

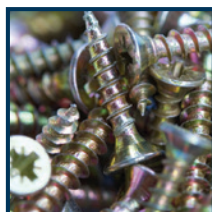
# SRM

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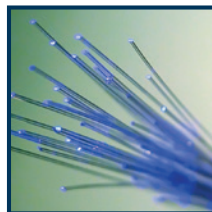
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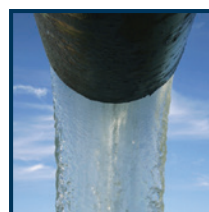
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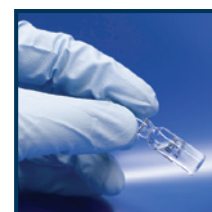
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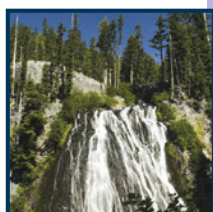
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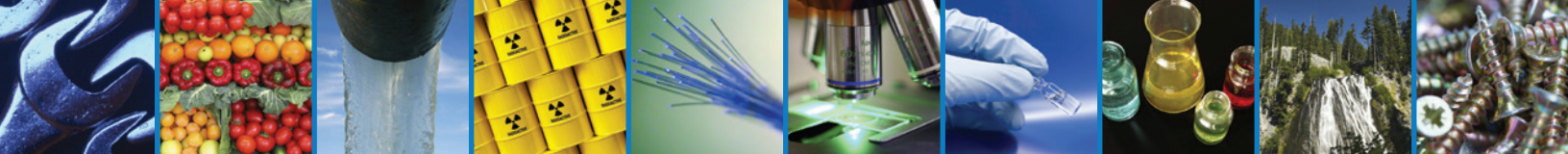
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January 2018

*Editors: Regina R. Montgomery and  
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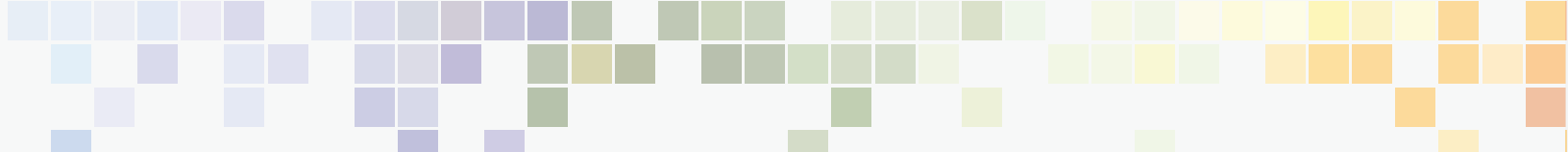
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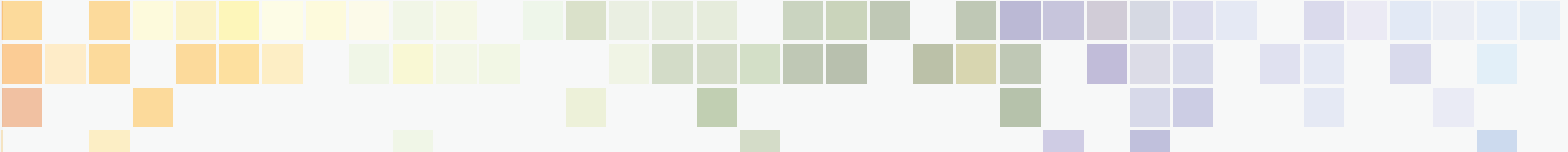
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**N**IST Standard Reference Materials® (SRMs) are used by industry, government, and academia to ensure the highest quality measurements. This catalog lists over 1200 individual reference materials produced and sold by NIST, each with carefully assigned values for chemical composition and physical properties.

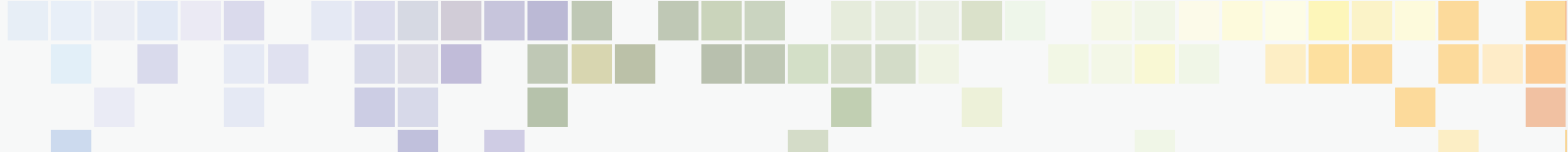
SRMs find use in calibrating instruments and in assuring the long-term integrity of quality assurance programs. They are also key mechanisms for verifying important measurement results and in developing new measurement methods. SRMs provide users with tools to assist in establishing traceability of measurement results to the International System of Units (SI). Each SRM comes carefully packaged with documentation containing assigned values with stated uncertainties and a material safety data sheet, if applicable. Details on use, stability, and NIST analytical methods are also included.

For further information and prices, contact us at:

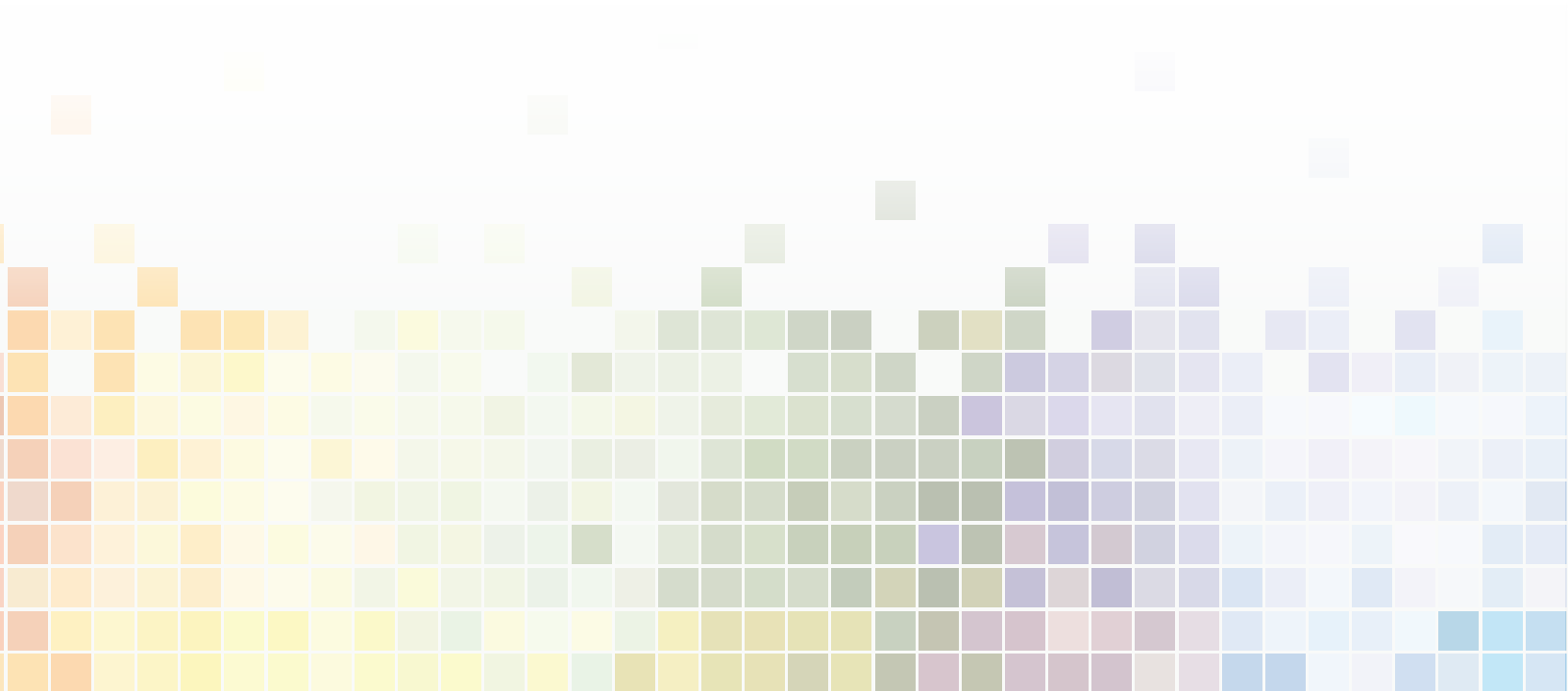
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The data given in this catalog is constantly being revised. For the most up-to-date information, please consult our website at <https://www.nist.gov/srm>.



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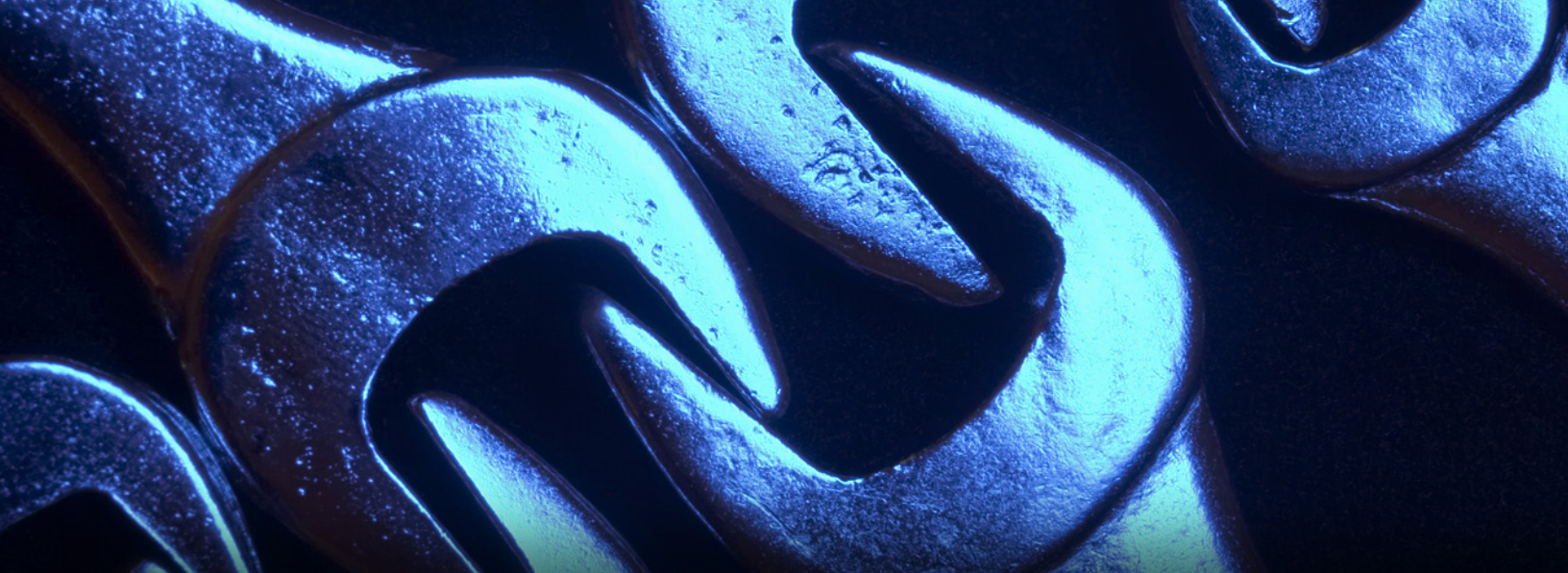
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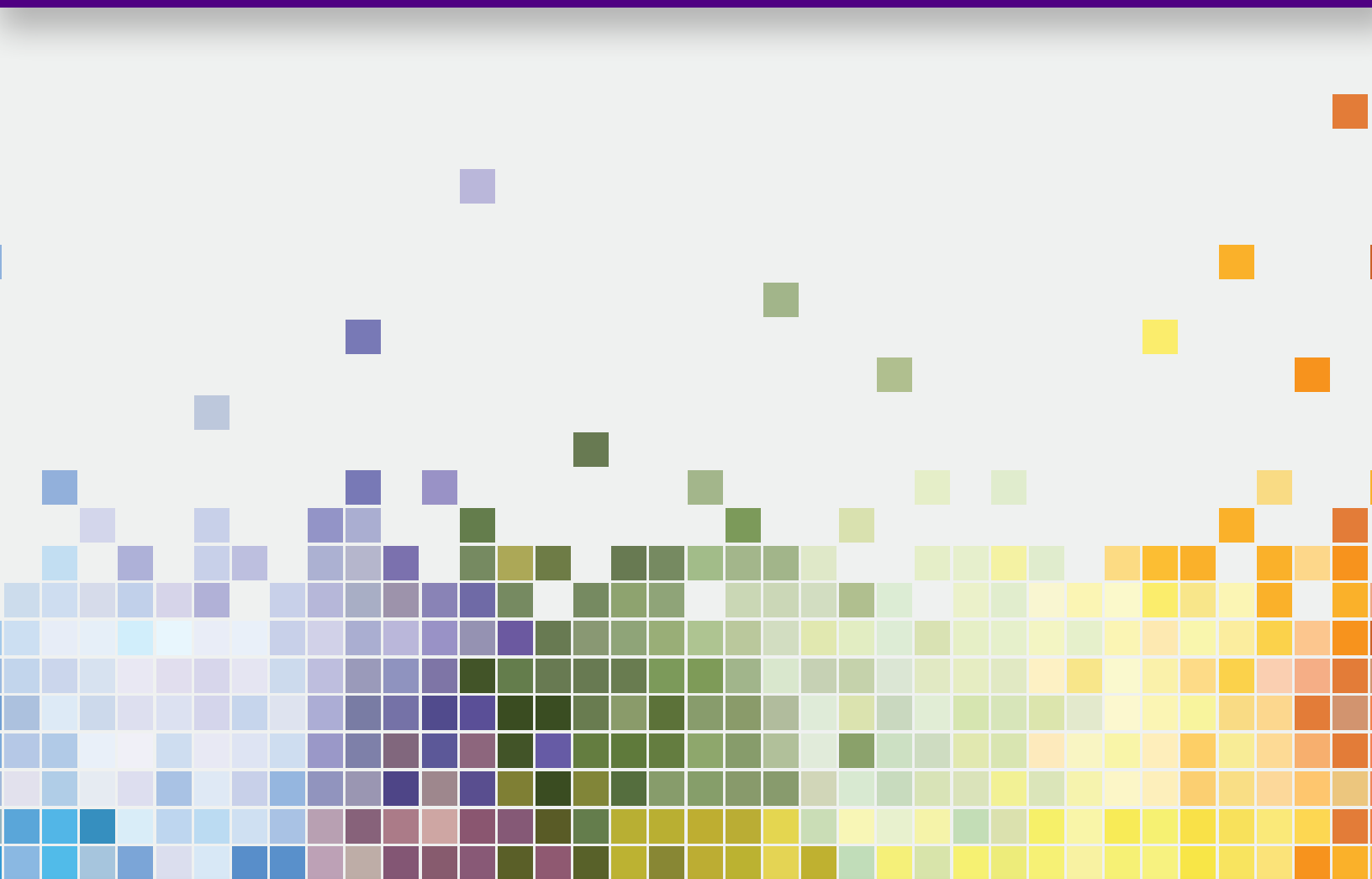
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# 101

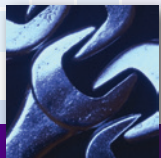
## Standard Reference Materials for Chemical Composition

**Ferrous Metals**



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These SRMs are for checking optical emission and X-ray fluorescence spectrometric methods and for other methods of chemical analysis. They consist of steel alloys selected to provide a wide range of analytical values for elements. They are furnished as chips (small metal turnings), rods, disks, pins or powders from selected portions of commercial ingots. A “C” preceding the SRM number indicates a chill cast sample. Certificates are available on the website with information regarding specific alloy composition.

## Plain Carbon Steels (chip form)

SRM	Description	Unit of Issue
8k	Bessemer Steel (Simulated), 0.1 % Carbon	150 g
12h	Basic Open-Hearth Steel, 0.4% Carbon	150 g
13g	0.6% Carbon Steel	150 g
14g	Carbon Steel (AISI 1078)	150 g
16f	Basic Open-Hearth Steel, 1% Carbon (chip form)	150 g
19h	Basic Electric Steel, 0.2% Carbon	150 g
20g	AISI 1045 Steel	150 g
152a	Basic Open-Hearth Steel 0.5% Carbon (Tin Bearing)	150 g
178	0.4C Basic Oxygen Furnace Steel	150 g
368	Carbon Steel (AISI 1211)	150 g

See [Table 101.1](#) on the website for more information.

## Special Low Alloy Steels (chip and pin forms)

SRM	Description	Unit of Issue
361	AISI 4340 Steel (chip form)	150 g
363	Chromium-Vanadium Steel (Modified)	150 g
364	LA Steel, High C (Modified)	150 g
2159	Low-Alloy Steel (pin form)	200 g
2160	Low-Alloy Steel (pin form)	200 g
2165	Low Alloy Steel	150 g
2166	Low Alloy Steel	150 g
2167	Low Alloy Steel	150 g
2168	High-Purity Iron (chip form)	150 g

See [Table 101.3](#) on the website for more information.

## Low Alloy Steels (chip form)

SRM	Description	Unit of Issue
30f	Cr-V Steel (SAE 6150)	150 g
32e	Carbon Low Alloy Steel (SAE 3140) (chip form)	50 g
33e	Nickel Steel	150 g
36b	Chromium-Molybdenum Steel	150 g
72g	Low Alloy Steel (AISI 4130)	150 g
100b	Manganese Steel	150 g
125b	LA Steel, High Silicon	100 g
129c	LA Steel, High Sulfur (SAE 112)	150 g
131h	Refined Cast Iron	100 g
139b	Chromium-Nickel-Molybdenum Steel	150 g
155	Chromium-Tungsten Steel	150 g
163	Chromium Steel	100 g
179	LA Steel, High Silicon	150 g
291	Cr-Mo Steel (ASTM A-213)	150 g
293	Cr-Ni-Mo (AISI 8620)	150 g
2171	LA Steel (HSLA 100)	150 g

See [Table 101.2](#) on the website for more information.





### Low Alloy Steels (disk and rod forms)

SRM	Description	Unit of Issue
663	Chromium-Vanadium Steel (Modified)	5 rods
665	Electrolytic Iron	5 rods
1134	LA Steel, High Silicon	disk
1135	LA Steel, High Silicon	disk
1218	LA Steel, High Silicon	disk
1224	LA Steel, Carbon (AISI 1078)	disk
1225	LA Steel (AISI 4130)	disk
1226	LA Steel	disk
1227	LA Steel, Basic Open Hearth, 1% C	disk
1228	LA Steel, 0.1% C	disk
1264a	LA Steel, High Carbon (Modified)	disk
1265a	Electrolytic Iron	disk
1269	Line Pipe (AISI 1526 (Modified))	disk
1270	LA Steel, Cr-Mo (A336) (F-22)	disk
1271	LA Steel (HSLA-100)	disk
1286	Low Alloy Steel (HY 80)	disk
1761a	Low Alloy Steel	disk
1762a	Low Alloy Steel	disk
1763a	Low Alloy Steel	disk
1764a	Low Alloy Steel	disk
1765	Low Alloy Steel	disk
1766	Low Alloy Steel	disk
1767	Low Alloy Steel	disk
1768	High-Purity Iron	disk
C1285	LA Steel (A242) (Modified)	disk

See [Table 101.8](#) on the website for more information.



### High Alloy Steels (chip form)

SRM	Description	Unit of Issue
126c	High-Nickel Steel (Nominal Mass Fraction 36 % Ni) (chip form)	150 g
344	15 Chromium-7 Nickel Steel (Mo Precipitation Hardening)	150 g
345b	Fe-Cr-Ni Alloy UNS J92180 (chip form)	150 g
346a	Valve Steel	150 g
862	High-Temperature Alloy L 605 (chip form)	100 g
868	High-Temperature Alloy (Fe-Ni-Co) (chip form)	100 g

See [Table 101.4](#) on the website for more information.

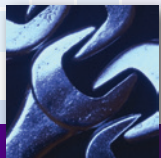
### High Temperature Alloys (chip and disk forms)

SRM	Description	Unit of Issue
866	Incoloy® 800 (chip form)	100 g
867	Ni-Fe-Cr Alloy UNS N08825 (chip form)	100 g
1230	High-Temperature Alloy A286 (disk form)	disk
1246	Incoloy® 800 (disk form)	disk
1247	Ni-Fe-Cr Alloy UNS N08825 (disk form)	disk
1250	High-Temperature Alloy Fe-Ni-Co	disk
C2400	Fe-Cr-Ni Alloy UNS J92180 (disk form)	disk
C2401	HA Steel (ACI-C-4M-Cu)	disk

See [Table 101.9](#) on the website for more information.







## Stainless Steels (chip form)

SRM	Description	Unit of Issue
101g	18 Cr-10 Ni Steel (AISI 304L) (powder form)	100 g
123c	Stainless Steel, Cr-Ni-Nb (AISI 348)	150 g
133b	Chromium-Molybdenum Steel	150 g
160b	Stainless Steel (Cr 18-Ni 12-Mo 2) (AISI 316)	150 g
166c	Stainless Steel, Low-Carbon (AISI 316L)	100 g
339	17 Chromium-9 Nickel-0.2 Selenium Steel	150 g
343a	Stainless Steel (AISI 431)	150 g
893	Stainless Steel (SAE 405)	150 g
895	Stainless Steel (SAE 201)	150 g

See [Table 101.6](#) on the website for more information.

## Stainless Steels (disk form)

SRM	Description	Unit of Issue
1155a	Stainless Steel (Cr 18 Ni 12, Mo 2)	disk
1171	Stainless Steel Cr 17-Ni 11-Ti 0.3 (AISI 321)	disk
1172	Stainless Steel Cr 17-Ni 11-Nb 0.6 (AISI 348)	disk
1219	Stainless Steel Cr16 - Ni2 (AISI 431)	disk
1223	Chromium Steel	disk
1295	Stainless Steel (SAE 405)	disk
1297	Stainless Steel (SAE 201)	disk
C1151a	Stainless Steel 23Cr-7Ni	disk
C1152a	Stainless Steel 18Cr-11Ni	disk
C1153a	Stainless Steel 17Cr-9Ni	disk
C1154a	Stainless Steel 19Cr-13Ni	disk
C1296	Stainless Steel	disk

See [Table 101.10](#) on the website for more information.

## Tool Steels (chip form)

SRM	Description	Unit of Issue
50c	Tungsten-Chromium-Vanadium Steel	150 g
132b	Tool Steel (AISI M2)	150 g
134a	Molybdenum-Tungsten-Chromium-Vanadium Steel	150 g
2172	S-7 Tool Steel	150 g

See [Table 101.7](#) on the website for more information.

## Specialty Steels (disk form)

SRM	Description	Unit of Issue
1157	Tool Steel (AISI M2)	disk
1158	High-Nickel Steel (Nominal Mass Fraction 36 % Ni)	disk
1772	Tool Steel (S-7)	disk

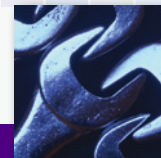
See [Table 101.11](#) on the website for more information.

## Steelmaking Alloys (powder form)

These SRMs are for checking chemical methods of analysis for major constituents and selected minor elements. They are furnished as fine powders (usually <0.1 mm).

SRM	Description	Unit of Issue
57b	Silicon Metal	40 g
58a	Ferrosilicon (73 % Si Regular Grade)	75 g
59a	Ferrosilicon	50 g
64c	Ferrochromium, High Carbon	100 g
68c	High-Carbon Ferromanganese	100 g
90	Ferrophosphorus	75 g
195	Ferrosilicon (75 % Si-High Purity Grade)	75 g
196	Ferrochromium, (Low-Carbon)	100 g
689	Ferrochromium Silicon	100 g

See [Table 101.12](#) on the website for more information.



## Gases in Ferrous Metals (rod and disk forms)

These SRMs are for determining oxygen and nitrogen by vacuum fusion, inert gas fusion, and neutron activation methods.

SRM	Description	Unit of Issue
1089†	Steels, Set (consists of SRMs 1095, 1096, 1097, 1098 and 1099)	5 rods
1090	Oxygen in Ingot Iron	rod
1091a	Oxygen in Stainless Steel (AISI 431)	rod
1093	Oxygen in Valve Steel	rod
1094	Oxygen in Maraging Steel	rod
1754	Low-Alloy Steel, AISI 4320	rod
1755	Nitrogen in Low Alloy Steel	disk

† These SRMs are sold only as a set designated SRM 1089. See [Table 101.5](#) on the website for more information.

## Cast Steels, White Cast Irons, and Ductile Irons (disk form)

These SRMs are for analysis of cast steels and cast irons by rapid instrumental methods.

SRM	Description	Unit of Issue
1138a	Cast Steel Standard	block
1139a	Cast Steel Standard	block
1173	Ni-Cr-Mo-V Steel	disk
C1137a	White Cast Iron	disk
C1145a	White Cast Iron	disk
C1173	Cast Steel 3	disk
C1290	High-Alloy White Cast Iron (HC-250+V)	disk
C1291	High-Alloy White Cast Iron (Ni-Hard, Type I)	disk
C1292	High-Alloy White Cast Iron I (Ni-Hard, Type IV)	disk
C2424	Ductile Iron C	disk

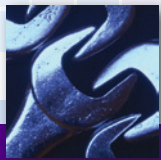
See [Table 101.14](#) on the website for more information.



## Cast Irons (chip form)

SRM	Description	Unit of Issue
4l	Cast Iron	150 g
5m	Cast Iron	150 g
6g	Cast Iron	150 g
82b	Nickel-Chromium Cast Iron	150 g
107c	Cast Iron (Ni-Cr-Mo)	150 g
115a	Copper-Nickel-Chromium Cast Iron	150 g
122i	Cast Iron	150 g
334	Gray Cast Iron	150 g
341	Ductile Cast Iron	150 g
342a	Nodular Cast Iron	150 g
892	High-Alloy White Cast Iron (Ni-Hard, Type IV)	150 g

See [Table 101.13](#) on the website for more information.

