Chromium-Nickel Alloy for Microanalysis, NBS Spec. Publ. 260-70 (May 1981). SN003-003-02328-1*

Seward, R. W., and Mavrodineanu, R., Standard Reference Materials: Summary of the Clinical Laboratory Standards Issued by the National Bureau of Standards, NBS Spec. Publ. 260-71 (November 1981). SN003-003-02381-7*

Reeder, D. J., Coxon, B., Enagonio, D., Christensen, R. G., Schaffer, R., Howell, B. F., Paule, R. C., Mandel, J., Standard Reference Materials: SRM 900, Antiepilepsy Drug Level Assay Standard, NBS Spec. Publ. 260-72 (June 1981). SN003-003-02329-9*

Interrante, C. G., and Hicho, G. E., Standard Reference Materials: A Standard Reference Material Containing Nominally Fifteen Percent Austenite (SRM 486), NBS Spec. Publ. 260-73 (January 1982). SN003-003-02386-8*

Marinenko, R. B., Standard Reference Materials: Preparation and Characterization of K-411 and K-414 Mineral Glasses for Microanalysis: SRM 470. NBS Spec. Publ. 260-74 (April 1982). SN003-003-023-95-7*

Weidner, V. R., Hsia, J. J., Standard Reference Materials: Preparation and Calibration of First Surface Aluminum Mirror Specular Reflectance Standards (SRM 2003a), NBS Spec. Publ. 260-75 (May 1982). SN003-003-023-99-0*

Hicho, G. E. and Eaton, E. E., Standard Reference Materials: A Standard Reference Material Containing Nominally Five Percent Austenite (SRM 485a), NBS Spec. Publ. 260-76 (August 1982).*

Furukawa, G. T., Riddle, J. L., Bigge, W. G., and Pfieffer, E. R., Standard Reference Materials: Application of Some Metal SRM's as Thermometric Fixed Points, NBS Spec. Publ. 260-77 (August 1982).*

Hicho, G. E. and Eaton, E. E., Standard Reference Materials: Standard Reference Material Containing Nominally Thirty Percent Austenite (SRM 487), NBS Spec. Publ. 260-78 (September 1982). SN003-003-024-35-0*

Richmond, J. C., Hsia, J. J., Weidner, V. R., and Wilmering, D. B., Standard Reference Materials: Second Surface Mirror Standards of Specular Spectral Reflectance (SRM's 2023, 2024, 2025), NBS Spec. Publ. 260-79 (October 1982). SN003-003-024-47-3*

Schaffer, R., Mandel, J., Sun, T., Cohen, A., and Hertz, H. S., Standard Reference Materials: Evaluation by an ID/MS Method of the AACC Reference Method for Serum Glucose, NBS Spec. Publ. 260-80 (October 1982). SN003-003-024-43-1*

Burke, R. W., Mavrodineanu, R. (NBS retired). Standard Reference Materials: Accuracy in Analytical Spectrophotometry, NBS Spec. Publ. 260-81 (April 1983). SN003-003-024-84-8*

Weidner, V. R., Standard Reference Materials: White Opal Glass Diffuse Spectral Reflectance Standards for the Visible Spectrum (SRM's 2015 and 2016). NBS Spec. Publ. 260-82 (April 1983). SN-003-003024-89-9*

Bowers, G. N., Jr., Alvarez, R., Cali, J. P. (NBS retired), Eberhardt, K. R., Reeder, D. J., Schaffer, R., Uriano, G. A., Standard Reference Materials: The Measurement of the Catalytic (Activity) Concentration of Seven Enzymes in NBS Human Serum SRM 909. NBS Spec. Publ. 260-83 (June 1983). SN003-003-024-99-6*

Gills, T. E., Seward, R. W. Collins, R. J., and Webster, W. C., Standard Reference Materials: Sampling, Materials Handling, Processing, and Packaging of NBS Sulfur in Coal Standard Reference Materials, 2682, 2683, 2684 and 2685. NBS Spec. Publ. 260-84 (In Press).

Swyt, D. A., Standard Reference Materials: A Look at Techniques for the Dimensional Calibration of Standard Microscopic Particles. NBS Spec. Publ. 260-85 (In Press).