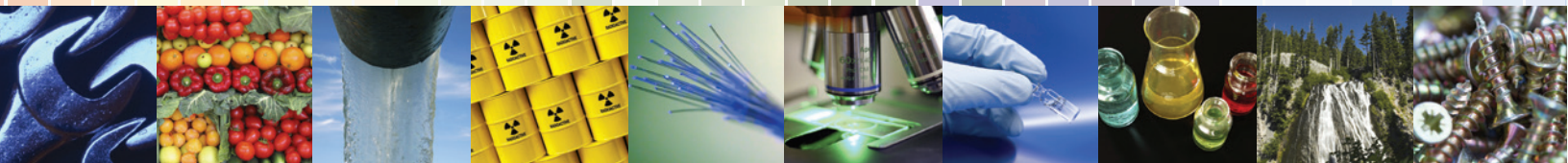


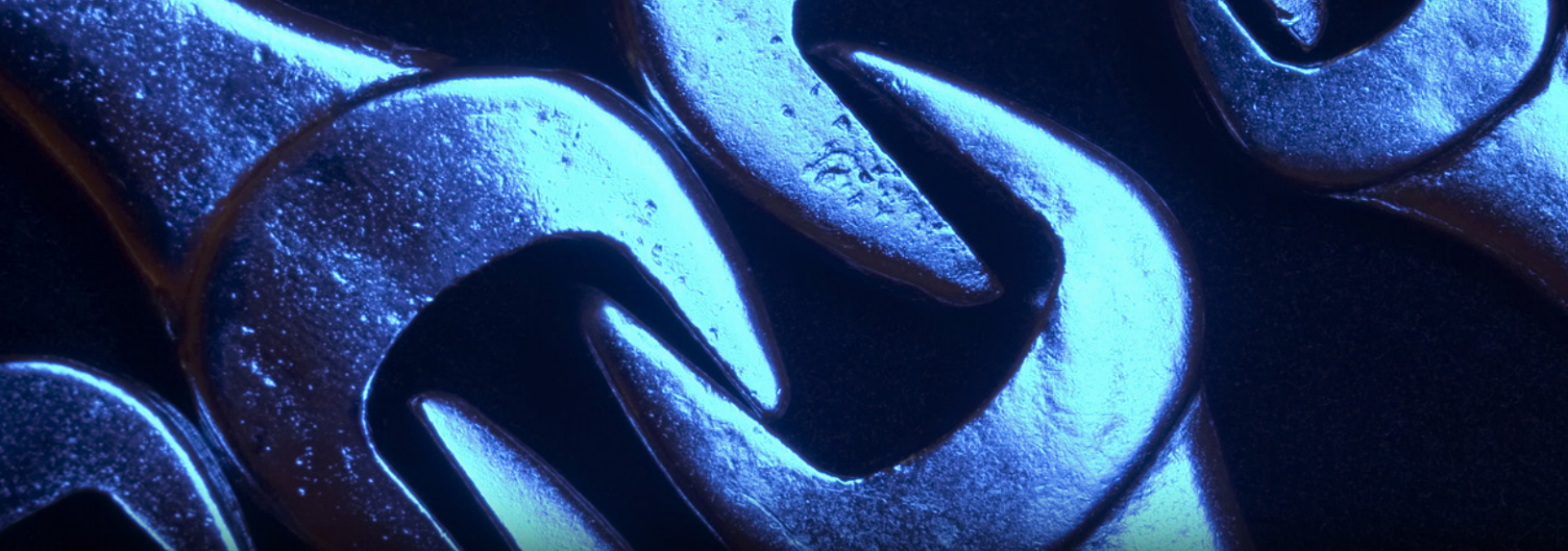
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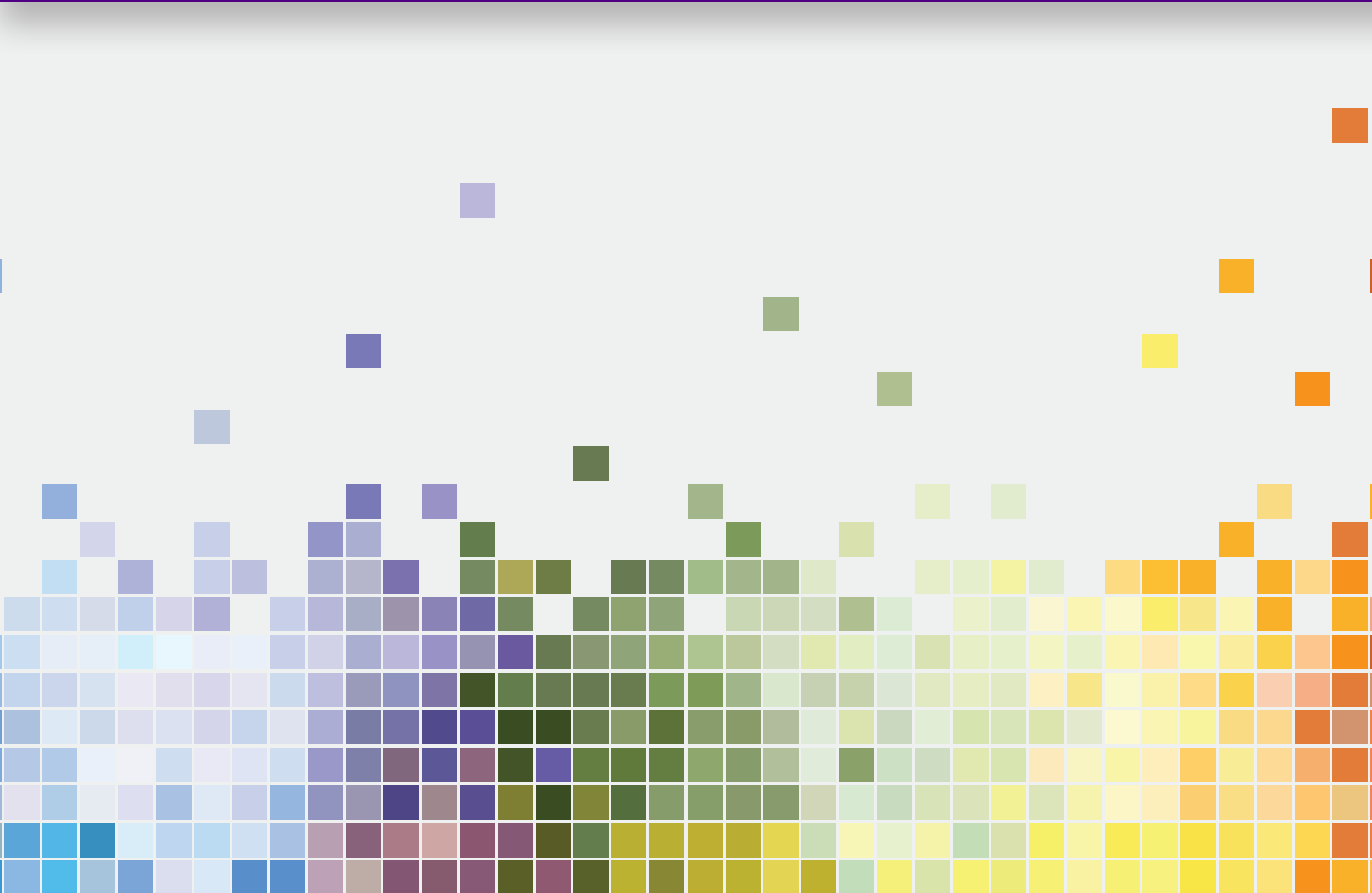




# 102

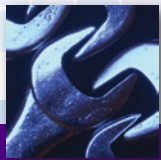
## Standard Reference Materials for Chemical Composition

### Nonferrous Metals



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These SRMs are for checking optical emission and X-ray fluorescence spectrometric methods and for other methods of chemical analysis. They consist of alloys selected to provide a wide range of analytical values for elements. They are furnished as chips (small metal turnings), rods, disks, pins or powders from selected portions of commercial ingots. A “C” preceding the SRM number indicates a chill cast sample. Certificates are available on the website with information regarding specific alloy composition.

## Aluminum Base Alloys (chip and disk forms)

These SRMs are intended for analyses of aluminum alloys by chemical and instrumental methods. SRMs 1710 through 1713 are specially prepared to include low levels of cadmium and lead encountered in the analysis of recycled aluminum. SRM 2426 is a hot-dip coating alloy for sheet steel applications.

SRM	Description	Unit of Issue
87a	Silicon-Aluminum Alloy (chip form)	75 g
853a	Aluminum Alloy 3004 (chip form)	40 g
854a	Aluminum Alloy 5182 (chip form)	40 g
855a	Aluminum Casting Alloy 356 (chip form)	30 g
856a	Aluminum Casting Alloy 380 (chip form)	30 g
858	Aluminum Alloy 6011 (chip form)	35 g
1240c	Aluminum Alloy 3004	disk
1241c	Aluminum Alloy 5182	disk
1255b	Aluminum Alloy 356	disk
1256b	Aluminum Alloy 380	disk
1258-I	Aluminum Alloy 6011	disk
1259	Aluminum Alloy 7075	disk
1710	Aluminum Alloy 3004	disk
1711	Aluminum Alloy 3004	disk
1713	Aluminum Alloy 5182	disk
2426	55 % Aluminum-Zinc Alloy	40 g

See [Table 102.1](#) on the website for more information.

## Cobalt Base Alloys (chip and disk forms)

SRM	Description	Unit of Issue
862	High-Temperature Alloy L 605 (chip form)	100 g
1242	High Temperature Alloy L 605	disk
1775	Refractory Alloy MP-35-N	disk
2175	Refractory Alloy MP-35-N (chip form)	150 g

See [Table 102.2](#) on the website for more information.

## Copper Base Alloys (chip and rod forms)

SRM	Description	Unit of Issue
158a	Silicon Bronze (chip form)	150 g
458	Beryllium-Copper (17510) (chip form)	50 g
459	Beryllium-Copper (17200) (chip form)	50 g
460	Beryllium-Copper Alloy (chip form)	50 g
871	Phosphor Bronze (CDA 521) (chip form)	100 g
872	Phosphor Bronze (CDA 544) (chip form)	100 g
874	Cupro-Nickel, 10 % (CDA 706) “HIGH-PURITY” (chip form)	100 g
875	Cupro-76t5Nickel, 10 % (CDA 706) “DOPED” (chip form)	100 g
880	Nickel Silver (CDA 770) (chip form)	100 g
1034	Unalloyed Copper	rod
1035	Leaded-Tin Bronze Alloy (chip form)	50 g

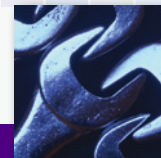
See [Table 102.3](#) on the website for more information.

## Copper Base Alloys (block and disk forms)

The SRMs with a “C” prefix are chill-cast blocks, 31 mm square and 19 mm thick; the others are wrought disks, 31 mm in diameter and 19 mm thick. Both forms have nearly identical elemental compositions.

SRM	Description	Unit of Issue
1107	Naval Brass UNS 46400	disk
1110	Red Brass B	disk
1111	Red Brass Standard	disk
1112	Gilding Metal	disk
1113	Gilding Metal	disk
1114	Gilding Metal	disk
1115	Commercial Bronze Standard for Optical Emission and X-ray Spectroscopic Analysis	disk
1116	Commercial Bronze Standard for Optical Emission and X-ray Spectroscopic Analysis	disk
1117	Commercial Bronze Standard for Optical Emission and X-ray Spectroscopic Analysis	disk
1124	Free Cutting Brass (UNS C36000)	disk
1276a	Cupro-Nickel (CDA 715)	disk
C1114	Gilding Metal C (block)	block
C1115	Commercial Bronze A (block)	block
C1117	Commercial Bronze C (block)	block

See [Table 102.4](#) on the website for more information.



### Copper “Benchmark” (block, chip and rod forms)

SRMs with a “C” prefix are chill-cast blocks approximately 32 mm square and 19 mm thick.

SRM	Description	Unit of Issue
399	Unalloyed Copper - Cu VI (chip form)	50 g
400	Unalloyed Copper - Cu VII (chip form)	50 g
454	Unalloyed Copper XI (chips)	35 g
457	Unalloyed Copper IV (solid)	rod
494	Unalloyed Copper I (solid)	rod
495	Unalloyed Copper II (solid)	rod
498	Unalloyed Copper V (solid)	rod
499	Unalloyed Copper VI (solid)	rod
500	Unalloyed Copper - Cu VII (solid)	rod
C1251a	Phosphorus Deoxidized Copper - Cu VIII	block
C1252a	Phosphorus Deoxidized Copper - Cu IX	block
C1253a	Phosphorus Deoxidized Copper - Cu X	block

See [Table 102.5](#) on the website for more information.

### Lead-Base Alloys (disk and powder forms)

SRMs in the form of disks are approximately 50 mm in diameter and 16 mm thick. They are intended for use with optical emission spectrometric methods of analysis.

SRM	Description	Unit of Issue
53e	Lead-Base Bearing Metal (84Pb-10Sb-6Sn)	150 g
127b	Solder (40Sn—60Pb)	150 g
1129	Solder (63Sn—37Pb)	200 g
1131	Solder (40Sn—60Pb)	disk
1132	Lead-Base Bearing Metal (84Pb-10Sb-6Sn)	disk
C2415a	Battery Lead (UNS 52770)	disk
C2416	Bullet Lead	disk
C2417	Lead-Base Alloy	disk
C2418	High-Purity Lead	disk

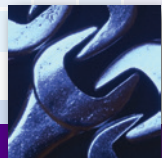
See [Table 102.10](#) on the website for more information.

### Nickel Base Alloys (chip and disk forms)

SRM	Description	Unit of Issue
349a	Waspaloy	150 g
861	Nickel-based Superalloy PWA 1484 (chip form)	50 g
864	Nickel Alloy UNS N06600 (chip form)	100 g
865	Inconel 625 (chip form)	150 g
882	Nickel-Copper Alloy (65Ni-31Cu-3Al) (chip form)	100 g
897	Tracealloy A (chip form)	35 g
899	Tracealloy C (chip form)	35 g
1159	Electronic and Magnetic Alloy Standard	disk
1160	Elec/Mag Ni-Mo-Fe	disk
1243	Ni-Cr-Co Alloy UNS N07001 (disk form)	disk
1244	Nickel Alloy UNS N06600	disk
1249	Ni-Cr-Fe-Nb-Mo Alloy UNS N077178 (disk form)	disk
1775	Refractory Alloy MP-35-N	disk
2175	Refractory Alloy MP-35-N (chip form)	150 g
C1248	Nickel-Copper Alloy	disk
C2402	Hastelloy 7C	disk

See [Table 102.12](#) on the website for more information.





## Tin Base Alloys

SRM	Description	Unit of Issue
54d	Bearing Metal (Tin Base)	75 g
1727	Anode Tin	block
1728	Tin Alloy (Sn-3Cu-0.5Ag)	disk
1729	Tin Alloy (97Sn-3Pb)	disk

See [Table 102.15](#) on the website for more information.

## Titanium Base Alloys (chip and disk forms)

SRM	Description	Unit of Issue
173c	Titanium Alloy UNS R56400 (chip form)	50 g
641	Spectroscopic Titanium-Base Standards Titanium Alloy, 8 Mn (A)	disk
642	Spectroscopic Titanium-Base Standards Titanium Alloy, 8 Mn (B)	disk
643	Spectroscopic Titanium-Base Standards Titanium Alloy, 8 Mn (C)	disk
647	Titanium Alloy, Al-Mo-Sn-Zr (chip form)	50 g
648	Titanium-Base Alloy 5Al-2Sn-2Zr-4Cr-4Mo (chip form)	50 g
649	Titanium-Base Alloy (15V-3Al-3Cr-3Sn) (chip form)	50 g
654b	Titanium Alloy, Al-V	disk
1128	Titanium -Base Alloy (15V-3Al-3Cr-3Sn)	disk
2061	TiAl(NbW) Alloy for Microanalysis	cube
2062	Titanium Alloy, Al-Nb-W	disk
2431	Titanium Base Alloy (chip form)	50 g
2432	Titanium-Base Alloy 10V-2Fe-3Al (chip form)	50 g
2433	Titanium-Base Alloy 8Al-1Mo-1V (chip form)	50 g
2452	Hydrogen In Titanium Alloy (chip form)	10 g
2453a	Hydrogen In Titanium Alloy (Nominal Mass Fraction 125 mg/kg H) (chip form)	10 g
2454	Hydrogen In Titanium Alloy (chip form)	10 g

See [Table 102.16](#) on the website for more information.

## Zinc Base Alloys (block, chip and disk forms)

SRM 1738 through 1742 and SRM 2139 are specially prepared alloys primarily intended for use with spectrometric methods of analysis.

SRM	Description	Unit of Issue
94c	Zinc-Base Alloy (Die Casting) (chip form)	150 g
625	Spectrographic Zinc-Base Die-Casting Alloy A	block
626	Spectrographic Zinc-Base Die-Casting Alloy B	block
627	Spectrographic Zinc-Base Die-Casting Alloy C	block
628	Spectrographic Zinc-Base Die-Casting Alloy D	block
629	Spectrographic Zinc-Base Die-Casting Alloy E	block
630	Spectrographic Zinc-Base Die-Casting Alloy F	block
631	Spectrographic Zinc Spelter (Modified)	block
1738	Zinc-Aluminum Alloy	disk
1739	Zinc-Aluminum Alloy	disk
1740	Zinc-Aluminum Alloy	disk
1741	Zinc-Aluminum Alloy	disk
1742	Zinc-Aluminum Alloy	disk
2139	Zinc-Aluminum Alloy	100 g
2426	55 % Aluminum-Zinc Alloy (chip form)	40 g

See [Table 102.17](#) on the website for more information.

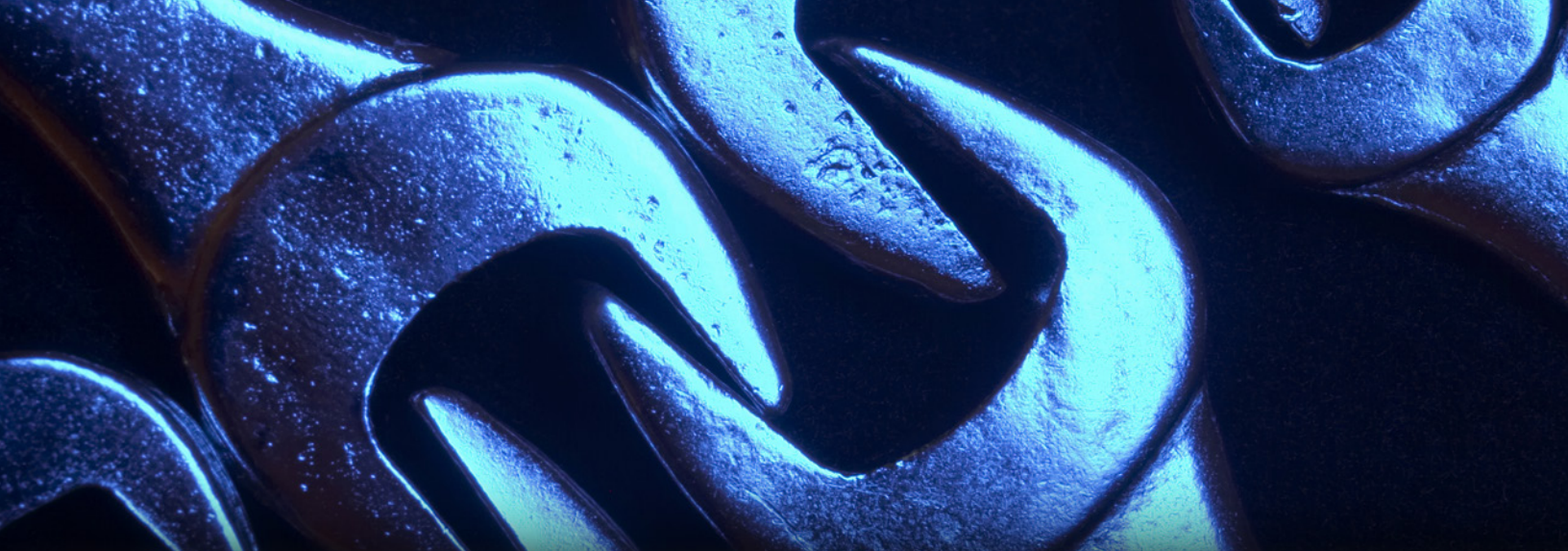
## Zirconium Base Alloys (chip form)

SRM	Description	Unit of Issue
360b	Zirconium (Sn-Fe-Cr) Alloy	100 g

See [Table 102.18](#) on the website for more information.



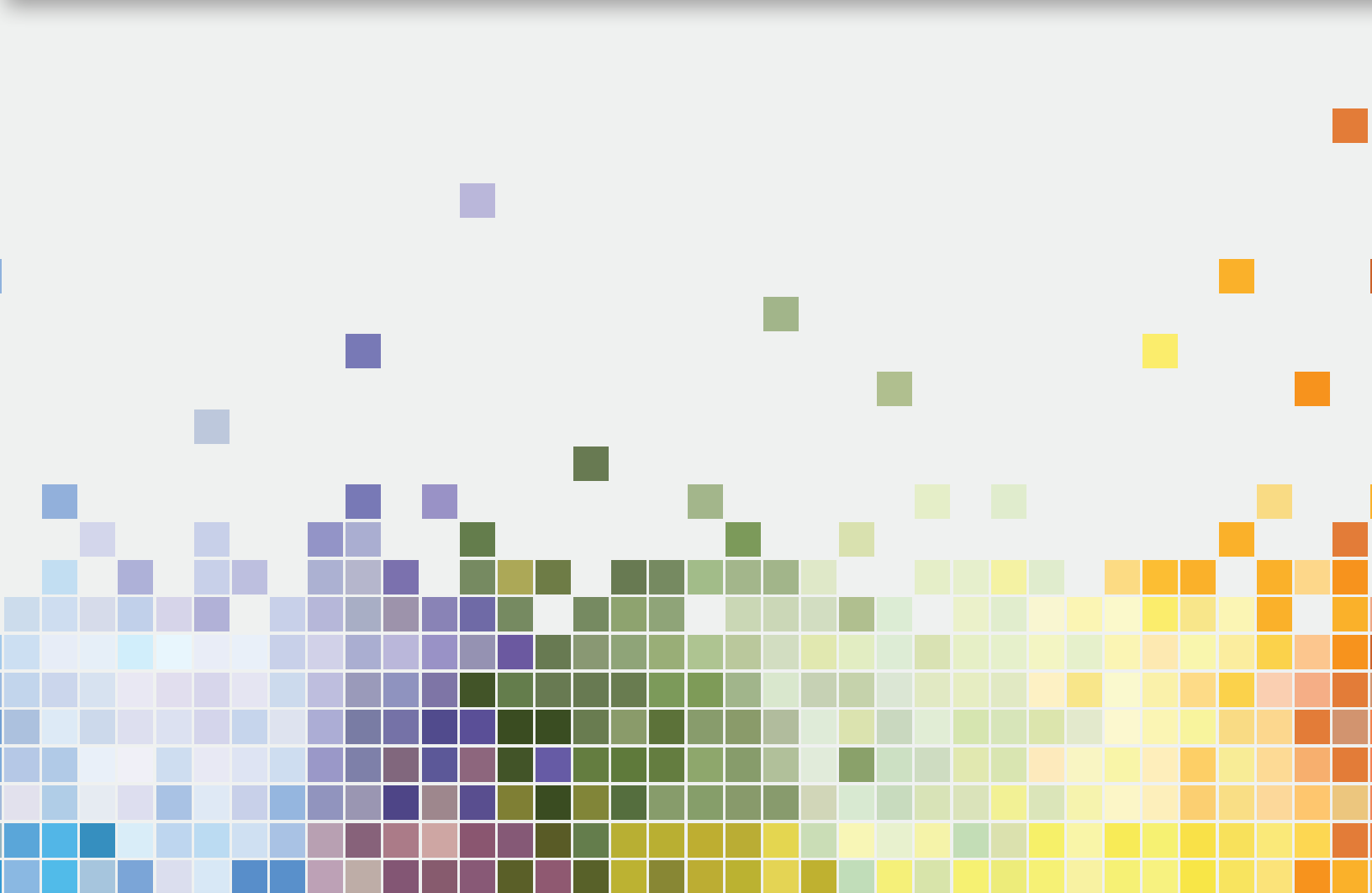


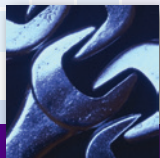


# 103

## Standard Reference Materials for Chemical Composition

**Microanalysis**





## Metals (wire, disk and cube forms)

SRM	Description	Unit of Issue
480	Tungsten 20 % - Molybdenum Alloy Electron Microprobe Standard	disk
481	Gold-Silver Wires for Microprobe Analysis	set (6)
482	Gold-Copper Wires for Microprobe Analysis	set (6)
2061	TiAl(NbW) Alloy for Microanalysis	cube

See [Table 103.1](#) on the website for more information.

## Synthetic Glasses for Microanalysis (rod and microsphere forms)

The glass SRM listed below is suitable for microanalysis, such as electron probe microanalysis (EMPA) secondary ion mass spectrometry (SIMS) and other methods that require high homogeneity.

SRM	Description	Unit of Issue
2066	K-411 Glass Microspheres	50 mg

See [Table 103.2](#) on the website for more information.

## Semiconductor Thin Film for the Composition of Thin Films

Standard Reference Material SRM 2841 is intended for use as a reference standard for analytical methods that measure the composition of thin films, such as electron microprobe analysis (EMPA), photoluminescence (PL), auger electron spectroscopy (AES) and X-ray photoelectron spectroscopy (XPS). The SRM consists of an epitaxial layer of  $\text{Al}_x\text{Ga}_{1-x}\text{As}$ ,  $3\mu\text{m}$  thick, on a  $1\text{ cm} \times 1\text{ cm}$  square of GaAs substrate. The semiconductor chip is attached with carbon tape to a  $2.5\text{ cm}$  diameter stainless steel disk for labeling and handling.

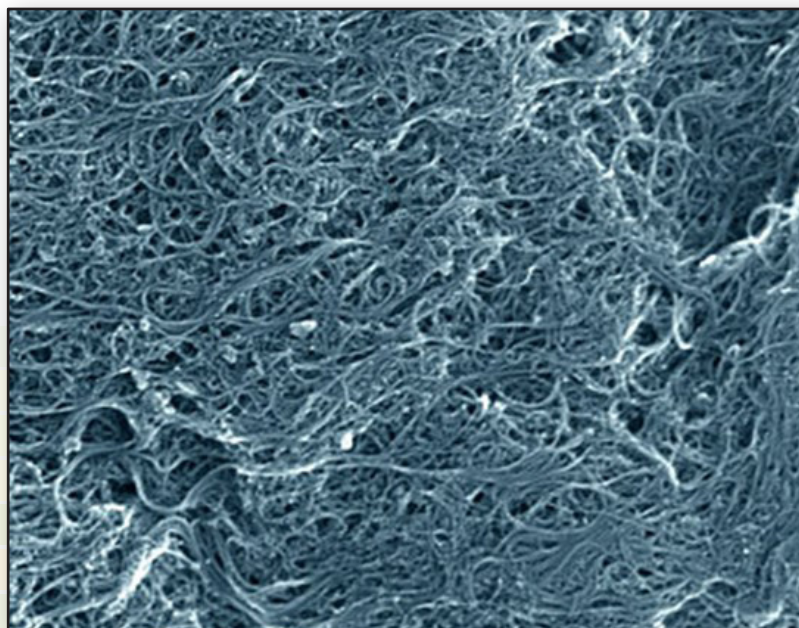
SRM	Description	Unit of Issue
2841	Semiconductor Thin Film: $\text{Al}_x\text{Ga}_{1-x}\text{As}$ Epitaxial Layers (Al mole fraction $x$ near 0.20)	disk
2842	Semiconductor Thin Film: $\text{Al}_x\text{Ga}_{1-x}\text{As}$ Epitaxial Layers (Al mole fraction $x$ near 0.30)	disk
8095	$\text{Si}_{1-x}\text{Ge}_x$ Films on Si	2 wafers, 1 each level

See [Table 103.4](#) on the website for more information.

## Nanomaterials: Composition

SRM	Description	Unit of Issue
2483	Single-Wall Carbon Nanotubes (Raw Soot)	250 mg

See [Table 103.5](#) on the website for more information.



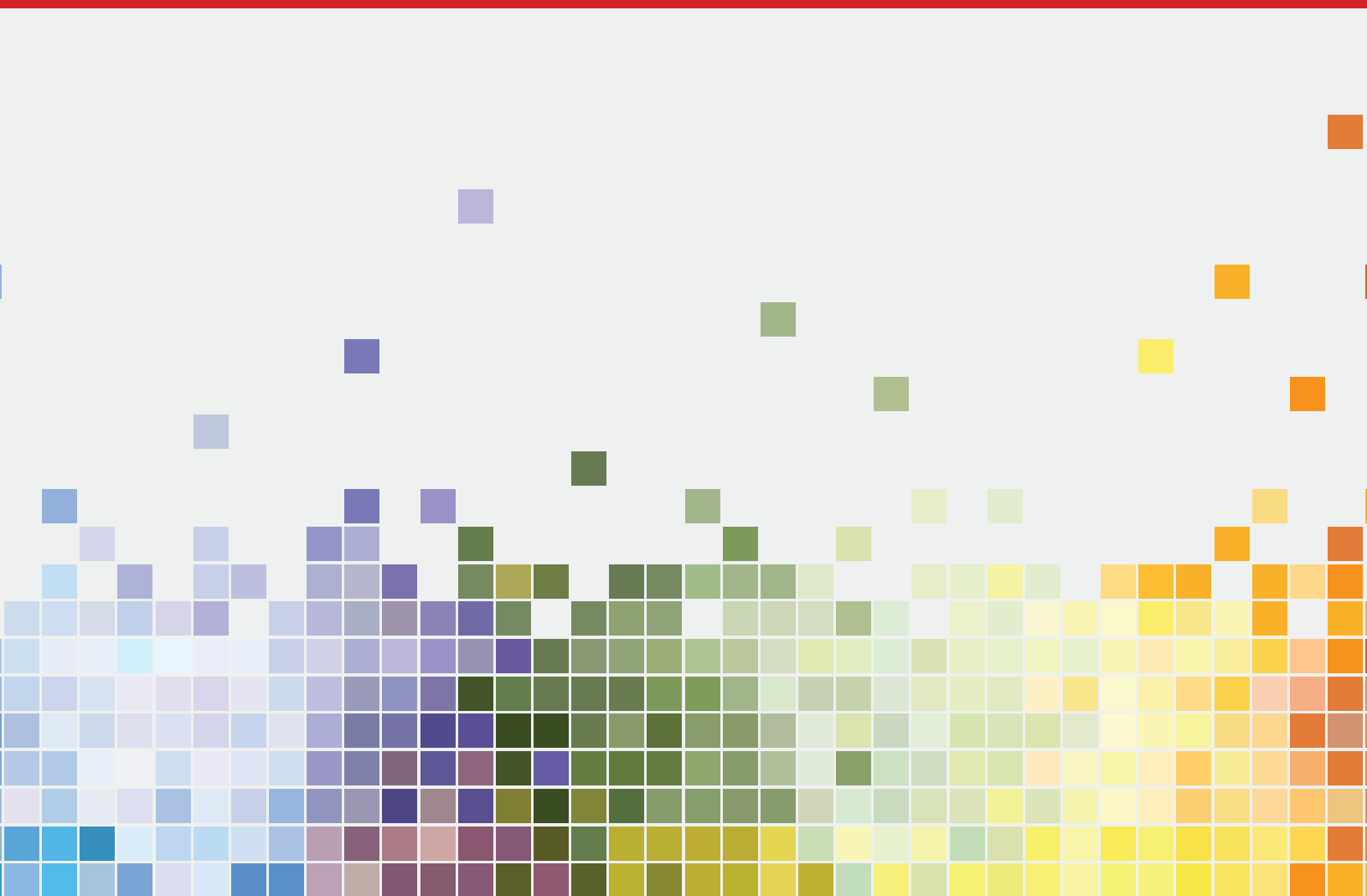
Scanning Electron Microscopy Image of SRM 2483



# 104

## Standard Reference Materials for Chemical Composition

**High-Purity Materials**







## High Purity Metals (solid forms)

These SRMs are for determining impurity elements in high purity metals.

SRM	Description	Unit of Issue
682	High-Purity Zinc	block
683	Zinc Metal	block
685r	High-Purity Gold (rod)	15g
728	Intermediate-Purity Zinc (pellet)	450 g
885	Refined Copper (pin)	200 g

See [Table 104.1](#) on the website for more information.

## Stoichiometry (powder form)

These SRMs are 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  $100 \pm 0.02\%$  (Purity 99.98 + %).

### Working Standard:

A commercially available substance of purity  $100 \pm 0.05\%$  (Purity 99.95 + %).

### Secondary Standard:

A substance of lower purity which can be standardized against a primary grade standard.

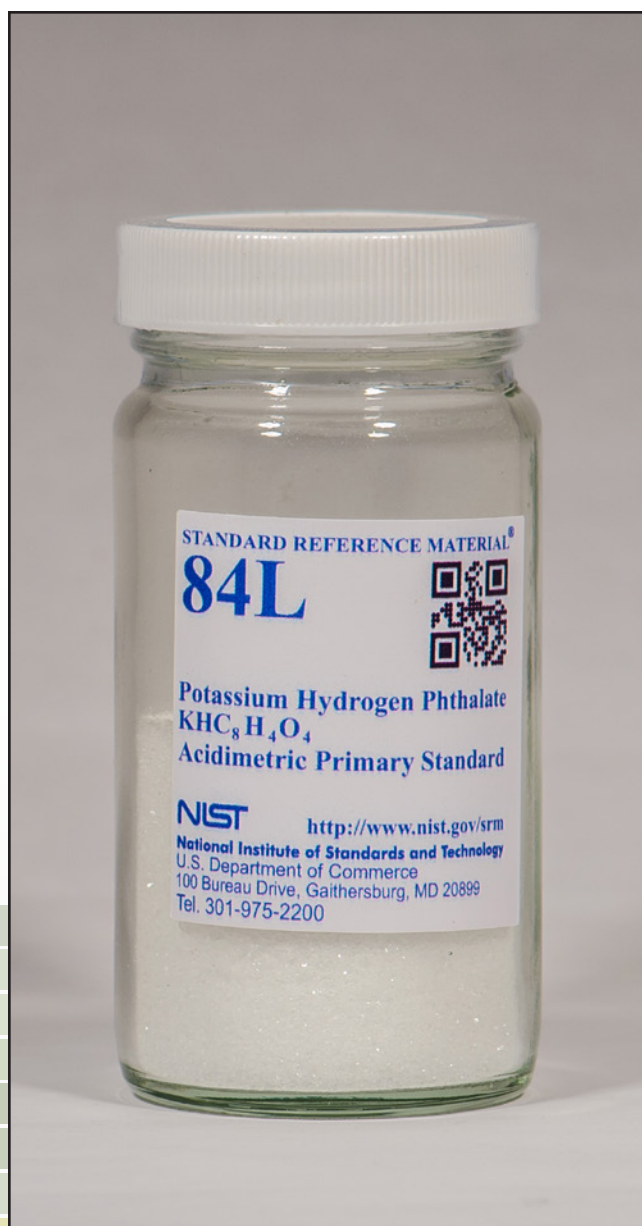
SRM	Description	Unit of Issue
17f	Sucrose Optical Rotation	60 g
84L	Potassium Hydrogen Phthalate	60 g
136f	Potassium Dichromate, (Oxidimetric Standard)	60 g
154c	Titanium Dioxide	90 g
350c	Benzoic Acid (Acidimetric)	30 g
351a	Sodium Carbonate	50 g
723e	Tris Acidimetric	50 g
917c	D-Glucose (Dextrose)	50 g
973	Boric Acid Acidimetric Standard	100 g
999c	Potassium Chloride Primary Standard (Dried at 500 °C)	30 g
8040	Sodium Oxalate ( $\text{Na}_2\text{C}_2\text{O}_4$ ) Reductometric Standard	60 g

See [Table 104.3](#) on the website for more information.

## Microchemistry (powder form)

SRM	Description	Unit of Issue
141d	Acetanilide	2 g
143d	Cystine	2 g
148	Nicotinic Acid	2 g
2141	Urea	2 g
2143	p-Fluorobenzoic Acid	2 g
2144	m-Chlorobenzoic Acid	2 g

See [Table 104.4](#) on the website for more information.





## Spectrometry, Single Element Standard Solutions

These SRMs are intended as standard solutions for calibrating instruments including atomic absorption spectrophotometry, inductively coupled plasma optical emission spectrometry, and inductively coupled plasma mass spectrometry. They can also be used in conjunction with any other analytical technique or procedure where standard solutions are required. Each SRM is a single element solution of 50 mL with a nominal concentration of 10 mg/g. Each unit is provided in either a single high density polyethylene bottle or in 5 x 10 mL borosilicate glass ampoules.

SRM	Description	Unit of Issue
3101a	Aluminum (Al) Standard Solution	5 x 10 mL
3102a	Antimony (Sb) Standard Solution	50 mL
3103a	Arsenic (As) Standard Solution	5 x 10 mL
3104a	Barium (Ba) Standard Solution	50 mL
3105a	Beryllium (Be) Standard Solution	5 x 10 mL
3106	Bismuth (Bi) Standard Solution	5 x 10 mL
3107	Boron (B) Standard Solution	50 mL
3108	Cadmium (Cd) Standard Solution	5 x 10 mL
3109a	Calcium (Ca) Standard Solution	5 x 10 mL
3110	Cerium (Ce) Standard Solution	5 x 10 mL
3111a	Cesium (Cs) Standard Solution	5 x 10 mL
3112a	Chromium (Cr) Standard Solution	5 x 10 mL
3113	Cobalt (Co) Standard Solution	5 x 10 mL
3114	Copper (Cu) Standard Solution	50 mL
3115a	Dysprosium (Dy) Standard Solution	5 x 10 mL
3116a	Erbium (Er) Standard Solution	5 x 10 mL
3117a	Europium (Eu) Standard Solution	5 x 10 mL
3118a	Gadolinium (Gd) Standard Solution	5 x 10 mL
3119a	Gallium (Ga) Standard Solution	5 x 10 mL
3120a	Germanium (Ge) Standard Solution	50 mL
3121	Gold (Au) Standard Solution	5 x 10 mL
3122	Hafnium (Hf) Standard Solution	50 mL
3123a	Holmium (Ho) Standard Solution	5 x 10 mL
3124a	Indium (In) Standard Solution	5 x 10 mL
3126a	Iron (Fe) Standard Solution	5 x 10 mL
3127a	Lanthanum (La) Standard Solution	5 x 10 mL
3128	Lead (Pb) Standard Solution	5 x 10 mL
3129a	Lithium (Li) Standard Solution	5 x 10 mL
3130a	Lutetium (Lu) Standard Solution	5 x 10 mL
3131a	Magnesium (Mg) Standard Solution	5 x 10 mL

SRM	Description	Unit of Issue
3132	Manganese (Mn) Standard Solution	5 x 10 mL
3133	Mercury (Hg) Standard Solution	5 x 10 mL
3134	Molybdenum (Mo) Standard Solution	5 x 10 mL
3135a	Neodymium (Nd) Standard Solution	5 x 10 mL
3136	Nickel (Ni) Standard Solution	5 x 10 mL
3137	Niobium (Nb) Standard Solution	50 mL
3138	Palladium (Pd) Standard Solution	5 x 10 mL
3139a	Phosphorus (P) Standard Solution	5 x 10 mL
3140	Platinum (Pt) Standard Solution	5 x 10 mL
3141a	Potassium (K) Standard Solution	5 x 10 mL
3142a	Praseodymium (Pr) Standard Solution	5 x 10 mL
3143	Rhenium (Re) Standard Solution	5 x 10 mL
3144	Rhodium (Rh) Standard Solution	5 x 10 mL
3145a	Rubidium (Rb) Standard Solution	5 x 10 mL
3147a	Samarium (Sm) Standard Solution	5 x 10 mL
3148a	Scandium (Sc) Standard Solution	5 x 10 mL
3149	Selenium (Se) Standard Solution	5 x 10 mL
3150	Silicon (Si) Standard Solution	50 mL
3151	Silver (Ag) Standard Solution	5 x 10 mL
3152a	Sodium (Na) Standard Solution	50 mL
3153a	Strontium (Sr) Standard Solution	5 x 10 mL
3154	Sulfur (S) Standard Solution	5 x 10 mL
3155	Tantalum (Ta) Standard Solution	50 mL
3156	Tellurium (Te) Standard Solution	5 x 10 mL
3157a	Terbium (Tb) Standard Solution	5 x 10 mL
3158	Thallium (Tl) Standard Solution	5 x 10 mL
3159	Thorium (Th) Standard Solution	50 mL
3160a	Thulium (Tm) Standard Solution	5 x 10 mL
3161a	Tin (Sn) Standard Solution	50 mL
3162a	Titanium (Ti) Standard Solution	50 mL
3163	Tungsten (W) Standard Solution	50 mL
3164	Uranium (U) Standard Solution (Radioactive)	5 x 10 mL
3165	Vanadium (V) Standard Solution	5 x 10 mL
3166a	Ytterbium (Yb) Standard Solution	5 x 10 mL
3167a	Yttrium (Y) Standard Solution	5 x 10 mL
3168a	Zinc (Zn) Standard Solution	5 x 10 mL
3169	Zirconium (Zr) Standard Solution	50 mL
3177	Mercuric Chloride Standard Solution	5 x 10 mL

See [Table 104.5](#) on the website for more information.



## Anion Chromatography (solution form)

These SRMs are single component solutions prepared gravimetrically for use in anion chromatography or any other technique that requires aqueous standard solutions for calibration or control materials.

SRM	Description	Unit of Issue
3180	Iodide Anion ( $I^-$ ) Standard Solution	5 x 5 mL
3181	Sulfate Anion ( $SO_4^{2-}$ ) Standard Solution	5 x 10 mL
3182	Chloride Anion ( $Cl^-$ ) Standard Solution	5 x 10 mL
3183	Fluoride Anion ( $F^-$ ) Standard Solution	50 mL
3184	Bromide Anion ( $Br^-$ ) Standard Solution	5 x 10 mL
3185	Nitrate Anion ( $NO_3^-$ ) Standard Solution	5 x 10 mL
3186	Phosphate Anion ( $PO_4^{3-}$ ) Standard Solution	5 x 10 mL

See [Table 104.8](#) on the website for more information.

## Stable Isotopic Materials (solid and solution forms)

The isotopic composition of these SRMs has been determined by mass spectrometry.

For light stable isotopic materials value assigned on an artifact based scale, see Light Stable Isotopic Materials

SRM	Description	Unit of Issue
951a	Boric Acid Isotopic Standard	10 g
952	Enriched Boric Acid Standard	0.25 g
973	Boric Acid Acidimetric Standard	100 g
975a	Isotopic Standard for Chlorine	0.25 g
977	Isotopic Standard for Bromine	0.25 g
978a	Assay-Isotopic Standard for Silver	0.25 g
979	Chromium Isotopic Standard	0.25 g
980	Isotopic Standard for Magnesium	0.25 g
981	Common Lead Isotopic Standard (wire)	1 g
982	Equal-Atom Lead Isotopic Standard (wire)	1 g
983	Radiogenic Lead Isotopic Standard (wire)	1 g
984	Rubidium Chloride	0.25 g
986	Isotopic Standard for Nickel	0.5 g
987	Strontium Carbonate Isotopic Standard	1 g
994	Isotopic Standard for Gallium	0.25 g
997	Thallium Isotopic Standard	0.25 g
8599	Henderson Molybdenite	10 g

See [Table 104.9](#) on the website for more information.







### Light Stable Isotopic Materials (gas, liquid, and solid forms)

These RMs are for calibration of isotope-ratio mass spectrometers and associated sample preparation systems. They are distributed by NIST on behalf of the International Atomic Energy Agency (IAEA). At the request of the IAEA, quantities of these materials are limited to one unit of each RM per laboratory every 3 years.

The isotopic compositions are given in parts per thousand difference from isotope-ratio standards-Hydrogen and oxygen: Vienna Standard Mean Ocean Water (VSMOW), Carbon: Vienna PeeDee Belemnite (VPDB), Nitrogen: atmospheric N<sub>2</sub> (Air), Silicon: NBS28 Silica Sand (optical), and Sulfur: Vienna Canyon Diablo Troilite (VCDT). In RM 8545 (LSVEC) is also expressed as an absolute isotopic ratio.

SRM	Description	Unit of Issue
8529	IAEA-S-3 (Sulfur Isotopes in Silver Sulfide)	1 x 0.5 g
8535a	VSMOW2 Vienna Standard Mean Ocean Water (Hydrogen and Oxygen Isotopes in Water)	20 mL
8536	GISP-Water	20 mL
8537	SLAP-Water Light Stable Isotopic Standard	20 mL
8539	NBS22 Oil (Carbon and Hydrogen Isotopes in Oil)	1 mL
8540	IAEA-CH-7 (Carbon and Hydrogen Isotopes in Polyethylene Foil)	3.5 g
8541	USGS24 Graphite (Carbon Isotopes in Graphite)	0.8 g
8542	IAEA-CH-6 Sucrose (Carbon Isotopes in Sucrose)	1 g
8543	NBS 18 (Carbon Isotopes in Carbonate)	0.4 g
8544	NBS 19 Limestone (Carbon and Oxygen Isotopes in Carbonate)	0.4 g
8545	LSVEC (Carbon, Oxygen, and Lithium Isotopes in Lithium Carbonate)	0.4 g
8546	NBS28 (Silicon and Oxygen Isotopes in Silica Sand)	0.4 g
8547	IAEA-N-1 (Nitrogen Isotopes in Ammonium Sulfate)	0.4 g
8548	IAEA-N-2 (Nitrogen Isotopes in Ammonium Sulfate)	0.4 g
8550	USGS25 (Nitrogen Isotopes in Ammonium Sulfate)	0.5 g

SRM	Description	Unit of Issue
8551	USGS26 (Nitrogen Isotopes in Ammonium Sulfate)	0.5 g
8552	NSVEC (Nitrogen Isotopes in Gaseous Nitrogen)	300 µmol
8553	IAEA-S-4 (Sulfur Isotopes in Elemental Sulfur)	0.5 g
8554	IAEA-S-1 (Sulfur Isotopes in Silver Sulfide)	0.5 g
8555	IAEA-S-2 (Sulfur Isotopes in Silver Sulfide)	0.5 g
8556	NBS123 (Sulfur Isotopes in Sphalerite)	1.5 g
8557	NBS127 (Sulfur and Oxygen Isotopes in Barium Sulfate)	0.5 g
8558	USGS32 (Nitrogen and Oxygen Isotopes in Nitrate)	0.9 g
8562	CO <sub>2</sub> -Heavy, Paleomarine Origin (Carbon Dioxide)	set (2)
8563	CO <sub>2</sub> -Light, Petrochemical Origin (Carbon Dioxide)	set (2)
8564	CO <sub>2</sub> -Biogenic, Modern Biomass Origin (Carbon Dioxide)	set (2)
8568	USGS34 Nitrogen and Oxygen Isotopes in Nitrate	0.9 g
8569	USGS35 Nitrogen and Oxygen Isotopes in Nitrate	0.9 g
8573	L-glutamic Acid USGS40 (Light Carbon and Nitrogen Isotopes in L-glutamic Acid)	1 g
8574	L-glutamic Acid USGS41 (Heavy Carbon and Nitrogen Isotopes in L-glutamic Acid)	0.5 g

See [Table 104.10](#) on the website for more information.





# NIST 2018 SRM EXHIBIT SCHEDULE

## *Pittsburgh Conference (PITTCON)*

Booth #3019

February 27 – March 1, 2018

Orange County Convention Center  
Orlando, FL

## *American Chemical Society Fall Meeting (ACS)*

Hynes Convention Center

August 19-21, 2018

Boston, MA

## *American Chemical Society Spring Meeting (ACS)*

March 18-20, 2018

Ernest N. Morial Convention Center  
New Orleans, LA

## *AOAC Annual Meeting & Exposition (AOAC)*

Sheraton Centre Hotel

August 26-29, 2018

Toronto, CANADA

## *AACC Meeting & Clinical Lab Exposition (AACC)*

July 31 – August 2, 2018

McCormick Place Convention Center  
Chicago, IL

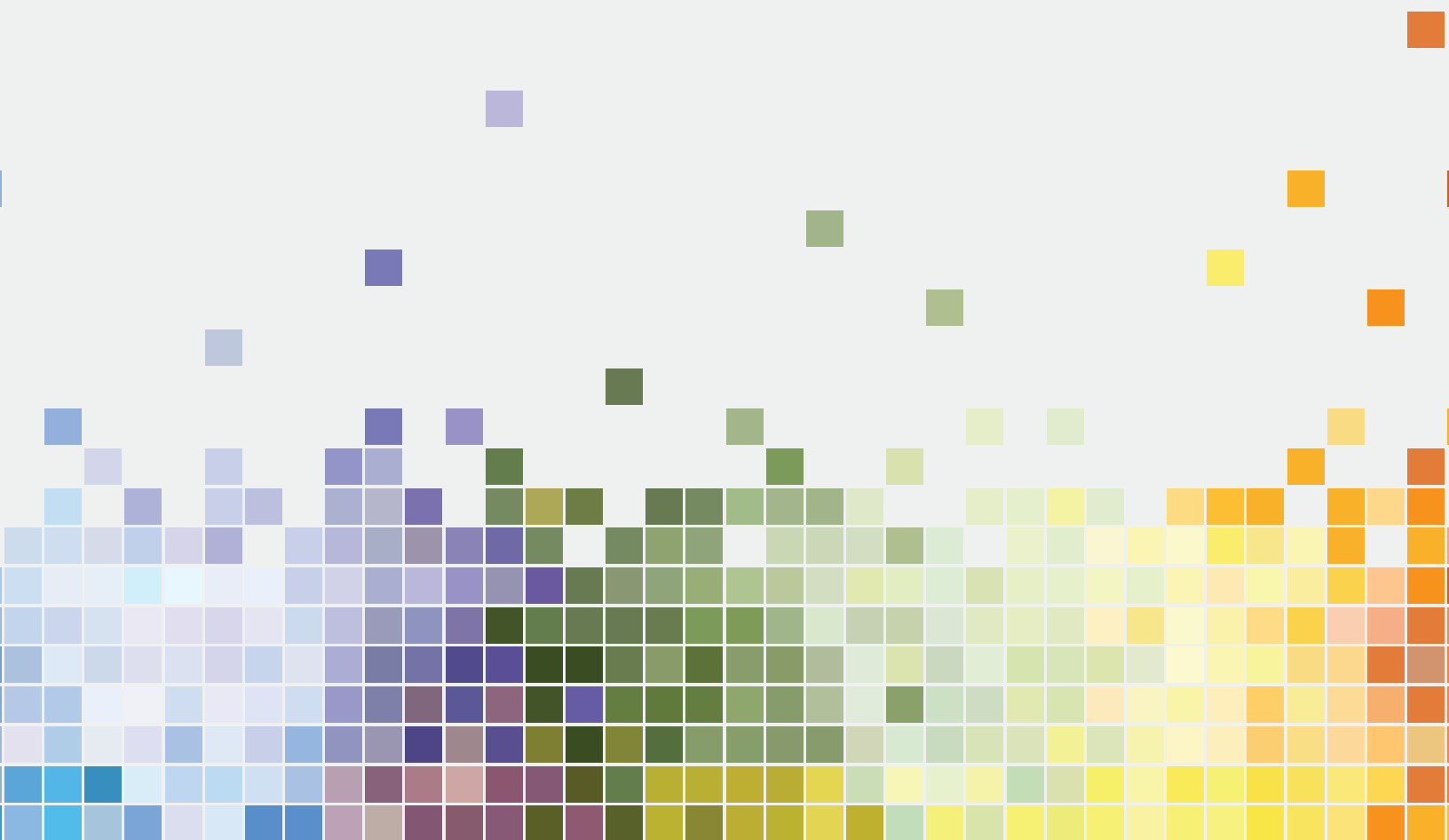




# 105

## Standard Reference Materials for Chemical Composition

Health & Industrial Hygiene





## Clinical Laboratory Materials (gas, liquid, and solid forms)

The following SRMs are for calibrating apparatus and validating analytical methods used in clinical and pathology laboratories. Additional information on the serum materials is given in table Serum and Plasma Materials.