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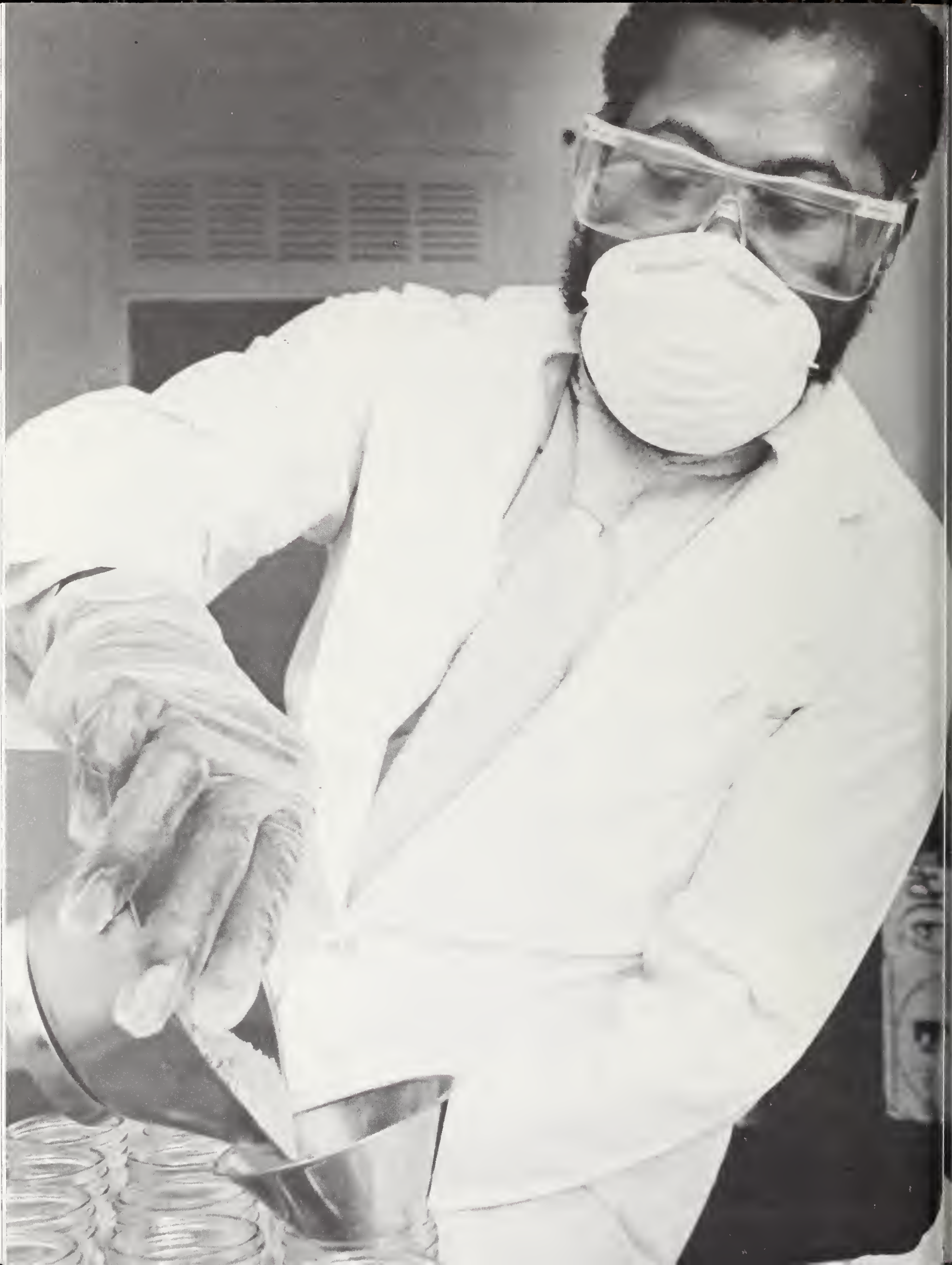

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The Certificate date listed is the current version of the Certificate. Those dates followed by the letter "P" indicate that it is a Provisional Certificate.

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 value are certified, the final Certificate is issued.

SRM purchasers whose Certificate shows an earlier date then listed below may obtain the current version of the Certificate from the Office of Standard Reference Materials, Room B311, Chemistry Building, National Bureau of Standards, Washington, DC 20234.

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

A. Individually Certified.
B. The materials 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. Special Reference Material: Information provided, but not certified by NBS.
G. Set of SRM's: Issued with Certificates for the individual SRM's.
H. Not individually issued; part of a set.

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