SRM	Description	Unit of Issue
900a	Antiepilepsy Drugs in Frozen Human Serum	4 vials
909c	Frozen Human Serum	3 x 2 mL
911c	Cholesterol	2 g
912a	Urea-Clinical	25 g
913b	Uric Acid	10 g
914a	Creatinine	10 g
915b	Calcium Carbonate (Clinical Standard)	20 g
916a	Bilirubin	100 mg
917c	D-Glucose (Dextrose)	50 g
918c	Potassium Chloride (Clinical)	30 g
919b	Sodium Chloride (Clinical)	30 g
920	D-Mannitol	50 g
921	Cortisol (Hydrocortisone)	1 g
924a	Lithium Carbonate	30 g
927e	Bovine Serum Albumin (7 %, solution) (Total Protein Solution)	10 x 2.2 mL
928	Lead Nitrate (Clinical)	30 g
929a	Magnesium Gluconate	5 g
937	Iron Metal (Clinical Standard)	50 g
955c	Toxic Metals in Caprine Blood	4 vials
956d	Electrolytes in Frozen Human Serum	6 x 2.0 mL
965b	Glucose in Frozen Human Serum	set (8)
967a	Creatinine in Frozen Human Serum	set(4)
968e	Fat-Soluble Vitamins, Carotenoids, and Cholesterol in Human Serum	set (3)
971	Hormones in Frozen Human Serum	2 x 5 mL
972a	Vitamin D Metabolites in Frozen Human Serum	4 x 1 mL
998	Angiotensin I (Human)	0.5 mg
1400	Bone Ash	50 g
1486	Bone Meal	50 g
1595	Tripalmitin	2 g
1598a	Inorganic Constituents in Animal Serum	2 vials
1599	Anticonvulsant Drug Level Assay Standard	set (4)
1950	Metabolites in Human Plasma	5 x 1 mL
1951c	Lipids in Frozen Human Serum	4 vials
1952a	Cholesterol in Human Serum	set (6)

SRM	Description	Unit of Issue
2366a	Cytomegalovirus DNA (Towne $\Delta$ <sub>147</sub> BAC) for DNA Measurements	1 vial
2378	Fatty Acids in Frozen Human Serum	3 vials
2389a	Amino Acids in 0.1 mol/L Hydrochloric Acid	5 x 1.2 mL
2668	Toxic Elements in Frozen Human Urine	set (10)
2669	Arsenic Species in Frozen Human Urine	set (10)
2670a	Toxic Elements in Urine (Freeze-Dried)	sets (4)
2921	Human Cardiac Troponin Complex	5 x 115 $\mu$ L
2924	C-Reactive Protein Solution	3 x 1 mL
2972a	25-Hydroxyvitamin D Calibration Solutions	20 x 1.2 mL
2973	Vitamin D Metabolites in Frozen Human Serum (High Level)	1 vial
3667	Creatinine in Frozen Human Urine	10 mL
3668	Mercury, Perchlorate, and Iodide in Frozen Human Urine	set (10)
3669	Arsenic Species in Frozen Human Urine (Elevated Levels)	5 x 1.5 mL
3671	Nicotine Metabolites in Human Urine (Frozen)	3 x 10 mL
3672	Organic Contaminants in Smokers' Urine (Frozen)	5 x 10 mL
3673	Organic Contaminants in Non-Smokers' Urine (Frozen)	5 x 10 mL
3950	Vitamin B <sub>6</sub> in Frozen Human Serum	2 vials
8321	Peptide Mixture of Proteomics	3 vials
8323	Yeast Protein Extract	3 x 0.2 mL
8327	Peptide Reference Material for Molecular Mass and Purity Measurements	set (3)
8642a	FDA Saxitoxin Dihydrochloride Solution	10 x 1.2 mL
8671	NISTmAb, Humanized IgG1 $\kappa$ Monoclonal Antibody	800 $\mu$ L

See [Table 105.1](#) on the website for more information.







## Serum and Plasma Materials (frozen, liquid, and lyophilized forms)

These SRMs serve a variety of clinical measurement needs.

SRMs 1957 and 1958 are freeze-dried human sera for evaluating PCB congeners, chlorinated pesticides, and PBDE congeners with non-certified values for PFCs and dioxins and furans.

SRM	Description	Unit of Issue
909c	Frozen Human Serum	3 x 2 mL
927e	Bovine Serum Albumin (7 %, solution) (Total Protein Solution)	10 x 2.2 mL
956d	Electrolytes in Frozen Human Serum	6 x 2.0 mL
965b	Glucose in Frozen Human Serum	set (8)
967a	Creatinine in Frozen Human Serum	set(4)
968e	Fat-Soluble Vitamins, Carotenoids, and Cholesterol in Human Serum	set (3)
971	Hormones in Frozen Human Serum	2 x 5 mL
972a	Vitamin D Metabolites in Frozen Human Serum	4 x 1 mL
1950	Metabolites in Human Plasma	5 x 1 mL
1951c	Lipids in Frozen Human Serum	4 vials
1952a	Cholesterol in Human Serum	set (6)
1957	Organic Contaminants in Non-Fortified Human Serum	5 x 10 mL
1958	Organic Contaminants in Fortified Human Serum	5 x 10 mL
2378	Fatty Acids in Frozen Human Serum	3 x 1 mL
2921	Human Cardiac Troponin Complex	5 x 115 µL
2973	Vitamin D Metabolites in Frozen Human Serum (High Level)	1 vial
3950	Vitamin B <sub>6</sub> in Frozen Human Serum	2 vials

See [Table 105.2](#) on the website for more information.



## Ethanol Solutions

These SRMs are for use in the calibration of instruments and techniques for the determination of ethanol (ethyl alcohol) in breath and blood. SRM 1828a consists of four concentrations of ethanol-water solutions in a set of five ampoules.

SRM	Description	Unit of Issue
1828b	Ethanol-Water Solutions (Nominal Mass Fractions of 0.02 %, 0.04 %, 0.08 %, 0.1 %, 0.2 %, and 0.3 %,)	6 x 1.2 mL
2891	Ethanol-Water Solution (Nominal Mass Fraction 0.02 %)	5 x 1.2 mL
2892	Ethanol-Water Solution (Nominal Mass Fraction 0.04 %)	5 x 1.2 mL
2893	Ethanol-Water Solution (Nominal Mass Fraction 0.08 %)	5 x 1.2 mL
2894	Ethanol-Water Solution (Nominal Mass Fraction 0.1 %)	5 x 1.2 mL
2895	Ethanol-Water Solution (Nominal Mass Fraction 0.2 %)	5 x 1.2 mL
2896	Ethanol-Water Solution (Nominal Mass Fraction 0.3 %)	5 x 1.2 mL
2897a	Ethanol Water Solution (Nominal Mass Fraction 2 %)	5 x 10 mL
2898a	Ethanol Water Solution (Nominal Mass Fraction 6 %)	5 x 10 mL
2899a	Ethanol-Water Solution (Nominal Mass Fraction 25 %)	5 x 10 mL
2900	Ethanol-Water Solution (Nominal Mass Fraction 95.6 %)	5 x 10 mL

See [Table 105.3](#) on the website for more information.

## Toxic Substances in Urine (powder and frozen form)

SRM 2669 is for determination of arsenic species in human urine. A unit consists of five pouches, each containing one vial of Level I Arsenic Species and one vial of Level II Arsenic Species.

SRM	Description	Unit of Issue
2668	Toxic Elements in Frozen Human Urine	set (10)
2669	Arsenic Species in Frozen Human Urine	set (10)
2670a	Toxic Elements in Urine (Freeze-Dried)	set (4)
3668	Mercury, Perchlorate, and Iodide in Frozen Human Urine	set (10)
3669	Arsenic Species in Frozen Human Urine (Elevated Levels)	set (5)

See [Table 105.4](#) on the website for more information.



## Drugs of Abuse (hair, serum, and urine)

SRM	Description	Unit of Issue
1507b	THC-COOH in Freeze-Dried Urine	set (3)
1508a	Benzoylcegonine (Cocaine Metabolite) in Freeze-Dried Urine	set (4)

See [Table 105.7](#) on the website for more information.

## Biomaterials (solid forms)

Biomaterials are found in medical devices that are in intimate contact with tissues and body fluids.

SRM	Description	Unit of Issue
2910b	Hydroxyapatite	2 g
8011	Gold Nanoparticles, Nominal 10 nm Diameter	2 x 5 mL
8012	Gold Nanoparticles, Nominal 30 nm Diameter	2 x 5 mL
8013	Gold Nanoparticles, Nominal 60 nm Diameter	2 x 5 mL
8394	Tissue Engineering Reference Scaffolds for Cell Culture	24 scaffolds

See [Table 105.9](#) on the website for more information.



## Respirable Materials on Filter Media

These SRMs enable the determination of hazardous materials potentially found in industrial environments. SRMs 2676d, 2677a, and 3087a have been superseded by SRM 2783 Air Particulate on Filter Media.

SRM	Description	Unit of Issue
2681	Trace Constituent Elements in Blank Filters (47 mm dia)	10 filters
2783	Air Particulate on Filter Media (47 mm dia)	2 + 2 Blank
2950a	Respirable Alpha Quartz on Filter Media (Nominal Mass of Alpha Quartz 5 µg - 500 µg)	35 filters plus 35 blanks
2960	Respirable Cristobalite on Filter Media (Nominal Mass of Cristobalite: 5 µg - 250 µg)	30 filters plus 30 blanks
8785	Air Particulate Matter on Filter Media	3 filters
8786	Filter Blank for RM 8785	filter

See [Table 105.10](#) on the website for more information.

## Respirable Materials

SRMs 1878b and 1879b are crystalline silica materials with particle size in the respirable range. They are intended for use in determining, by x-ray diffraction, the levels of respirable silica in an industrial atmosphere according to National Institute for Occupational Safety and Health (NIOSH) Analytical Method 7500 or equivalent methods.

SRM	Description	Unit of Issue
1648a	Urban Particulate Matter	2 g
1649b	Urban Dust	2 g
1650b	Diesel Particulate Matter	200 mg
1877	Beryllium Oxide Powder	20 g
1878b	Respirable Alpha Quartz (Quantitative X-Ray Powder Diffraction Standard)	5 g
1879b	Respirable Cristobalite (Quantitative X-Ray Powder Diffraction Standard)	5 g
1975	Diesel Particulate Extract	4 x 1.2 mL
2583	Trace Elements in Indoor Dust (Nominal Mass Fraction of 90 mg/kg Lead)	8 g
2584	Trace Elements in Indoor Dust (Nominal Mass Fraction of 1% Lead)	8 g
2585	Organic Contaminants in House Dust	10 g
2786	Fine Atmospheric Particulate Matter (Mean Particle Diameter < 4 µm)	100 mg
2787	Fine Atmospheric Particulate Matter (Mean Particle Diameter < 10 µm)	100 mg
2975	Diesel Particulate Matter (Industrial Forklift)	1 g

See [Table 105.12](#) on the website for more information.



## DNA Profiling and Nucleic Acid Materials (solid forms)

SRM 2374 is intended for use as a template for ribonucleic acid (RNA) control synthesis using *in vitro* transcription (IVT). These RNA controls are designed to be used as external, or “spike-in”, controls to support confidence in gene expression assays by providing quantitative assessment of the technical performance of a gene expression measurement. A unit of the SRM contains 96 different 0.5 mL polypropylene tubes, with approximately 10 µg of dehydrated plasmid deoxyribonucleic acid (DNA) in each tube. Depending on the strand transcribed, the controls will mimic either “sense” or “anti-sense” eukaryotic messenger RNA (mRNA).

SRM 2391c is intended for use in the standardization of forensic and paternity quality assurance procedures and instructional law enforcement or non-clinical research purposes. SRM 2391c includes short tandem repeat (STR) information for all genomic DNA samples in the SRM. The STR data includes the Federal Bureau of Investigation's (FBI's) CODIS (Combined DNA Index System) core STR loci and other loci that were commercially available at the time of certification. Certified values for a total of 54 STR loci plus Amelogenin, 29 of which are Y-STRs, Reference values for 26 STR loci, and Information values for 1 STR locus, 12 X-STR loci, and 30 Insertion/Deletions (Indels) are included in this issue. The new standard includes well-characterized DNA in two forms: genomic DNA and DNA to be extracted from cells spotted onto 903 and FTA filter papers. SRM 2391c consists of 6 components packaged in one box and stored at refrigeration temperatures (NOT frozen).

SRM 2392 is intended to provide quality control when performing the polymerase chain reaction (PCR) and sequencing of human mitochondrial DNA (mtDNA) for forensic identifications, medical diagnosis, or mutation detection. It may also be used as a control when amplifying (PCR) and sequencing any DNA. SRM 2392 Mitochondrial DNA Sequencing contains DNA extracted from two cell lines plus cloned DNA from a region that is difficult to sequence. The certificate accompanying the SRM details the base pair sequences of the DNA, and the sequences of 58 unique primer sets which permit the amplification and sequencing of any specific area or the entire human mitochondrial DNA (strand). SRM 2392 consists of three frozen components packaged in one box. For further information see: SP260-155

SRM 2392-I Mitochondrial DNA Sequencing compliments and adds another DNA template to SRM 2392 for the amplification and sequencing of human mtDNA. The selection of the HL-60 cell culture line for this additional DNA template was based on a suggestion from the Federal Bureau of Investigation (FBI) that this DNA would be particularly useful to the forensic community. For further information see: SP260-155

SRM 2394 Heteroplasmic Mitochondrial DNA Mutation Standard contains mixtures of a 285 base pair polymerase chain reaction (PCR) product from two different cell culture lines that differ by one base pair. These mixtures contain varying ratios of the minor/major heteroplasmy including 1/99, 2.5/97.5, 5/95, 10/90, 20/80, 30/70, 40/60, and 50/50. This SRM is intended to provide quality control in determining the sensitivity of heteroplasmic low-frequency single nucleotide mutation detection techniques.

RMs 8375, 8391, 8392, 8393, and 8398 are intended for assessing performance of human genome sequencing, including whole genome sequencing, whole exome sequencing, and more targeted sequencing such as gene panels. Specifically, the material can be used to obtain estimates of true positives, false positives, true negatives, and false negatives for variant calls.

SRM	Description	Unit of Issue
2366a	Cytomegalovirus DNA (Towne $\Delta$ 147 BAC) for DNA Measurements	1 vial
2372	Human DNA Quantitation Standard	set (3)
2373	Genomic DNA Standards for <i>HER2</i> Measurements	5 vials
2374	DNA Sequence Library for External RNA Controls	96 tubes
2391c	PCR-Based DNA Profiling Standard	6 vials
2392	Mitochondrial DNA Sequencing	set (3)
2392-I	Mitochondrial DNA Sequencing	1 vial
2393	CAG Repeat Length Mutation in Huntington's Disease	set (6)
2394	Heteroplasmic Mitochondrial DNA Mutation Detection Standard	set (10)
2396	Oxidative DNA Damage Mass Spectrometry Standards	set (10)
8375	Microbial Genomic DNA Standards for Sequencing Performance Assessment	4 vials
8391	Human DNA for Whole-Genome Variant Assessment (Son of Eastern European Ashkenazim Jewish Ancestry)	1 vial
8392	Human DNA for Whole-Genome Variant Assessment (Trio of Eastern European Ashkenazim Jewish Ancestry)	3 vials
8393	Human DNA for Whole-Genome Variant Assessment (Son of Chinese Ancestry)	1 vial
8398	Human DNA for Whole-Genome Variant Assessment (Daughter of Utah/European Ancestry)	1 vial

See [Table 105.8](#) on the website for more information.





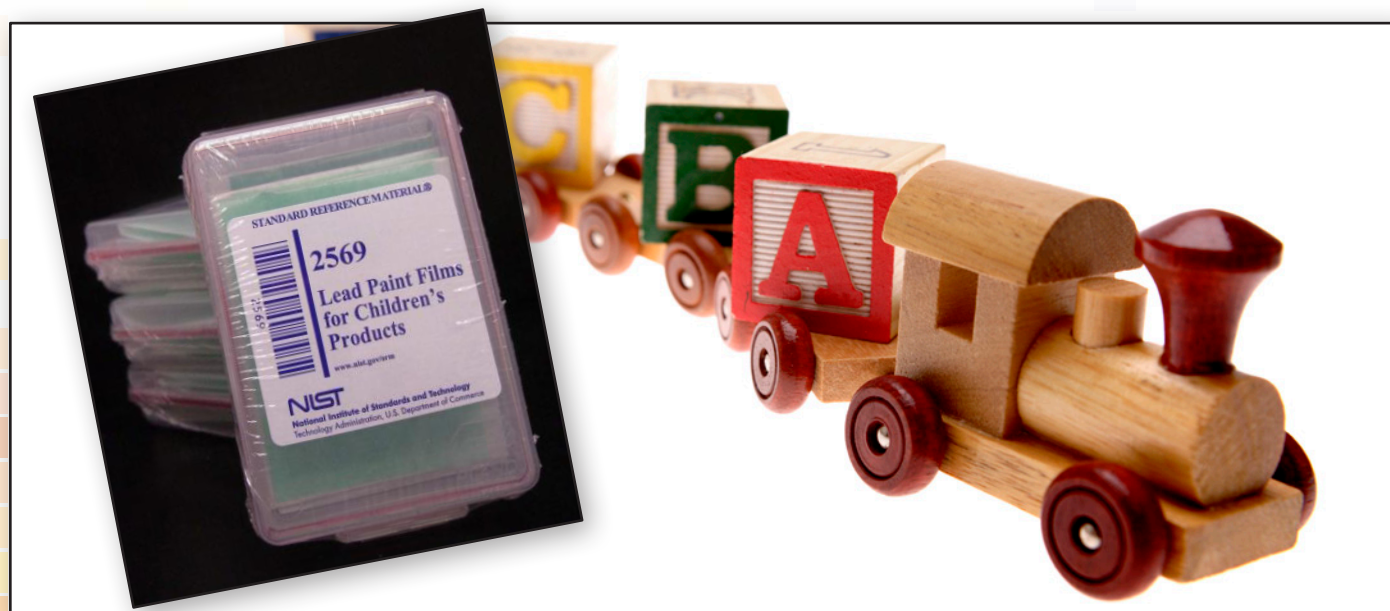
## Lead in Paint, Dust, and Soil (powder and sheet forms)

These SRMs and RM have been developed in conjunction with the U.S. EPA to monitor paint, soil, and dust sources of lead. SRMs 2570 through 2576 consist of one Mylar™ sheet per unit. Each sheet, 7.6 cm x 10.2 cm, is coated with a single uniform paint layer for use with portable x-ray fluorescence analyzers. SRMs 2580, 2581, 2582, and 2589 consist of paint that has been ground and homogenized into a powder, 99+% of which passes a 100 mm sieve. SRM 2583 and SRM 2584 consist of dust, 99+% of which passes a 100 mm sieve, that was collected in vacuum cleaner bags during cleaning of dwelling interiors. SRM 2583 and SRM 2584 are certified for arsenic, chromium, cadmium, lead, and mercury. [Also see Category 106.] SRMs 2584, 2586, and 2587 are dust or soil matrices containing lead from paint. RM 8680 consists of a 10.2 cm wide x 15.2 cm long x 1.3 cm thick section of painted fiberboard and is intended for use in the evaluation of destructive and nondestructive methods of measuring lead in paint on fiberboard.

SRM	Description	Unit of Issue
1648a	Urban Particulate Matter	2 g
2569	Lead Paint Films for Children's Products	8 sheets
2570	Lead Paint Film for Portable X-Ray Fluorescence Analyzers - Blank (Color: White)	1 film
2571	Lead Paint Film for Building Surfaces (Nominal Pb 3.5 mg/cm <sup>2</sup> )(Color: Yellow)	1 + blank
2572	Lead Paint Film for Building Surfaces (Nominal Pb 1.6 mg/cm <sup>2</sup> )(Color: Orange)	1 + blank
2573	Lead Paint Film for Building Surfaces (Nominal Pb 1.0 mg/cm <sup>2</sup> )(Color: Red)	1 + blank
2574	Lead Paint Film for Building Surfaces (Nominal Pb 0.7 mg/cm <sup>2</sup> )(Color: Gold)	1 + blank

SRM	Description	Unit of Issue
2575	Lead Paint Film for Building Surfaces (Nominal Pb 0.3 mg/cm <sup>2</sup> )(Color: Green)	1 + blank
2576	Lead Paint Film for Building Surfaces (Nominal Pb 5.6 mg/cm <sup>2</sup> )(Color: Blue)	1 + blank
2579a	Lead Paint Films For Building Surfaces (SRM 2570 through SRM 2575)	set (6)
2580	Powdered Paint (Nominal Mass Fraction 4 % Lead)	30 g
2581	Powdered Paint (Nominal Mass Fraction 0.5 % Lead)	35 g
2582	Powdered Paint (Nominal Mass Fraction 200 mg/kg Lead)	20 g
2583	Trace Elements in Indoor Dust (Nominal Mass Fraction of 90 mg/kg Lead)	8 g
2584	Trace Elements in Indoor Dust (Nominal Mass Fraction of 90 mg/kg Lead)	8 g
2586	Trace Elements in Soil Containing Lead From Paint (Nominal Mass Fraction 500 mg/kg Lead)	55 g
2587	Trace Elements in Soil (Nominal Mass Fraction of 3000 mg/kg Lead)	55 g
2589	Powdered Paint (Nominal Mass Fraction 10% Lead)	35 g
2783	Air Particulate on Filter Media (47 mm dia)	2 + 2 Blank
8680	Paint on Fiberboard, Nominal 1 to 2 mg/cm <sup>2</sup> Lead	each

See [Table 105.13](#) on the website for more information.



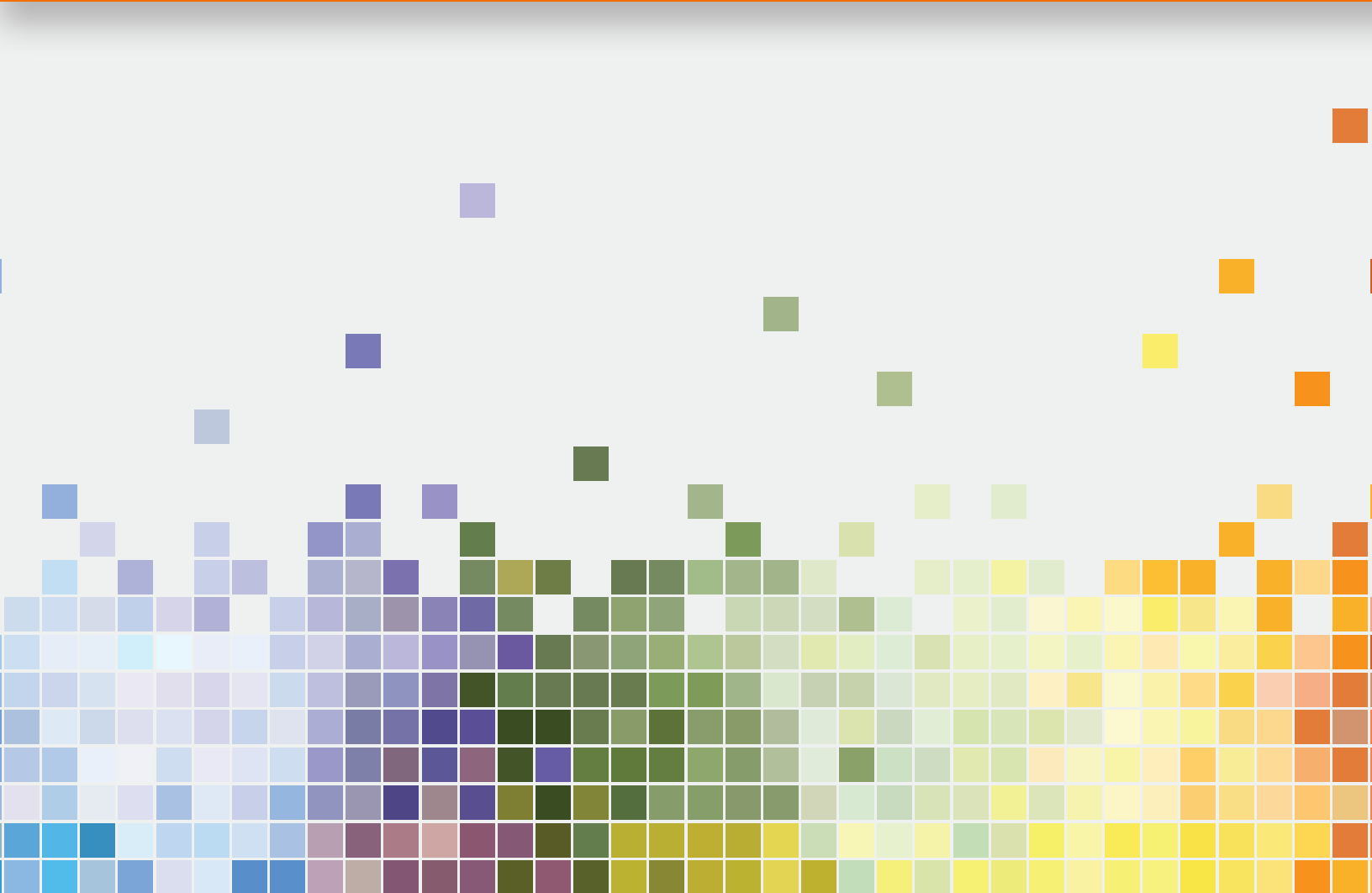


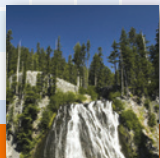


# 106

## Standard Reference Materials for Chemical Composition

**Inorganics**





## Metal (Inorganics) Constituents in Natural Matrices (liquid and solid forms)

These SRMs and RM are for analysis of materials of health or environmental interest.

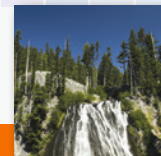
SRM	Description	Unit of Issue
1640a	Trace Elements in Natural Water	250 mL
1641e	Mercury in Water	10 x 10 mL
1643f	Trace Elements in Water	250 mL
1646a	Estuarine Sediment	70 g
1648a	Urban Particulate Matter	2 g
1944	New York/New Jersey Waterway Sediment	50 g
1946	Lake Superior Fish Tissue	5 x 7-9 g
1947	Lake Michigan Fish Tissue	5 x 8 g
2385	Slurried Spinach	4 x 70 g
2387	Peanut Butter	3 x 170 g
2451	Fine Carbon (Activated) From Cyanide Ore Leaching	100 g
2583	Trace Elements in Indoor Dust (Nominal Mass Fraction of 90 mg/kg Lead)	8 g
2584	Trace Elements in Indoor Dust (Nominal Mass Fraction of 1 % Lead)	8 g
2586	Trace Elements in Soil Containing Lead From Paint (Nominal Mass Fraction 500 mg/kg Lead)	55 g
2587	Trace Elements in Soil (Nominal Mass Fraction of 3000 mg/kg Lead)	55 g
2700	Hexavalent Chromium in Contaminated Soil (Low Level)	75 g
2701	Hexavalent Chromium in Contaminated Soil (High Level)	75 g
2702	Inorganics in Marine Sediment	50 g
2703	Sediment for Solid Sampling (Small Sample) Analytical Techniques	5 g
2709a	San Joaquin Soil	50 g
2710a	Montana I Soil	50 g
2711a	Montana II Soil	50 g
2780a	Hard Rock Mine Waste	50 g
2781	Domestic Sludge	40 g

SRM	Description	Unit of Issue
2782	Industrial Sludge	70 g
2783	Air Particulate on Filter Media (47 mm dia)	2 + 2 Blank
2976	Mussel Tissue (Trace Elements & Methylmercury) Freeze-Dried	25 g
8704	Buffalo River Sediment	50 g
8785	Air Particulate Matter on Filter Media	3 filters
8786	Filter Blank for RM 8785	filter

See [Table 106.1](#) on the website for more information.







## Mercury in Activated Carbon

These SRMs are intended for use in the evaluation of chemical methods of analysis for mercury.

SRM	Description	Unit of Issue
2445	Mercury in Iodinated Activated Carbon	25 g
2448	Mercury in Brominated Activated Carbon	25 g
2451	Fine Carbon (Activated) - From Cyanide Ore Leaching	100 g

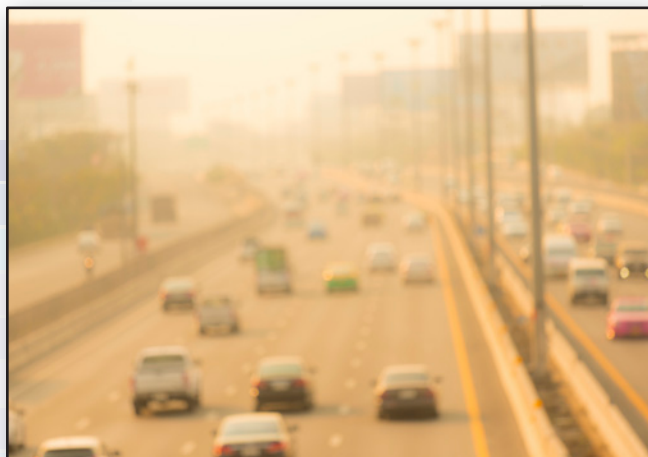
See [Table 106.3](#) on the website for more information.

## Environmental Matrices with Carbon Values

These materials are intended for use in evaluating analytical methods used to measure carbon; SRM 1216 is intended for the calibration of instruments, used to measure total carbon.

SRM	Description	Unit of Issue
1216	Carbon Modified Silica	3 x 1 g
1632d	Trace Elements in Coal (Bituminous)	50 g
1944	New York/New Jersey Waterway Sediment	50 g
2718a	Green Petroleum Coke	50 g
2719	Calcined Petroleum Coke	50 g
2775	Foundry Coke	50 g
2776	Furnace Coke	50 g
8704	Buffalo River Sediment	50 g
8785	Air Particulate Matter on Filter Media	3 filters
8786	Filter Blank for RM 8785	filter

See [Table 106.4](#) on the website for more information.



## Used Auto Catalysts (powder form)

These SRMs are intended for use in the evaluation of methods for the analysis of the platinum group metals and lead in auto catalysts. They were produced in cooperation with the International Precious Metals Institute and are issued as fine (74  $\mu\text{m}$ , 200 mesh) powders.

SRM	Description	Unit of Issue
2556	Used Auto Catalyst (Pellets)	70 g
2557	Used Auto Catalyst (Monolith)	70 g

See [Table 106.6](#) on the website for more information.

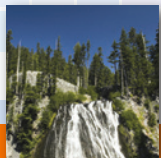
## Zeolites (powder form)

These RMs are intended to provide a common source of zeolite materials for measurement comparisons. Additional reference and information values are provided for atomic ratios of Si to Al and Na to Al, trace element content, enthalpy of formation, unit cell parameters and particle size distributions. Figures are provided showing spectra for NMR analyses, plots of particle size distribution, electron microscope images of particles and plots of variation in sample mass with change in ambient humidity.

SRM	Description	Unit of Issue
8850	Zeolite Y	35-40 g
8851	Zeolite A	35-40 g
8852	Ammonium ZSM-5 Zeolite	35-40 g

See [Table 106.7](#) on the website for more information.





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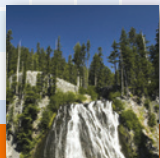


# 107

## Standard Reference Materials for Chemical Composition

**Primary Gas Mixtures**





## Primary Gas Mixtures

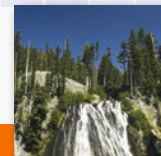
These SRMs are for calibrating equipment and apparatus used to measure various components of gas mixtures and atmospheric pollutants. The typical gas mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a nominal pressure exceeding 12.4 mPa that provides the user with approximately 0.73 m<sup>3</sup> of usable mixture. Due to increasing customer demand, these primary gas mixtures are in short supply and may not be readily available for sale. In such cases, a NIST traceable reference gas described below may be substituted.

A NIST Traceable Reference Material (NTRM) is a reference material produced by a commercial supplier with a well-defined traceability to NIST. This traceability is established via criteria and protocols defined by NIST that are tailored to meet the needs of the metrological community to be served. The NTRM concept was established to allow NIST to respond to the increasing needs for high quality reference materials by leveraging its relatively fixed human and financial resources with secondary reference material producers. Reference material producers adhering to NIST defined protocol requirements are allowed to use the NTRM trademark to identify their product.

The gas NTRM program was established in 1992 in partnership with the U.S. EPA and specialty gas companies as a means for providing end-users with the wide variety of certified gas standards needed to implement the Emissions Trading provision of the 1990 Clean Air Act. Gas NTRMs are produced and distributed by specialty gas companies with NIST oversight of the production and maintenance, and direct involvement in the analysis. NTRMs can be developed for any pollutant, concentration, and balance gas combination for which a NIST primary standard or SRM exists. The gas standards prepared according to this program are related, within known limits of uncertainty, to specific gaseous primary standards maintained by NIST.

SRM	Description	Unit of Issue
<b>Carbon Dioxide</b>		
2745*	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 16 % mol/mol)	6 L Cylinder
1674b*	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 7 % mol/mol)	6 L Cylinder
2625a*	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 3.5 % mol/mol)	6 L Cylinder
2624a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 3 % mol/mol)	6 L Cylinder
2623a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 2.5 % mol/mol)	6 L Cylinder
2622a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 2 % mol/mol)	6 L Cylinder
2621a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 1.5 % mol/mol)	6 L Cylinder
2620a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 1 % mol/mol)	6 L Cylinder
2619a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 0.5 % mol/mol)	6 L Cylinder
2617	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 500 µmol/mol)	6 L Cylinder

	<b>Carbon Monoxide</b>	
2614a	Carbon Monoxide in Air (Nominal Amount-of-Substance Fraction 45 µmol/mol)	6 L Cylinder
2613a	Carbon Monoxide in Air (Nominal Amount-of-Substance Fraction 20 µmol/mol)	6 L Cylinder
2741a	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 13 % mol/mol)	6 L Cylinder
2740a	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 10 % mol/mol)	6 L Cylinder
2642a*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 8 % mol/mol)	6 L Cylinder
2641a	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 4 % mol/mol)	6 L Cylinder
2640a	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 2 % mol/mol)	6 L Cylinder
2639a	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 1 % mol/mol)	6 L Cylinder
2638a*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 5000 µmol/mol)	6 L Cylinder
2637a*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 2500 µmol/mol)	6 L Cylinder
1681b*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 1000 µmol/mol)	6 L Cylinder



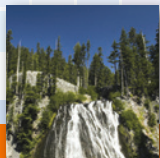
SRM	Description	Unit of Issue
<b>Carbon Monoxide</b>		
1680b*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 500 $\mu\text{mol/mol}$ )	6 L Cylinder
2636a*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 250 $\mu\text{mol/mol}$ )	6 L Cylinder
1679c*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 100 $\mu\text{mol/mol}$ )	6 L Cylinder
1678c*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 50 $\mu\text{mol/mol}$ )	6 L Cylinder
2635a*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 25 $\mu\text{mol/mol}$ )	6 L Cylinder
1677c*	Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 10 $\mu\text{mol/mol}$ )	6 L Cylinder

	<b>Nitric Oxide, Nitrous Oxide and Total Oxides of Nitrogen</b>	
2631a*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 3000 $\mu\text{mol/mol}$ )	6 L Cylinder
2630*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 1500 $\mu\text{mol/mol}$ )	6 L Cylinder
2735	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 800 $\mu\text{mol/mol}$ )	6 L Cylinder
1687b*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 1000 $\mu\text{mol/mol}$ )	6 L Cylinder
1686b*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 500 $\mu\text{mol/mol}$ )	6 L Cylinder
1685b*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 250 $\mu\text{mol/mol}$ )	6 L Cylinder
1684b*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 100 $\mu\text{mol/mol}$ )	6 L Cylinder
1683b*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 50 $\mu\text{mol/mol}$ )	6 L Cylinder
2629a*	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 20 $\mu\text{mol/mol}$ )	6 L Cylinder
2628a	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 10 $\mu\text{mol/mol}$ )	6 L Cylinder
2627a	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 5 $\mu\text{mol/mol}$ )	6 L Cylinder
2738	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 1000 nmol/mol)	30 L Cylinder
2737	Nitric Oxide in Nitrogen (Nominal Amount-of-Substance Fraction 500 nmol/mol)	30 L Cylinder
1718	Nitrous Oxide in Air (Nominal Amount-of-Substance Fraction 1 $\mu\text{mol/mol}$ )	6 L Cylinder
2660a*	Total Oxides of Nitrogen (NO <sub>x</sub> ) in Air (Nominal Amount-of-Substance Fraction 100 $\mu\text{mol/mol}$ )	6 L Cylinder

	<b>Oxygen</b>	
2659a*	Oxygen in Nitrogen (Nominal Amount-of-Substance Fraction 21 % mol/mol)	6 L Cylinder
2658a*	Oxygen in Nitrogen (Nominal Amount-of-Substance Fraction 10 % mol/mol)	6 L Cylinder
2657a*	Oxygen in Nitrogen (Nominal Amount-of-Substance Fraction 2 % mol/mol)	6 L Cylinder

	<b>Sulfur Dioxide</b>	
1696a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 3500 $\mu\text{mol/mol}$ )	6 L Cylinder
1664a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 2500 $\mu\text{mol/mol}$ )	6 L Cylinder
1663a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 1500 $\mu\text{mol/mol}$ )	6 L Cylinder
1662a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 1000 $\mu\text{mol/mol}$ )	6 L Cylinder
1661a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 500 $\mu\text{mol/mol}$ )	6 L Cylinder
1694a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 100 $\mu\text{mol/mol}$ )	6 L Cylinder
1693a*	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 50 $\mu\text{mol/mol}$ )	6 L Cylinder
1689	Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 5 $\mu\text{mol/mol}$ )	6 L Cylinder





# Chemical Composition

107 ■ Primary Gas Mixtures

SRM	Description	Unit of Issue
<b>Hydrogen Sulfide</b>		
2731	Hydrogen Sulfide in Nitrogen (Nominal Amount-of-Substance Fraction 20 $\mu\text{mol/mol}$ )	6 L Cylinder
2730	Hydrogen Sulfide in Nitrogen (Nominal Amount-of-Substance Fraction 5 $\mu\text{mol/mol}$ )	6 L Cylinder
<b>Organic Compounds</b>		
1800b	Eighteen Non-Methane Hydrocarbon Compounds in Nitrogen (Nominal 5 nmol/mol)	6 L Cylinder
1660a	Methane and Propane in Air (Nominal: 4 $\mu\text{mol/mol}$ Methane; 1 $\mu\text{mol/mol}$ Propane)	6 L Cylinder
2751	Methane in Air (Nominal Amount-of-Substance Fraction 100 $\mu\text{mol/mol}$ )	6 L Cylinder
2750	Methane in Air (Nominal Amount-of-Substance Fraction 50 $\mu\text{mol/mol}$ )	6 L Cylinder
1659a	Methane in Air (Nominal Amount-of-Substance Fraction 10 $\mu\text{mol/mol}$ )	6 L Cylinder
1658a	Methane in Air (Nominal Amount-of-Substance Fraction 1 $\mu\text{mol/mol}$ )	6 L Cylinder
1669b	Propane in Air (Nominal Amount-of-Substance Fraction 500 $\mu\text{mol/mol}$ )	6 L Cylinder
1668b*	Propane in Air (Nominal Amount-of-Substance Fraction 100 $\mu\text{mol/mol}$ )	6 L Cylinder
1666b	Propane in Air (Nominal Amount-of-Substance Fraction 10 $\mu\text{mol/mol}$ )	6 L Cylinder
1667b	Propane in Air (Nominal Amount-of-Substance Fraction 50 $\mu\text{mol/mol}$ )	6 L Cylinder
1665b	Propane in Air (Nominal Amount-of-Substance Fraction 3 $\mu\text{mol/mol}$ )	6 L Cylinder
2764	Propane in Air (Nominal Amount-of-Substance Fraction 0.25 $\mu\text{mol/mol}$ )	6 L Cylinder
2765	Propane in Air (Nominal Amount-of-Substance Fraction 100 nmol/mol)	6 L Cylinder
2647a	Propane in Nitrogen (Nominal Amount-of-Substance Fraction 2500 $\mu\text{mol/mol}$ )	6 L Cylinder
2646a	Propane in Nitrogen (Nominal Amount-of-Substance Fraction 1000 $\mu\text{mol/mol}$ )	6 L Cylinder
2644a	Propane in Nitrogen (Nominal Amount-of-Substance Fraction 250 $\mu\text{mol/mol}$ )	6 L Cylinder
<b>Ambient Air</b>		
1720	Northern Continental Air (Ambient Nominal Amount-of-Substance Fraction: Carbon Dioxide, Methane, Nitrous Oxide)	30 L Cylinder
1721	Southern Oceanic Air (Ambient Nominal Amount-of-Substance Fraction: Carbon Dioxide, Methane, Nitrous Oxide)	30 L Cylinder

See [Table 107.1](#) on the website for more information.

Those SRMs that are marked “\*” are available as NTRMs from commercial suppliers.



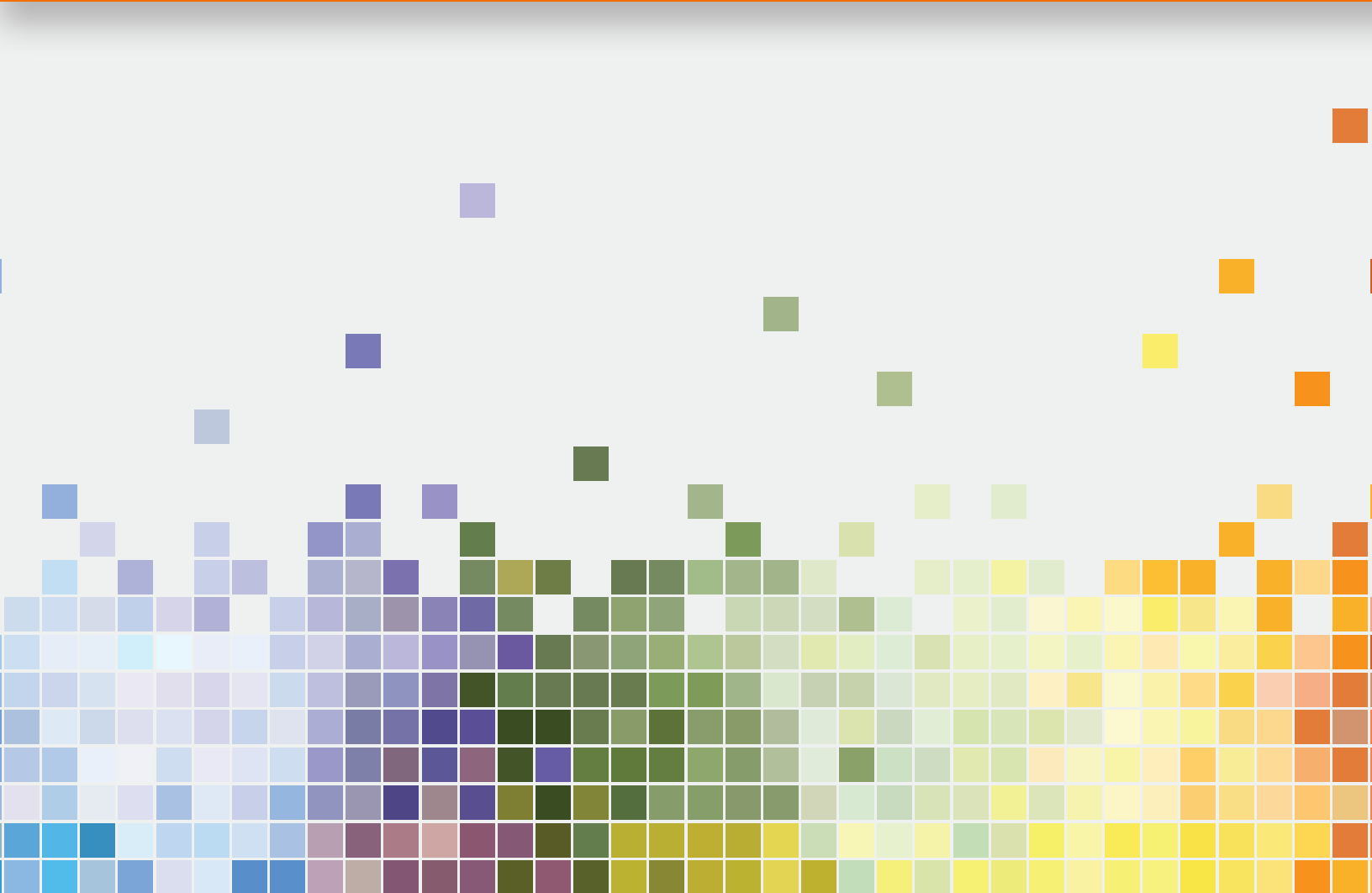


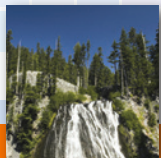


# 108

## Standard Reference Materials for Chemical Composition

**Fossil & Alternative Fuels**





### Alcohols and Ethers [Oxygenates] in Gasoline

SRMs 2294 through 2297 were produced in response to the U.S. EPA Final Rule on Reformulated Gas aimed at reducing the volatile organic compounds emitted from gasoline. SRMs 2294 through 2297 are certified for oxygenate, sulfur, benzene, and toluene, with reference values for olefins and aromatics.

SRM	Description	Unit of Issue
2294	Reformulated Gasoline (Nominal Mass Fraction 11 % MTBE)	2 x 20 mL
2295	Reformulated Gasoline (Nominal Mass Fraction 15 % MTBE)	2 x 20 mL
2296	Reformulated Gasoline (Nominal Mass Fraction 13 % ETBE)	2 x 20 mL
2297	Reformulated Gasoline (Nominal Mass Fraction 10 % Ethanol)	2 x 20 mL

See [Table 108.1](#) on the website for more information.

### Metal Constituents in Fossil Fuels (liquid forms)

This SRM and RM are for analysis of metal trace elements in fuel oil and reference fuel. SRM 1634c is a “No. 6” fuel oil in terms of viscosity but has a flash point of 43 °C.

SRM	Description	Unit of Issue
1634c	Trace Elements in Fuel Oil	100 mL
8505	Vanadium in Crude Oil	250 mL

See [Table 108.2](#) on the website for more information.

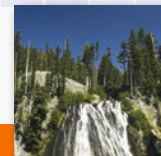
### Sulfur, Mercury, and Chlorine in Fuels (liquid and solid forms)

These materials are for analysis of sulfur, mercury, and chlorine in fossil fuels.

SRM	Description	Unit of Issue
1616b	Sulfur in Kerosene (Low Level)	100 mL
1617b	Sulfur in Kerosene (High Level)	100 mL
1619b	Sulfur in Residual Fuel Oil (0.7 %)	100 mL
1620c	Sulfur in Residual Fuel Oil (4 %)	100 mL
1622e	Sulfur in Residual Fuel Oil (Nominal Mass Fraction 2 %)	100 mL
1623c	Sulfur in Residual Fuel Oil 0.3 %	100 mL
1624d	Sulfur in Diesel Fuel Oil, 0.4 %	100 mL

SRM	Description	Unit of Issue
1632d	Trace Elements in Coal (Bituminous)	50 g
1635a	Trace Elements in Coal, (Subbituminous)	50 g
2294	Reformulated Gasoline (Nominal Mass Fraction 11% MTBE)	2 x 20 mL
2295	Reformulated Gasoline (Nominal Mass Fraction 15 % MTBE)	2 x 20 mL
2296	Reformulated Gasoline (Nominal Mass Fraction 13 % ETBE)	2 x 20 mL
2297	Reformulated Gasoline (Nominal Mass Fraction 10 % Ethanol)	2 x 20 mL
2298	Sulfur in Gasoline (High-Octane)	5 x 20 mL
2299	Sulfur in Gasoline (Reformulated)	5 x 20 mL
2682c	Subbituminous Coal (Nominal Mass Fraction 0.5 % Sulfur)	1 x 50 g
2683c	Bituminous Coal (Nominal Mass Fraction 2 % Sulfur)	50 g
2684c	Bituminous Coal (Nominal Mass Fraction 3 % Sulfur)	50 g
2685c	Bituminous Coal (Nominal Mass Fraction 5 % Sulfur)	50 g
2693	Bituminous Coal (Nominal Mass Fraction 0.5 % Sulfur)	50 g
2716	Sulfur in Gasoline (<1 mg/kg)	5 x 20 mL
2717a	Sulfur in Residual Fuel Oil (Nominal Mass Fraction 3 %)	100 mL
2718a	Green Petroleum Coke	50 g
2719	Calcined Petroleum Coke	50 g
2720	Sulfur in Di- <i>n</i> -Butyl Sulfide	5 x 4.5 mL
2721	Crude Oil (Light-Sour)	5 x 10 mL
2722	Crude Oil (Heavy Sweet)	5 x 10 mL
2723b	Sulfur in Diesel Fuel Oil (Nominal Mass Fraction 10 mg/kg)	100 mL
2770	Sulfur in Diesel Fuel Oil (40 mg/kg)	10 x 10 mL
2771	Sulfur in Diesel Fuel Blend Stock	100 mL
2773	B100 Biodiesel (Animal-Based)	5 x 10 mL
2775	Foundry Coke	50 g
2776	Furnace Coke	50 g

See [Table 108.3](#) on the website for more information and additional resources.



## Moisture in Oils and Alcohols (liquid form)

SRM 2890, Water Saturated 1-Octanol, is certified for water content and is intended for use in calibrating instruments and validating the accuracy of analytical methods. Water concentration values, for RMs 8506a, 8509, and 8510 are not certified, but represent the “best estimate” of the moisture content determined by NIST, and are intended for use in developing and validating methods for the determination of moisture in oil and similar matrices.

SRM	Description	Unit of Issue
2721	Crude Oil (Light -Sour)	5 x 10 mL
2722	Crude Oil (Heavy Sweet)	5 x 10 mL
2890	Water Saturated 1-Octanol	5 x 2 mL
8506a	Moisture in Transformer Oil	5 x 9.5 mL
8509	Moisture in Methanol	5 x 5 mL
8510	Moisture in Methanol	5 x 5 mL

See [Table 108.4](#) on the website for more information.

## Fossil Fuel: Trace Elements (solid forms)

SRM	Description	Unit of Issue
1632d	Trace Elements in Coal (Bituminous)	50 g
1633c	Trace Elements in Coal Fly Ash	75 g
1635a	Trace Elements in Coal, (Subbituminous)	50 g
2429	Flue Gas Desulfurization Gypsum	1 x 200 g
2689	Coal Fly Ash	3 x 10 g
2690	Coal Fly Ash	3 x 10 g
2691	Coal Fly Ash	3 x 10 g
2718a	Green Petroleum Coke	50 g
2719	Calcined Petroleum Coke	50 g

See [Table 108.6](#) on the website for more information.

## Biofuels

SRM	Description	Unit of Issue
2377	Fatty Acid Methyl Esters in 2,2,4-Trimethylpentane	5 x 1.2 mL
2772	B100 Biodiesel (Soy-Based)	5 x 10 mL
2773	B100 Biodiesel (Animal-Based)	5 x 10 mL

See [Table 108.8](#) on the website for more information.

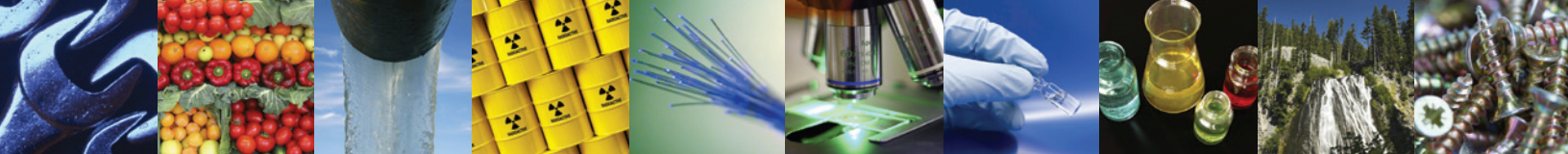
## Biomass Feedstock

SRM	Description	Unit of Issue
8491	Sugarcane Bagasse Whole Biomass Feedstock	50 g
8492	Eastern Cottonwood Whole Biomass Feedstock	50 g
8493	Monterey Pine Whole Biomass Feedstock	50 g
8494	Wheat Straw Whole Biomass Feedstock	50 g
8495	Northern Softwood	10 sheets
8496	Eucalyptus Hardwood	10 sheets

See [Table 108.9](#) on the website for more information.







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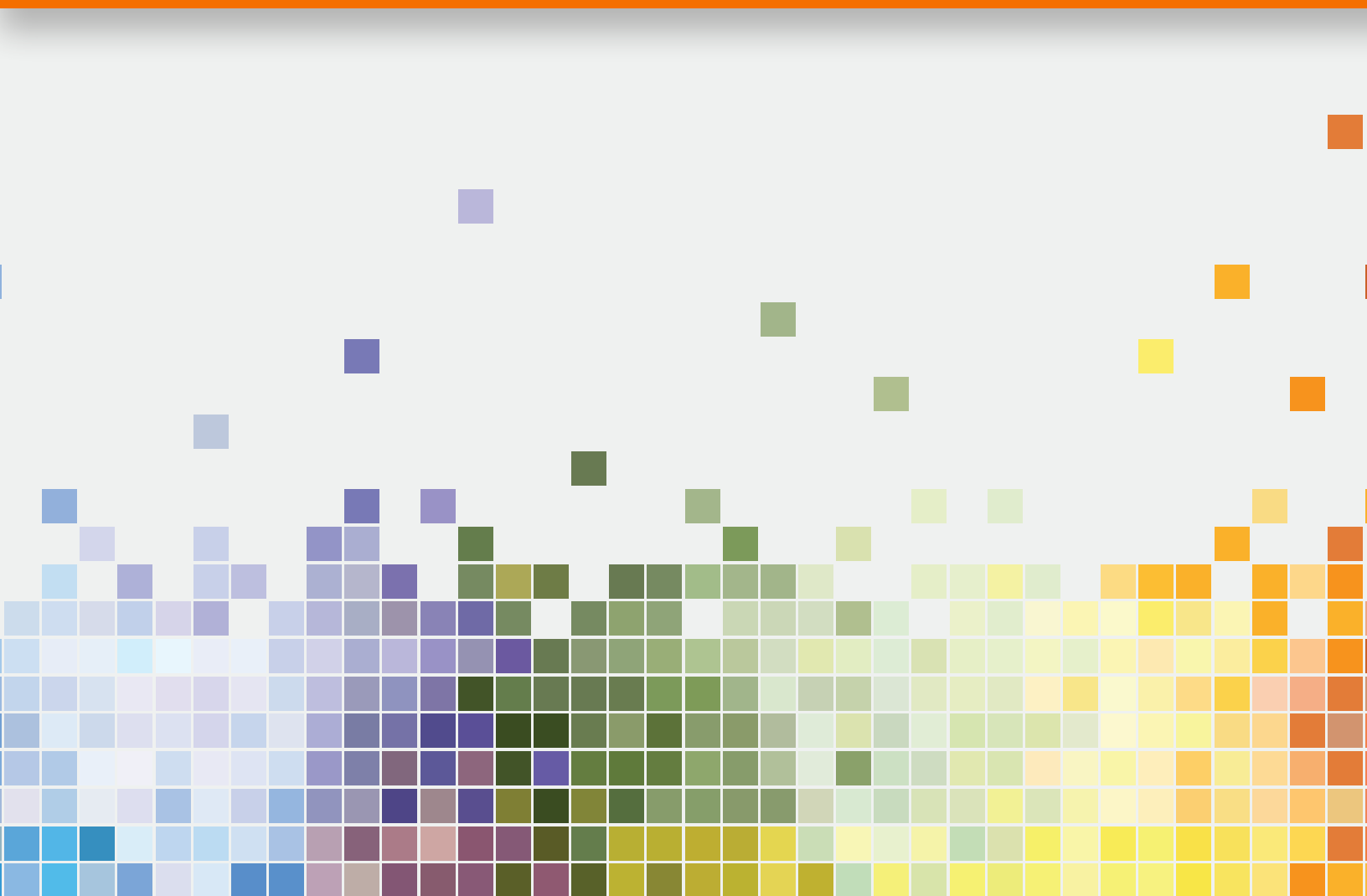


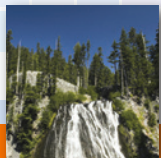


# 109

## Standard Reference Materials for Chemical Composition

**Organics**



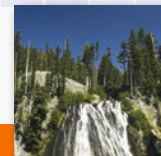


## Organics

SRM	Description	Unit of Issue
869b	Column Selectivity Test Mixture for Liquid Chromatography	5 x 1.1 mL
870	Column Performance Test Mixture for Liquid Chromatography	5 x 1.1 mL
1491a	Methyl-Substituted Polycyclic Aromatic Hydrocarbons in Toluene	5 x 1.2 mL
1492	Chlorinated Pesticides in Hexane	5 x 1.2 mL
1493	Polychlorinated Biphenyl Congeners in 2,2,4-Trimethylpentane	5 x 1.2 mL
1494	Aliphatic Hydrocarbons in 2,2,4-Trimethylpentane	5 x 1.2 mL
1543	GC/MS System Performance	4 x 1 mL
1584	Priority Pollutant Phenols in Methanol	5 x 1.2 mL
1596	Dinitropyrene Isomers and 1-Nitropyrene in Methylene Chloride	5 x 1.3 mL
1597a	Complex Mixture of Polycyclic Aromatic Hydrocarbons Coal Tar	1 x 1.3 mL
1614	Dioxin (2,3,7,8-TCDD in Isooctane)	6 x 1.2 mL
1647f	Priority Pollutant Polycyclic Aromatic Hydrocarbons in Acetonitrile	5 x 1.3 mL
1649b	Urban Dust	2 g
1650b	Diesel Particulate Matter	200 mg
1941b	Organics in Marine Sediment	50 g
1944	New York/New Jersey Waterway Sediment	50 g
1945	Organics in Whale Blubber	2 x 15 g
1946	Lake Superior Fish Tissue	5 x 7-9 g
1947	Lake Michigan Fish Tissue	5 x 8 g
1953	Organic Contaminants in Non-Fortified Human Milk	5 x 5 mL
1954	Organic Contaminants in Fortified Human Milk	5 x 5 mL
1957	Organic Contaminants in Non-Fortified Human Serum (Freeze Dried)	5 x 10 mL
1958	Organic Contaminants in Fortified Human Serum (Freeze Dried)	5 x 10 mL
1974c	Organics in Mussel Tissue ( <i>Mytilus edulis</i> )	5 x 10 g
1975	Diesel Particulate Extract	4 x 1.2 mL
1991	Mix Coal Tar/Petroleum Extract in Methylene Chloride	5 x 1.2 mL
2257	PBDE Congeners in 2,2,4-Trimethylpentane	5 x 1.2 mL
2258	BDE 209 in 2,2,4-Trimethylpentane	5 x 1.2 mL

SRM	Description	Unit of Issue
2259	PCB Congeners in 2,2,4-Trimethylpentane	5 x 1.2 mL
2260a	Aromatic Hydrocarbon in Toluene	5 x 1.2 mL
2261	Chlorinated Pesticides in Hexane	5 x 1.2 mL
2262	Chlorinated Biphenyl Congeners in Isooctane	5 x 1.2 mL
2266	Hopanes and Steranes in, 2,2,4-Trimethylpentane	5 x 1.2 mL
2269	Perdeuterated PAH-I Solution in Hexane/Toluene	5 x 1.2 mL
2270	Perdeuterated PAH-II Solution in Hexane/Toluene	5 x 1.2 mL
2273	Chlorinated Pesticides (DDTs) and Metabolites in Isooctane	5 x 1.2 mL
2274	PCB Congener Solution-II in Isooctane	5 x 1.2 mL
2275	Chlorinated Pesticide Solution-II in Isooctane	5 x 1.2 mL
2377	Fatty Acid Methyl Esters in 2,2,4-Trimethylpentane	5 x 1.2 mL
2585	Organic Contaminants in House Dust	10 g
2779	Gulf of Mexico Crude Oil	5 x 1.2 mL
2781	Domestic Sludge	40 g
2786	Fine Particulate Matter (<4 µm)	1 bottle
2787	Fine Particulate Matter (<10 µm)	1 bottle
2974a	Organics in Freeze-Dried Mussel Tissue ( <i>Mytilus edulis</i> )	5 g
2975	Diesel Particulate Matter	1 g
3060	Monoester Phthalates in Acetonitrile	5 x 1.2 mL
3257	Catechin Calibration Solutions	12 x 2 mL
3262	St. John's Wort ( <i>Hypericum perforatum</i> L.) Aerial Parts	5 x 3.3 g
3264	St. John's Wort ( <i>Hypericum perforatum</i> L.) Methanol Extract	5 x 1.6 g
3672	Organic Contaminants in Smokers' Urine (Frozen)	5 x 10 mL
3673	Organic Contaminants in Non-Smokers' Urine (Frozen)	5 x 10 mL
8446	Perfluorinated Carboxylic Acids and Perfluorooctane Sulfonamide in Methanol	4 x 1.2 mL
8447	Perfluorinated Sulfonic Acids in Methanol	3 x 1.2 mL

See [Table 109.1](#) on the website for more information.



## EPA: Organic Compounds Related to Water Analysis (including drinking water)

These SRMs are intended primarily for the calibration of instrumentation and validation of methods for volatile or semi-volatile organic compound determinations. Because of its miscibility with water, each SRM can also be used to fortify aqueous samples with known amounts of the organic compound. These SRMs were developed primarily to support the Chemical Calibration Providers of the Proficiency Testing Program with support by the U.S. Environmental Protection Agency (EPA).

SRM	Description	Unit of Issue
3074	Phthalates in Methanol	5 x 1.2 mL
3077	Aroclor 1242 in Transformer Oil	5 x 1.2 mL
3079	Aroclor 1254 in Transformer Oil	5 x 1.2 mL
3080	Aroclor 1260 in Transformer Oil	5 x 1.2 mL
8504	Transformer Oil	100 mL

See [Table 109.3](#) on the website for more information.



## Perfluorinated and Polyfluorinated Alkyl Substances (PFAS)

SRM	Description	Unit of Issue
1946	Lake Superior Fish Tissue	5 x 7-9 g
1947	Lake Michigan Fish Tissue	5 x 8 g
1957	Organic Contaminants in Non-fortified Human Serum (Freeze-Dried)	5 x 10.7 mL
1958	Organic Contaminants in Fortified Human Serum (Freeze-Dried)	5 x 10 mL
2781	Domestic Sludge	40 g
8446	Perfluorinated Carboxylic Acids and Perfluorooctane Sulfonamide in Methanol	4 x 1.2 mL
8447	Perfluorinated Sulfonic Acids in Methanol	3 x 1.2 mL

See [Table 109.5](#) on the website for more information.

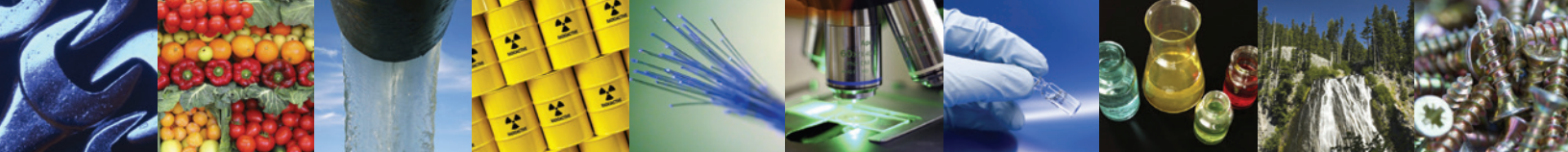
## Crime Scene Investigations

SRM 2285 is intended primarily for use in the calibration of chromatographic instrumentation used for the classification of an ignitable liquid residue. This SRM is a solution of 15 compounds, including even carbon number aliphatic hydrocarbons from hexane to tetracosane, toluene, *p*-xylene, 2-ethyltoluene, 3-ethyltoluene, and 1,2,4-trimethylbenzene in methylene chloride.

SRM	Description	Unit of Issue
2285	Ignitable Liquids Test Mixture	5 x 1.2 mL
2460	Standard Bullet	each
2461	Standard Cartridge Case	each
2905	Trace Terrorist Explosives Simulants	4 x 1 g
2907	Trace Terrorist Explosives Simulants	2 x 1 g

See [Table 109.4](#) on the website for more information.

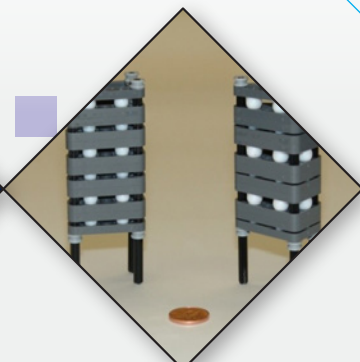




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Registering will ensure that you will be notified of any technical updates or developments.

[https://www.nist.gov/srm\\_reg](https://www.nist.gov/srm_reg)



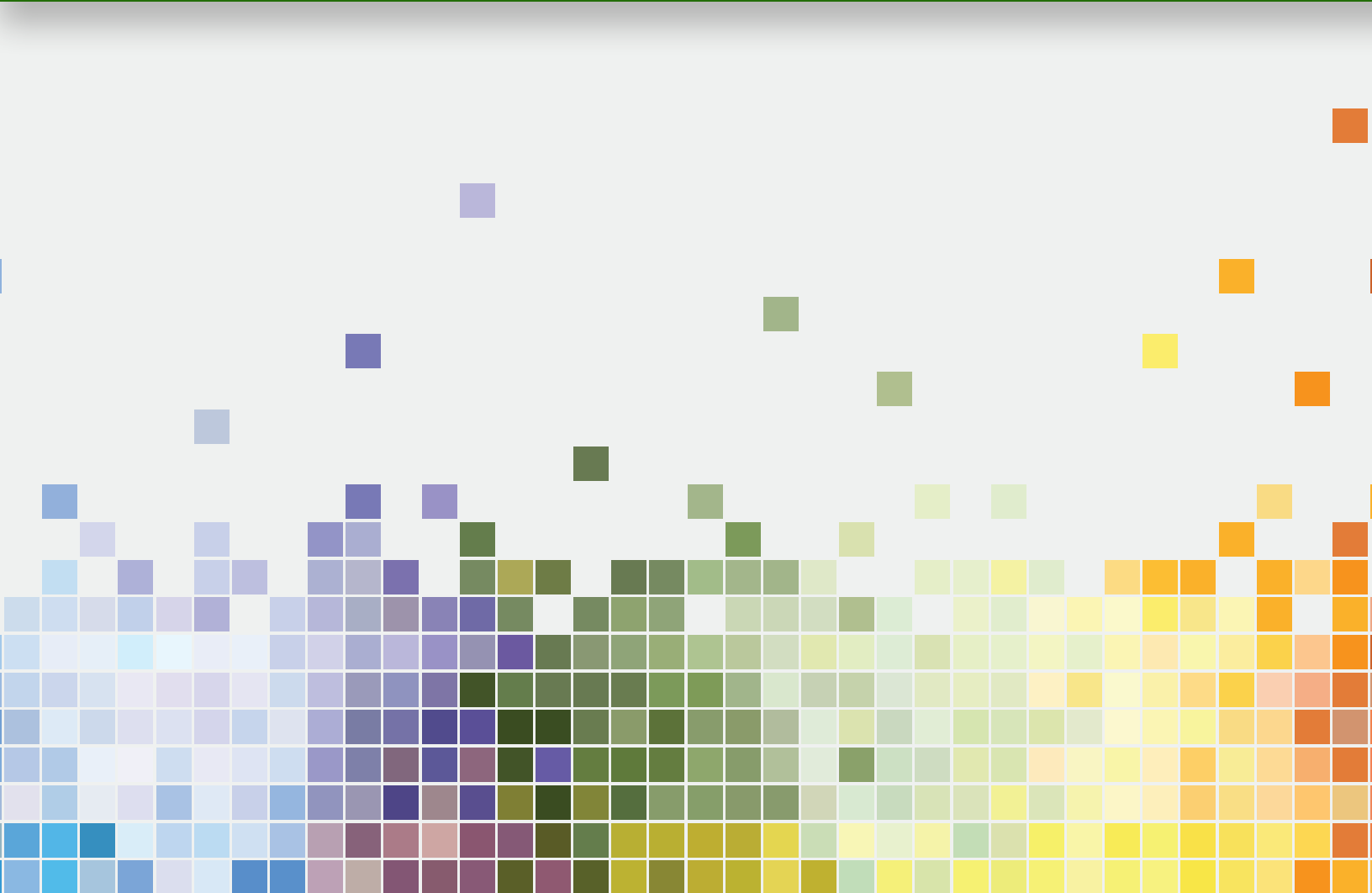




# 110

## Standard Reference Materials for Chemical Composition

Food & Agriculture





## Foods and Beverages

These SRMs are for validation of analytical procedures and calibration of apparatus used in the analysis of trace elements and other analytes in foods and related products.

SRM	Description	Unit of Issue
1546a	Meat Homogenate	4 x 85 g
1548a	Typical Diet	set (2)
1549a	Whole Milk Powder	5 x 10 g
1566b	Oyster Tissue	25 g
1567b	Wheat Flour	50 g
1568b	Rice Flour	50 g
1570a	Trace Elements in Spinach Leaves	60 g
1577c	Bovine Liver	20 g
1845a	Whole Egg Powder	5 x 10 g
1849a	Infant/Adult Nutritional Formula	10 x 10 g
1946	Lake Superior Fish Tissue	5 x 7-9 g
1947	Lake Michigan Fish Tissue	5 x 8 g
2383a	Baby Food Composite	4 x 70 g
2384	Baking Chocolate	5 x 91 g
2385	Slurried Spinach	4 x 70 g
3035	Arsenic Species in Apple Juice	5 x 1.5 mL
3233	Fortified Breakfast Cereal	60 g
3234	Soy Flour	50 g
3252	Protein Drink Mix	5 x 10 g
3254	Green Tea ( <i>Camellia sinensis</i> ) Leaves	5 x 3 g
3255	Green Tea ( <i>Camellia sinensis</i> ) Extract	5 x 1 g
3278	Tocopherols in Edible Oils	5 x 1 mL
3281	Cranberry (Fruit)	5 x 6 g
3282	Low-Calorie Cranberry Juice Cocktail	5 x 1.2 mL
3287	Blueberry (Fruit)	5 x 5 g
3290	Dry Cat Food	5 x 10 g
3530	Iodized Table Salt (Iodide)	1 x 200 g

See [Table 110.1](#) on the website for more information.

## Food Contaminants and Allergens

SRM	Description	Unit of Issue
1566b	Oyster Tissue	25 g
1946	Lake Superior Fish Tissue	5 x 7-9 g
1947	Lake Michigan Fish Tissue	5 x 8 g
1953	Organic Contaminants in Non-Fortified Human Milk	5 x 5 mL
1954	Organic Contaminants in Fortified Human Milk	5 x 5 mL
2387	Peanut Butter	3 x 170 g
3256	Green Tea-Containing Solid Oral Dosage Form	5 x 2.5 g
8445	Spray-Dried Whole Egg for Allergen Detection	5 g
8642a	FDA Saxitoxin Dihydrochloride Solution	5 x 1.2 mL

See [Table 110.2](#) on the website for more information.

## Agricultural Materials (powder form)

SRM	Description	Unit of Issue
1515	Apple Leaves	50 g
1547	Peach Leaves	50 g
1570a	Trace Elements in Spinach Leaves	60 g
1573a	Tomato Leaves	50 g
1575a	Trace Elements in Pine Needles	50 g

See [Table 110.4](#) on the website for more information.

## Fertilizers (powder form)

These SRMs are intended for use in the fertilizer industry as working standards.

SRM	Description	Unit of Issue
120c	Phosphate Rock (Florida)	90 g
193	Potassium Nitrate	90 g
194a	Ammonium Dihydrogen Phosphate (Fertilizer Standard)	90 g
200b	Potassium Dihydrogen Phosphate, ( $\text{KH}_2\text{PO}_4$ )	90 g
694	Phosphate Rock, Western	90 g
695	Trace Elements in Multi-Nutrient Fertilizer	70 g
2429	Flue Gas Desulfurization Gypsum	200 g

See [Table 110.5](#) on the website for more information.





## Wheat Hardness (kernel form)

This RM is intended primarily for calibrating instruments used to determine the hardness of bulk or single kernel wheat. RM 8441 was prepared and analyzed by the Federal Grain Inspection Service program, Grain Inspection Packers and Stockyards Administration of the United States Department of Agriculture.

SRM	Description	Unit of Issue
8441a	Wheat Hardness	set (50)

See [Table 110.6](#) on the website for more information.



## Tobacco Related Materials

SRM	Description	Unit of Issue
3222	Cigarette Tobacco Filler	20 x 10 g

See [Table 110.10](#) on the website for more information.

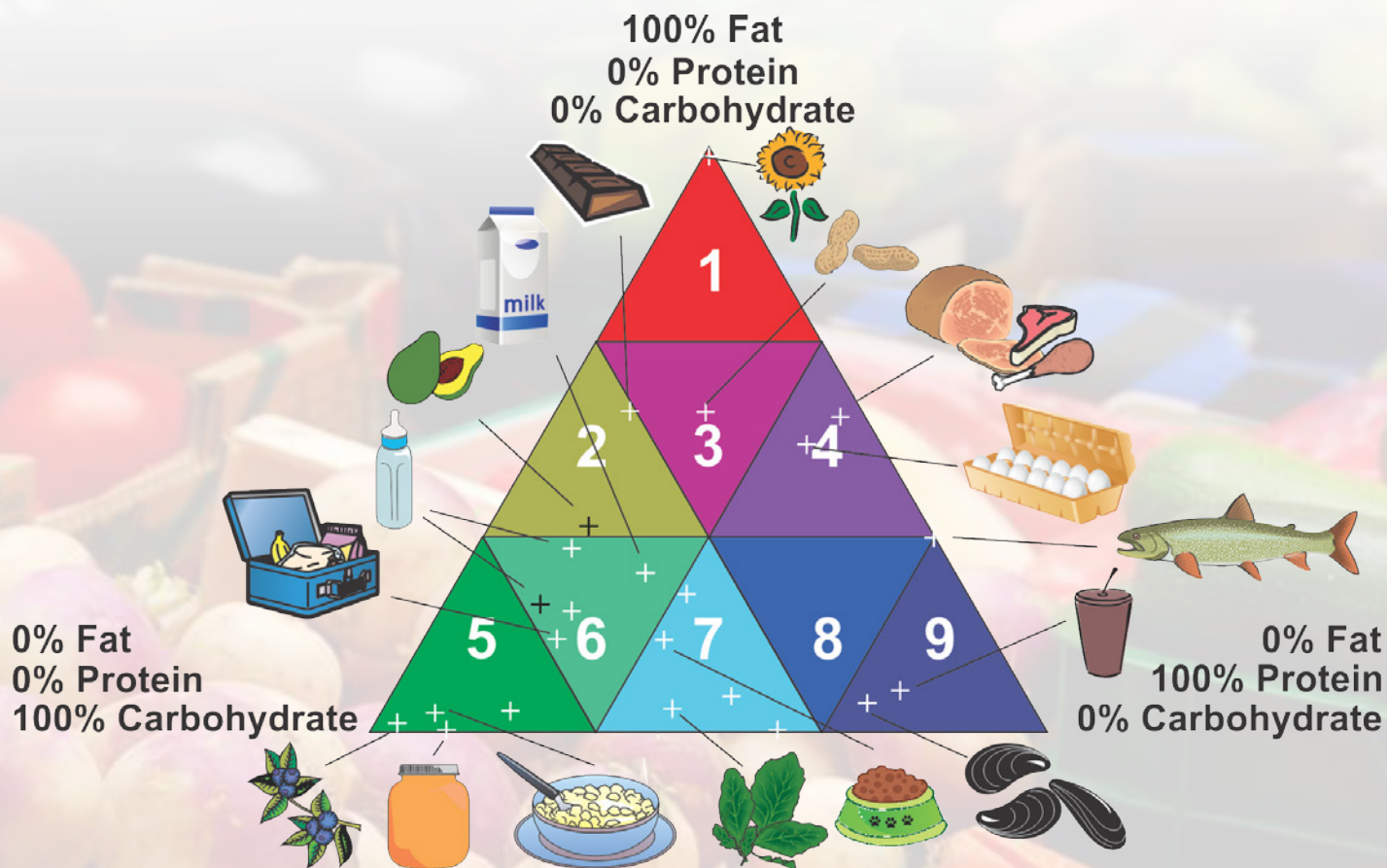
## Dietary Supplement Materials (includes nutraceuticals and herbs)

SRM	Description	Unit of Issue
3232	Kelp Powder ( <i>Thallus laminariae</i> )	3 x 5 g
3235	Soy Milk	10 x 10 mL
3236	Soy Protein Isolate	5 x 10 g
3237	Soy Protein Concentrate	5 x 10 g
3238	Soy-Containing Solid Oral Dosage Form	5 x 10 g
3239	Isoflavones Calibration Solutions	10 x 1.2 mL
3246	<i>Ginkgo biloba</i> (Leaves)	5 x 3 g
3247	<i>Ginkgo biloba</i> (Extract)	5 x 1 g
3248	Ginkgo-Containing Tablets	5 x 1 g
3250	Saw Palmetto ( <i>Serenoa repens</i> ) Fruit	5 x 6 g
3251	Saw Palmetto ( <i>Serenoa repens</i> ) Extract	5 x 1 mL
3254	Green Tea ( <i>Camellia sinensis</i> ) Leaves	5 x 3 g
3255	Green Tea ( <i>Camellia sinensis</i> ) Extract	5 x 1 g
3256	Green Tea-Containing Solid Oral Dosage Form	5 x 2.5 g
3257	Catechin Calibration Solutions	12 x 2 mL
3262	St. John's Wort ( <i>Hypericum perforatum</i> L.) Aerial Parts	5 x 3.3 g
3264	St. John's Wort ( <i>Hypericum perforatum</i> L.) Methanol Extract	5 x 1.6 g
3274	Botanical Oils Containing Omega-3 and Omega-6 Fatty Acids	4 x 1.2 mL
3275	Omega-3 and Omega-6 Fatty Acids in Fish Oil	3 ea (2 x 1.2 mL)
3280	Multivitamin/Multielement Tablets	30 x 5 bottles
3281	Cranberry (Fruit)	5 x 6 g
3282	Low-Calorie Cranberry Juice Cocktail	5 x 1.2 mL
3283	Cranberry Extract	5 x 2.5 g
3284	Cranberry-Containing Solid Oral Dosage Form	5 x 2.5 g
3285	Mixed-Berry Containing Solid Oral Dosage Form	5 x 2.5 g
3286	Organic Acids Calibration Solution	5 x 2 mL
3291	Bilberry Extract	5 x 1 g
3530	Iodized Table Salt (Iodide)	1 x 200 g
3532	Calcium-Containing Solid Oral Dosage Form	5 x 10 g

See [Table 110.9](#) on the website for more information.



# Distribution of SRMs in the AOAC Food Triangle



NIST classifies food-matrix SRMs based on fat, protein, and carbohydrate content using a triangle developed by AOAC INTERNATIONAL<sup>1</sup>, based on the supposition that foods (and thus reference materials) within each sector will have similar properties and therefore will pose similar challenges in determination of the same nutrient. Preparation of food-matrix SRMs has been based on the distribution of foods from a typical US diet in the AOAC triangle, with a majority of common foods and SRMs categorized in sectors 5 and 6 (e.g., fruits, vegetables, cereals, and grains). Conversely, only a small fraction of foods and SRMs are categorized in sectors 1 through 4 (higher-fat foods like meats and nuts). Additional materials are also prepared based on suggestions from user communities.

- |  |   |
|--|---|
| 1 SRM 1588c Organics in Fish Oil           | 6 SRM 1544 Fatty Acids in Frozen Diet Composite |
| SRM 3274 Fatty Acids in Botanical Oils     | SRM 1548a Typical Diet                          |
| SRM 3275 Fatty Acids in Fish Oils          | SRM 1549a Whole Milk Powder                     |
| 2 SRM 2384 Baking Chocolate                | SRM 1849a Infant/Adult Nutritional Formula      |
| SRM 2386 Avocado Powder*                   | 7 SRM 1566b Oyster Tissue                       |
| 3 SRM 2387 Peanut Butter                   | SRM 2385 Slurried Spinach                       |
| 4 SRM 1546a Meat Homogenate                | SRM 3234 Soy Flour                              |
| SRM 1845a Whole Egg Powder                 | SRM 3290 Dry Cat Food                           |
| 5 SRM 1568b Rice Flour                     | 9 SRM 1946 Lake Superior Fish Tissue            |
| SRM 2383a Baby Food Composite              | SRM 1947 Lake Michigan Fish Tissue              |
| SRM 3233 Fortified Breakfast Cereal        | SRM 2974a Mussel Tissue                         |
| SRM 3287 Blueberries                       | SRM 3252 Protein Drink Mix                      |
| SRM 1869 Infant/Adult Nutritional Formula* | *in preparation                                 |

<sup>1</sup> WR Wolf, KW Andrews (1995) *Fresenius J Anal Chem* 352:73-76.

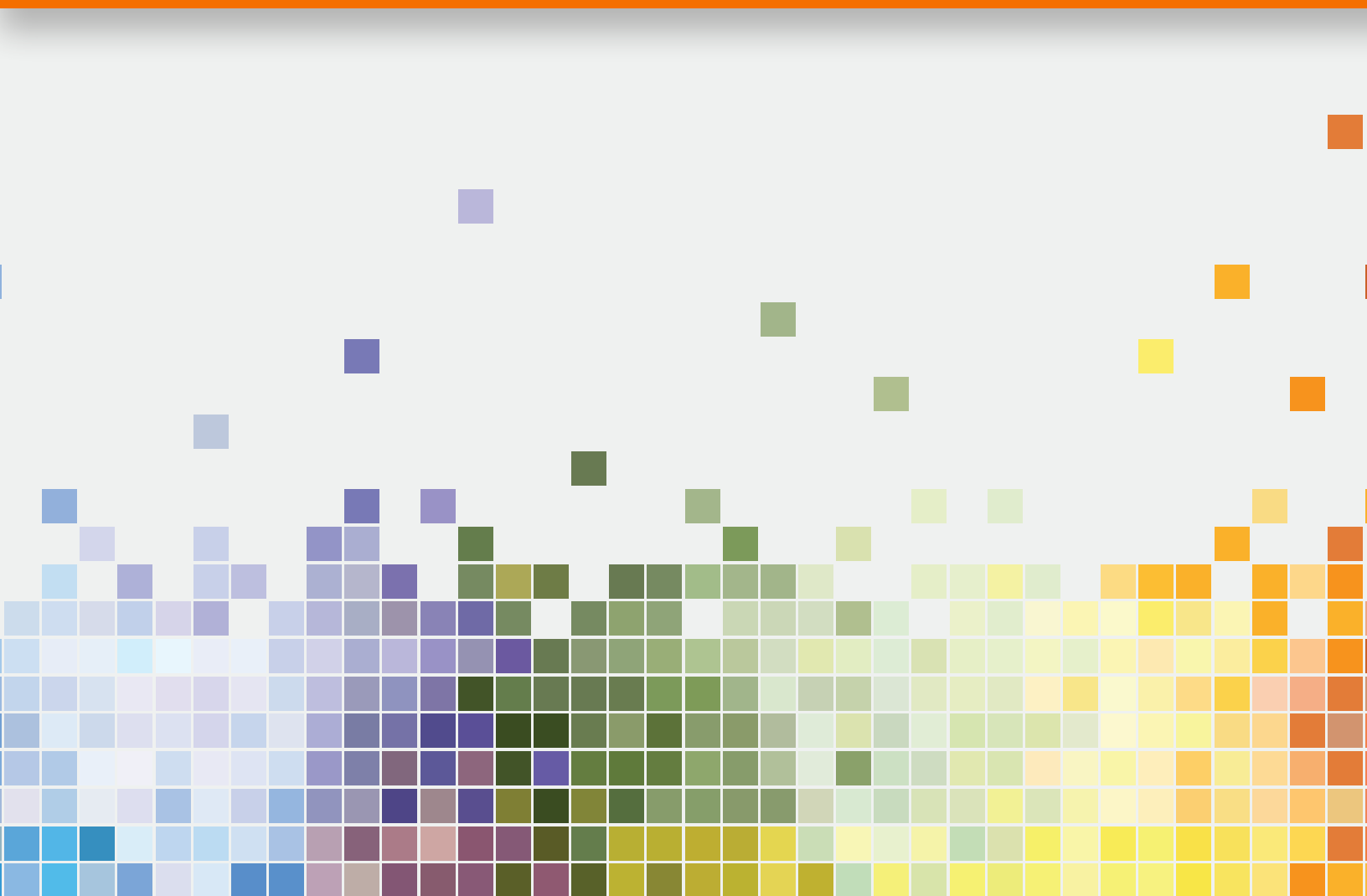


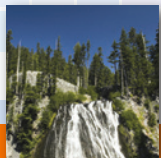


# 111

## Standard Reference Materials for Chemical Composition

**Geological Materials & Ores**





## Ores (powder form)

SRM	Description	Unit of Issue
25d	Manganese Ore	60 g
69b	Bauxite (Arkansas)	60 g
79a	Fluorspar	120 g
120c	Phosphate Rock (Florida)	90 g
180	Fluorspar, High Grade	120 g
181	Lithium Ore (Spodumene)	45 g
182	Lithium Ore (Petalite)	45 g
183	Lithium Ore (Lepidolite)	45 g
277	Tungsten Concentrate	100 g
330a	Copper Ore Mill Heads	90 g
331a	Copper Ore Mill Tails	40 g
333a	Molybdenum Sulfide Concentrate	60 g
423	Molybdenum Oxide Concentrate	60 g
600	Bauxite, Australian-Darling Range	90 g
670	Rutile Ore	90 g
690	Iron Ore Canada	100 g
691	Iron Oxide, Reduced	100 g
692	Iron Ore, Labrador	100 g
693	Iron Ore (Nimba)	100 g
694	Phosphate Rock, Western	90 g
696	Bauxite, Surinam	60 g
697	Bauxite, Dominican	60 g
698	Bauxite, Jamaican	60 g
699	Alumina (Reduction Grade)	60 g
886	Refractory Gold Ore	200 g
1835	Borate Ore	60 g
2430	Scheelite Ore	100 g

See [Table 111.2](#) on the website for more information.

## Ore Bioleaching Substrate (powder form)

This RM is for use as a bioleaching substrate and for testing bioleaching rates. The material consists of pyrite from New Mexico. *Thiobacillus ferrooxidans* was used in the determinations.

SRM	Description	Unit of Issue
8455	Pyrite Ore Bioleaching Substrate	100 g

See [Table 111.3](#) on the website for more information.

## Clays (powder form)

SRM	Description	Unit of Issue
97b	Flint Clay	60 g
98b	Plastic Clay	60 g
679	Brick Clay	75 g

See [Table 111.4](#) on the website for more information.

## Rock and Minerals (powder form)

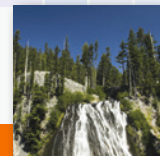
SRM	Description	Unit of Issue
1d	Limestone, Argillaceous	70 g
70b	Potassium Feldspar	40 g
81a	Glass Sand	75 g
88b	Dolomitic Limestone	75 g
99b	Soda Feldspar	40 g
165a	Glass Sand	75 g
278	Obsidian Rock	35 g
607	Potassium Feldspar	5 g
688	Basalt Rock	60 g
1413	High Alumina Sand	75 g
2429	Flue Gas Desulfurization Gypsum	200 g

See [Table 111.5](#) on the website for more information.

## Refractories (powder form)

SRM	Description	Unit of Issue
76a	Burnt Refractory ( $\text{Al}_2\text{O}_3$ -40%)	75 g
77a	Burnt Refractory ( $\text{Al}_2\text{O}_3$ -60%)	75 g
78a	Burnt Refractory ( $\text{Al}_2\text{O}_3$ -70%)	75 g
154c***	Titanium Dioxide	90 g
198	Silica Brick	45 g
199	Silica Brick	45 g

\*\*\* Information values are provided for additional 71 elements  
See [Table 111.6](#) on the website for more information.



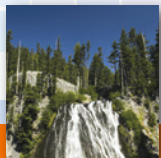
## Soils, Sediments, and Sludges (powder form)

SRMs 2586, 2587, 2700 2701, 2709a, 2710a, 2711a, 2781, 2782 also have non-certified leach data. See certificate for details and leach methods used.

SRM	Description	Unit of Issue
1646a	Estuarine Sediment	70 g
1944	New York/New Jersey Waterway Sediment	50 g
2586	Trace Elements in Soil Containing Lead From Paint (Nominal 500 mg/kg Lead)	55 g
2587	Trace Elements in Soil Containing Lead From Paint (Nominal 3000 mg/kg Lead)	55 g
2700	Hexavalent Chromium in Contaminated Soil (Low Level)	75 g
2701	Hexavalent Chromium in Contaminated Soil (High Level)	75 g
2702	Inorganics in Marine Sediment	50 g
2703	Sediment for Solid Sampling (Small Sample) Analytical Techniques	5 g
2709a	San Joaquin Soil	50 g
2710a	Montana I Soil	50 g
2711a	Montana II Soil	50 g
2780	Hard Rock Mine Waste	50 g
2781	Domestic Sludge	40 g
2782	Industrial Sludge	70 g
8704	Buffalo River Sediment	50 g

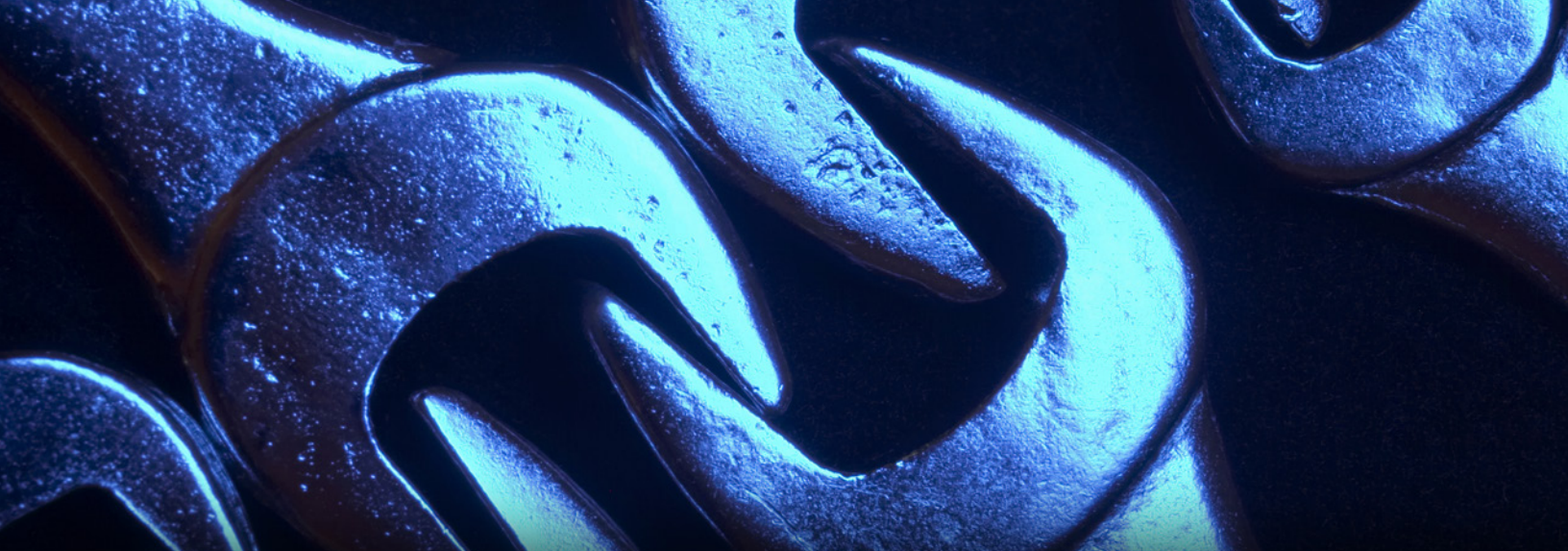
See [Table 111.7](#) on the website for more information.





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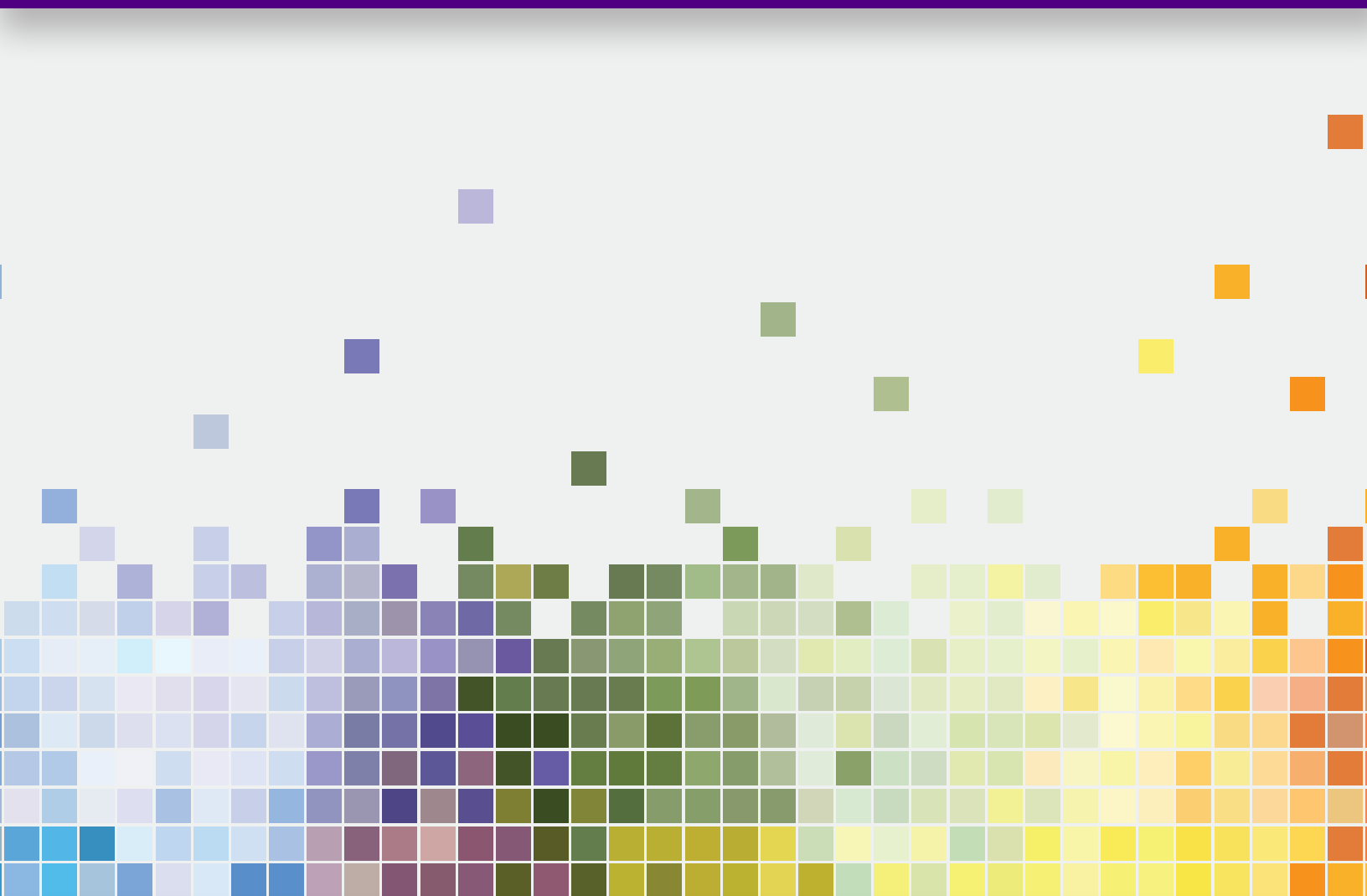


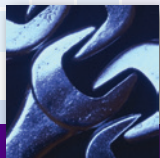
# 112

## Standard Reference Materials for Chemical Composition

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### Ceramics & Glasses





## Nitrides (powder form)

SRM	Description	Unit of Issue
8983	Silicon Nitride	4.5 g

See [Table 112.1](#) on the website for more information.

## Cemented Carbides (powder form)

SRMs 887-889 are prepared from sintered tungsten carbide base materials.

SRM	Description	Unit of Issue
887	Cemented Carbide (W-83,Co-10)	100 g
888	Cemented Carbide (W-64,Co-25,Ta-5)	100 g
889	Cemented Carbide (W-75,Co-9,Ta-5,Ti-4)	100 g

See [Table 112.2](#) on the website for more information.

## Glasses (powder and solid forms)

SRM	Description	Unit of Issue
80a	Soda-Lime Glass	45 g
81a	Glass Sand	75 g
89	Glass, Lead Barium	45 g
92	Soda-Lime Glass (Low Boron)	45 g
93a	Borosilicate Glass	wafer
165a	Glass Sand	75 g
620	Soda Lime, Flat	set (3)
1411	Soft Borosilicate Glass	set (10)
1412	Multicomponent Glass	set (8)
1413	High Alumina Sand	75 g
1830	Soda Lime Float Glass (Nominal Mass Fraction 0.1 % $\text{Al}_2\text{O}_3$ )	3 platelets
1831	Soda Lime Sheet Glass (Nominal Mass Fraction 1.2 % $\text{Al}_2\text{O}_3$ )	3 platelets
2696	Silica Fume	70 g

See [Table 112.3](#) on the website for more information.

## Trace Elements (wafer form)

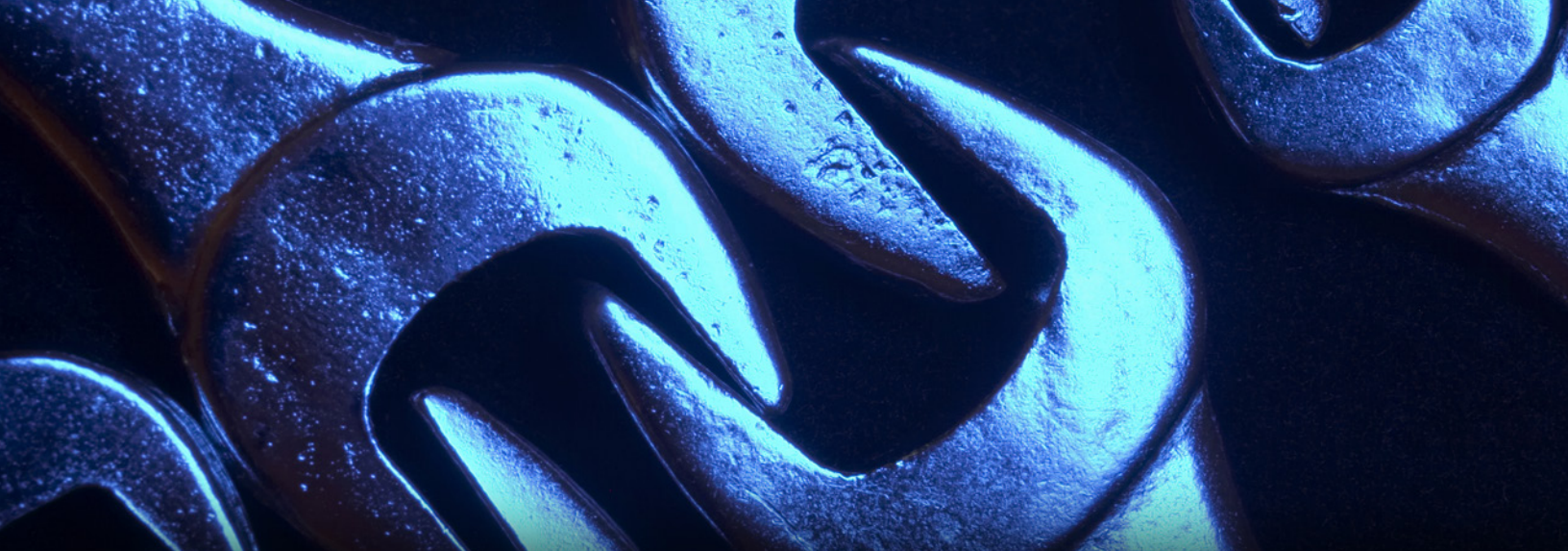
These SRMs are for calibrating instruments and evaluating analytical techniques used to determine trace elements in inorganic matrices. NOTE: The nominal glass composition of SRMs 610 through 617 is 72 %  $\text{SiO}_2$ , 12 %  $\text{CaO}$ , 14 %  $\text{Na}_2\text{O}$ , and 2%  $\text{Al}_2\text{O}_3$ .

SRM	Description	Unit of Issue
610	Trace Elements in Glass	4 wafers
611	Trace Elements in Glass	4 wafers
612	Trace Elements in Glass	4 wafers
613	Trace Elements in Glass	4 wafers
614	Trace Elements in Glass	4 wafers
616	Trace Elements in Glass	4 wafers
617	Trace Elements in Glass	4 wafers

In addition to the elements listed above, the glass SRMs contain the following 23 elements: Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, S, Tb, Te, Tm, Sn, W, V, Y, and Zr.

See [Table 112.4](#) on the website for more information.

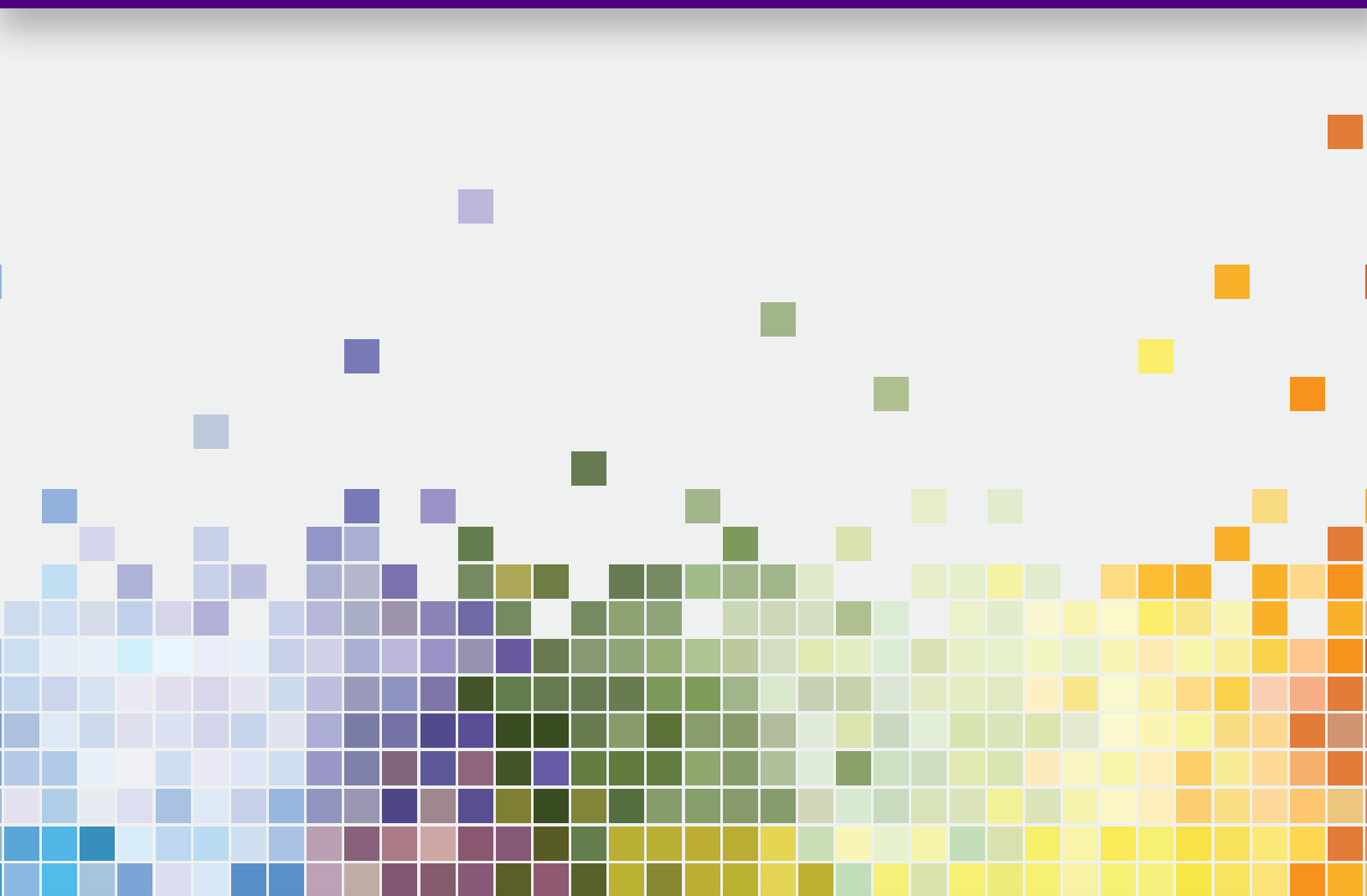




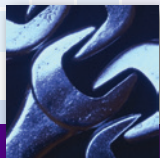
# 113

## Standard Reference Materials for Chemical Composition

**Cement**







## Cements and Related Materials (powder form)

These portland (1880b, 1881b, 1884b, 1885a, 1886a, 1887a, 1888b, and 1889a) and calcium aluminate (1882a and 1883a) cement SRMs are for x-ray spectroscopic and chemical analysis of cements and related materials.

SRM	Description	Unit of Issue
633a	Portland Cement	4 x 5 g
634a	Portland Cement	100 g
635a	Portland Cement (Blended with Slag)	5 x 5 g
1880b	Portland Cement	4 x 5 g
1881b	Portland Cement (Blended with Fly Ash)	4 x 5g
1882a	Calcium Aluminate Cement	4 x 5 g
1883a	Calcium Aluminate Cement	4 x 5 g
1884b	Portland Cement	5 x 4.5 g
1885b	Portland Cement	5 x 5 g
1886a	Portland Cement (White Portland Cement with Low Iron)	4 x 5 g
1886b	White Portland Cement	5 x 5 g
1887b	Portland Cement	5 x 4 g
1888b	Portland Cement	4 x 5 g
1889a	Portland Cement (Blended with Limestone)	4 x 5 g
2429	Flue Gas Desulfurization Gypsum	200 g
2696	Silica Fume	70 g

See [Table 113.1](#) on the website for more information.

## Portland Cement Clinkers (solid form)

These SRMs provide certified values for the abundance of major phases in cement clinkers, i.e., the percentages of alite ( $C_3S$ ), belite ( $C_2S$ ), aluminate ( $C_3A$ ), and ferrite ( $C_2(A,F)$ ).

NOTE: In cement chemist notation, C=CaO, S=SiO<sub>2</sub>, A=Al<sub>2</sub>O<sub>3</sub> and F=Fe<sub>2</sub>O<sub>3</sub>.

SRM	Description	Unit of Issue
2686a	Portland Cement Clinker	4 x 7 g
2687	Portland Cement Clinker	3 x 10 g
2688	Portland Cement Clinker	3 x 10 g

See [Table 113.2](#) on the website for more information.



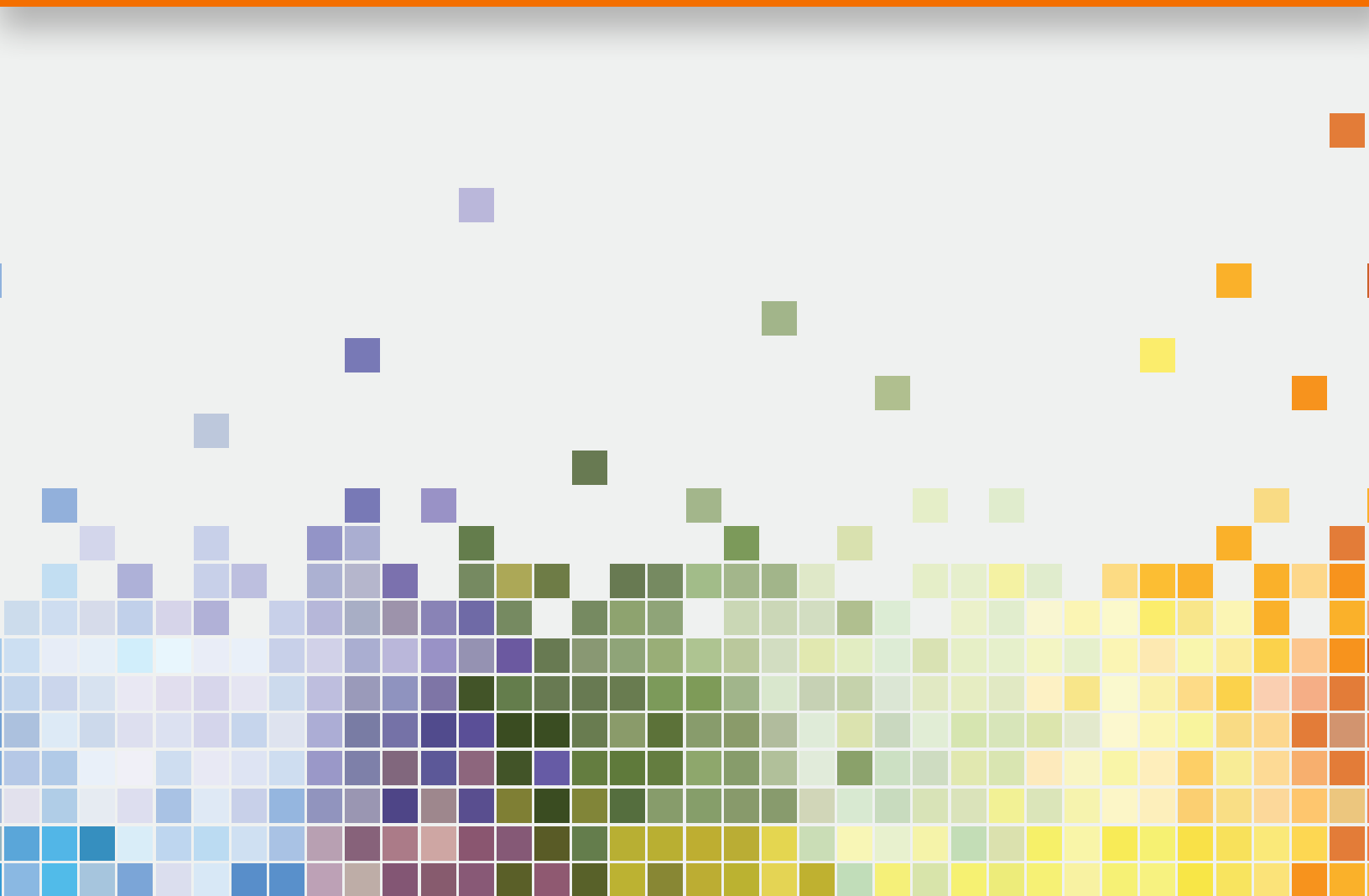


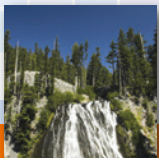


# 114

## Standard Reference Materials for Chemical Composition

**Engine Wear Materials**



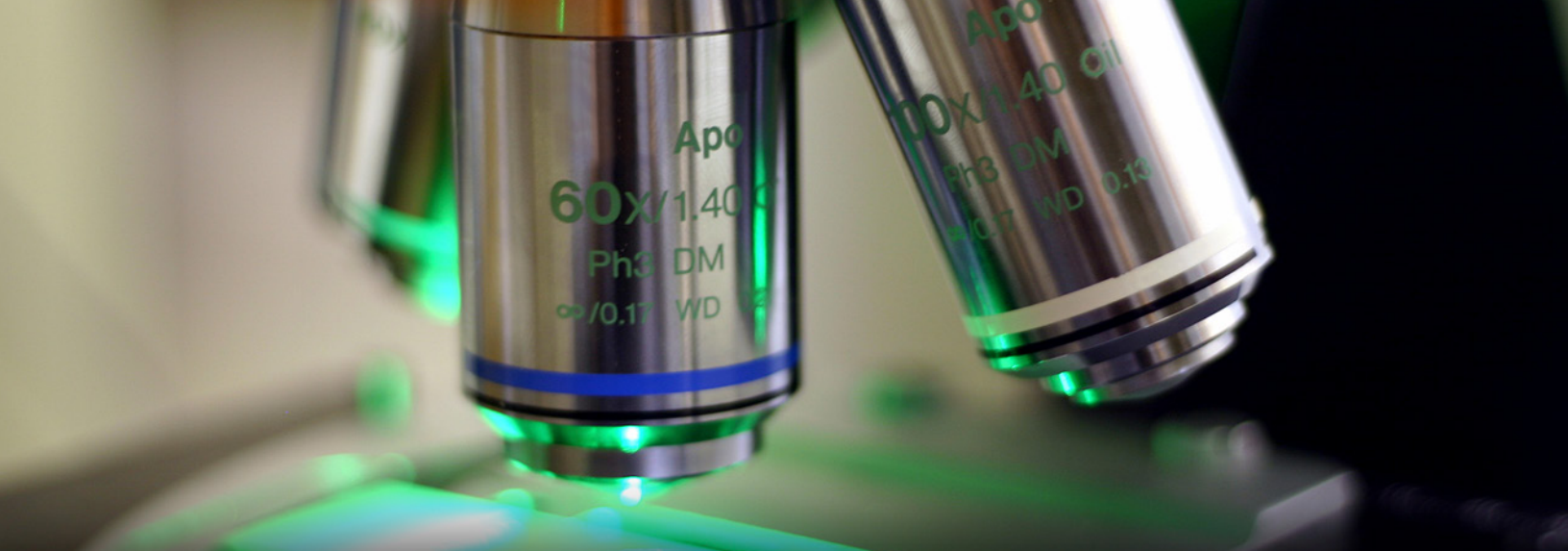


## Lubricating Oils

SRM	Description	Unit of Issue
1083	Wear Metals in Lubricating Oil	150 mL
1085c	Wear Metals in Lubricating Oil	set (10)
1818a	Chlorine in Lubricating Base Oils	set (5)
1819a	Sulfur in Lubricating Base Oil	set (5)
1848	Lubricating Oil Additive Package	100 g

See [Table 114.2](#) on the website for more information.

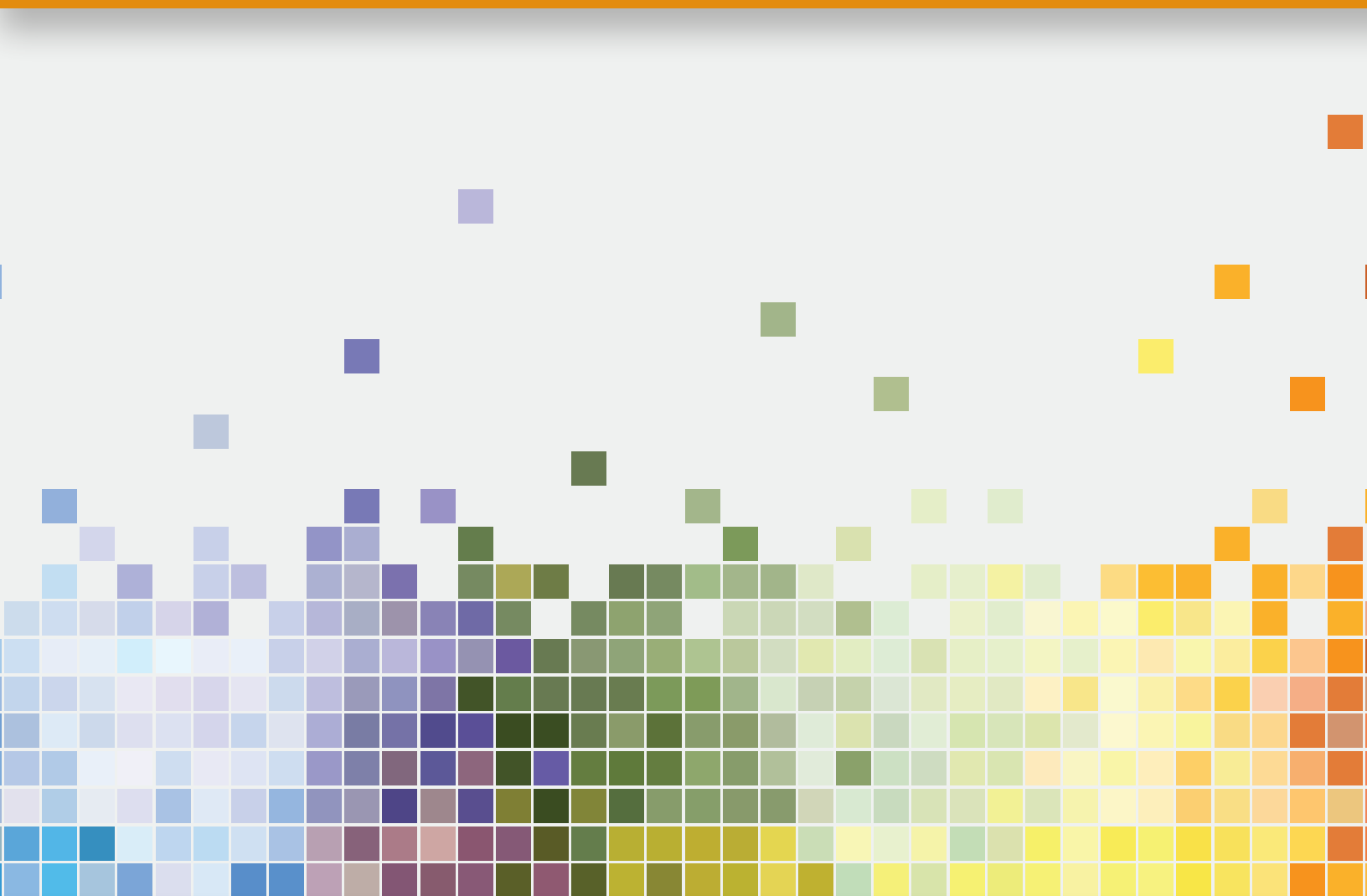




# 115

## Standard Reference Materials for Chemical Composition

**Forensics**







## Ethanol Solutions

SRM	Description	Unit of Issue
1828b	Ethanol-Water Solutions	6 x 1.2 mL
2891	Ethanol-Water Solution (Nominal Mass Fraction 0.02 %)	5 x 1.2 mL
2892	Ethanol-Water Solution (Nominal Mass Fraction 0.04 %)	5 x 1.2 mL
2893	Ethanol-Water Solution (Nominal Mass Fraction 0.08 %)	5 x 1.2 mL
2894	Ethanol-Water Solution (Nominal Mass Fraction 0.1 %)	5 x 1.2 mL
2895	Ethanol-Water Solution (Nominal Mass Fraction 0.2 %)	5 x 1.2 mL
2896	Ethanol-Water Solution (Nominal Mass Fraction 0.3 %)	5 x 1.2 mL
2897a	Ethanol Water Solution (Nominal Mass Fraction 2 %)	5 x 10 mL
2898a	Ethanol Water Solution (Nominal Mass Fraction 6 %)	5 x 10 mL
2899a	Ethanol-Water Solution (Nominal Mass Fraction 25 %)	5 x 10 mL
2900	Ethanol-Water Solution (Nominal Mass Fraction 95.6 %)	5 x 10 mL

See [Table 105.3](#) on the website for more information.

## Drugs of Abuse (hair, serum, and urine)

SRM	Description	Unit of Issue
1507b	THC-COOH in Freeze-Dried Urine	set (3)
1508a	Benzoylcegonine (Cocaine Metabolite) in Freeze-dried Urine	set (4)

See [Table 105.7](#) on the website for more information.

## DNA Profiling and Nucleic Acid Materials (solid forms)

SRM	Description	Unit of Issue
2366a	Cytomegalovirus DNA (Towne <sub>Δ147</sub> BAC) for DNA Measurements	1 vial
2372	Human DNA Quantitation Standard	set (3)
2373	Genomic DNA Standards for <i>HER2</i> Measurements	5 vials
2374	DNA Sequence Library for External RNA Controls	96 tubes

SRM	Description	Unit of Issue
2391c	PCR-Based DNA Profiling Standard	6 vials
2392	Mitochondrial DNA Sequencing	set (3)
2392-I	Mitochondrial DNA Sequencing (Human HL-60 DNA)	1 vial
2393	CAG Repeat Length Mutation in Huntington's Disease	set (6)
2394	Heteroplasmic Mitochondrial DNA Mutation Detection Std	set (10)
2396	Oxidative DNA Damage Mass Spectrometry Standards	set (10)
8375	Microbial Genomic DNA Standards for Sequencing Performance Assessment	4 vials
8391	Human DNA for Whole-Variant Assessment (Son of Eastern European Ashkenazim Jewish Ancestry)	1 vial
8392	Human DNA for Whole-Genome Variant Assessment (Trio of Eastern European Ashkenazim Jewish Ancestry)	3 vials
8393	Human DNA for Whole-Genome Variant Assessment (Son of Chinese Ancestry)	1 vial
8398	Human DNA for Whole-Genome Variant Assessment (Daughter of Utah/European Ancestry)	1 vial

See [Table 105.8](#) on the website for more information.

## Crime Scene Investigations

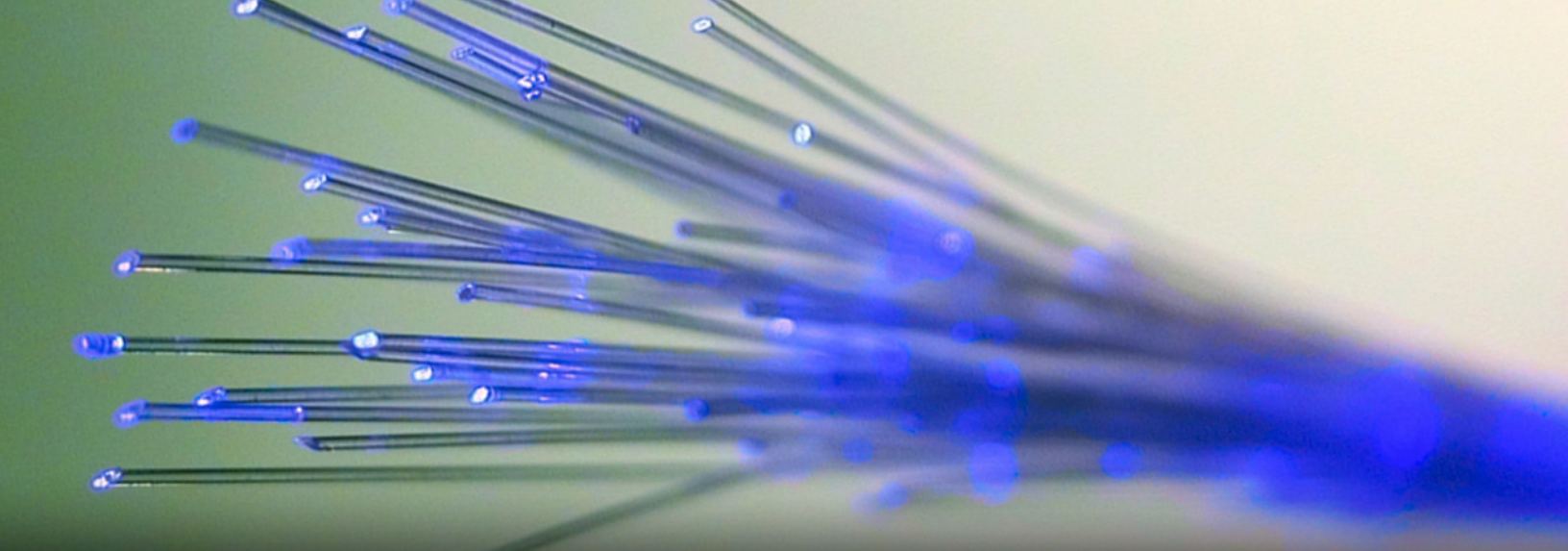
SRM	Description	Unit of Issue
2285	Ignitable Liquids Test Mixture	5 x 1.2 mL
2460	Standard Bullet	each
2461	Standard Cartridge Case	each
2905	Trace Terrorist Explosives Simulants	4 x 1 g
2907	Trace Terrorist Explosives Simulants	2 bottles

See [Table 109.4](#) on the website for more information.



**Right** - optical micrograph showing the three certified areas of the SRM, breech face impression (BF), firing pin impression (FP), and ejector mark (EM);  
**Left** - a NIST SRM 2461 Standard Cartridge Case mounted on a brass cylinder holder.

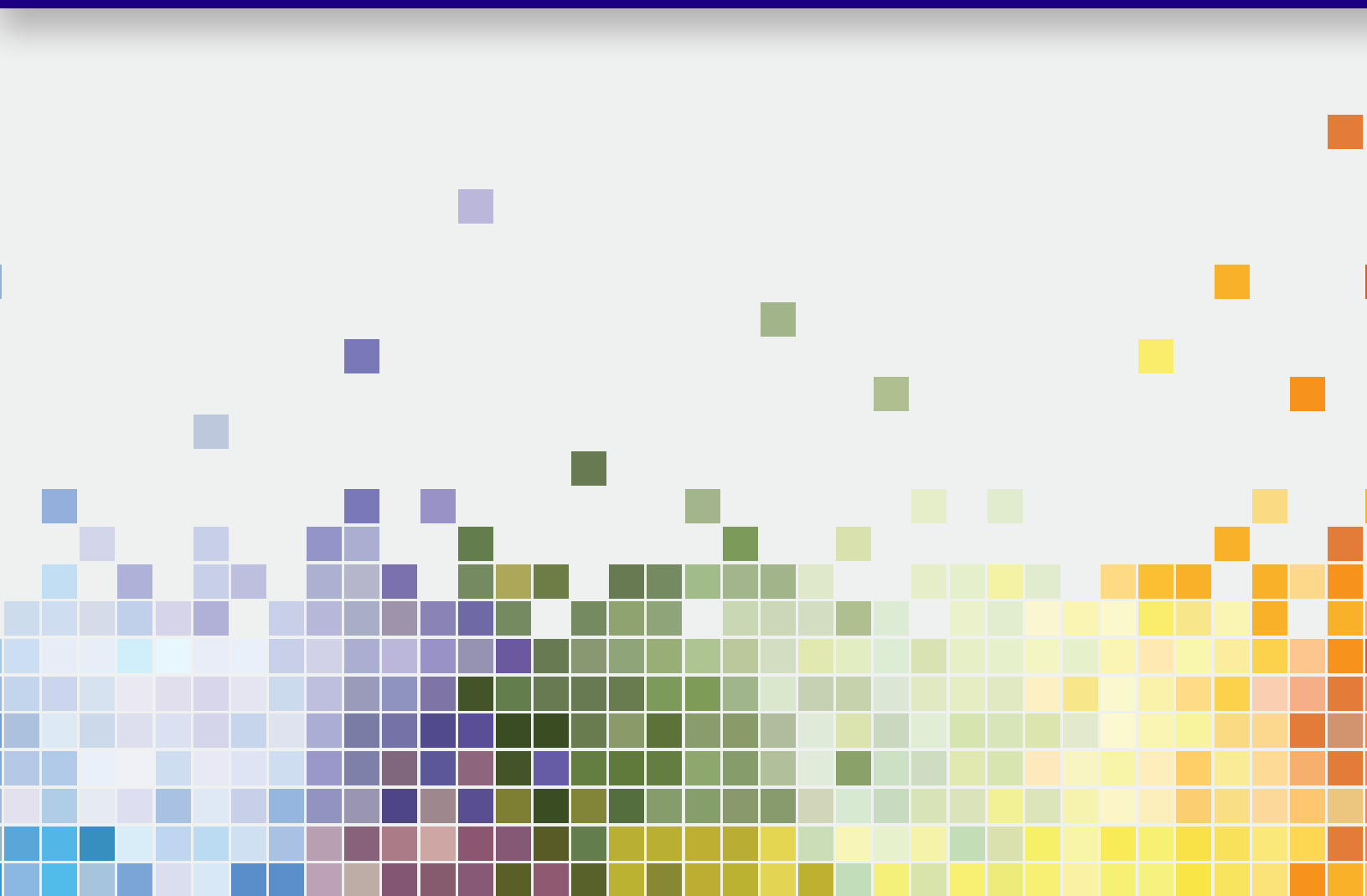


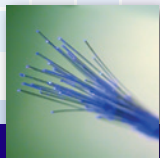


# 201

## Standard Reference Materials for Physical Properties

**Ion Activity**





## pH Calibration (powder form)

These SRMs are used to prepare solutions of known hydrogen ion activity to calibrate commercial pH instruments. SRMs 186g and 191d are each certified for use as an admixture only. SRM 186g (186-I-g and 186-II-g) may be used to prepare solutions with a pH of 6.8640 at 25°C, or physiological buffer solutions with a pH of 7.4157 at 25°C.

SRM	Description	Unit of Issue
185i	Potassium Hydrogen Phthalate pH Standard	60 g
186g	pH Standards Potassium Dihydrogen Phosphate (186-I-g) Disodium Hydrogen Phosphate (186-II-g)	1 x 30 g; 1 x 45 g
187e	Sodium Tetraborate (Borax), pH	30 g
188	Potassium Hydrogen Tartrate (pH Standard)	60 g
189c	Potassium Tetroxalate Dihydrate pH Standard	65 g
191d	pH Standard Sodium Bicarbonate (191d-I) Sodium Carbonate (191d-II)	1 x 25 g; 1 x 30 g
2193a	Calcium Carbonate pH Standard [used as saturated Ca(OH) <sub>2</sub> solution]	30 g

See [Table 201.1](#) on the website for more information.

## Biological Buffer Systems (powder form)

These SRMs are used to calibrate clinical instruments (e.g., blood pH measurements), in the range of pH 7 to 8. They are each certified for use as an admixture only. The pH(S) values for the buffer solutions are certified at 0.05 molal and 0.08 molal with respect to the free acid and the sodium salt admixture as a function of temperature.

SRM	Description	Unit of Issue
2181	HEPES	60 g
2182	HEPES Sodium Salt	60 g

See [Table 201.2](#) on the website for more information.

## pD Calibration (powder form)

These SRMs are for the preparation of solutions of known deuterium ion activity to calibrate pH instruments to indicate pD data. SRMs 2186-I and 2186-II, and 2191a and 2192a are certified for use as admixtures only.

SRM	Description	Unit of Issue
2185	Potassium Hydrogen Phthalate pD Standard	60 g
2186I	Potassium Dihydrogen Phosphate	30 g
2186II	Disodium Hydrogen Phosphate	30 g
2191a	Sodium Bicarbonate	30 g
2192a	Sodium Carbonate	30 g

See [Table 201.3](#) on the website for more information.

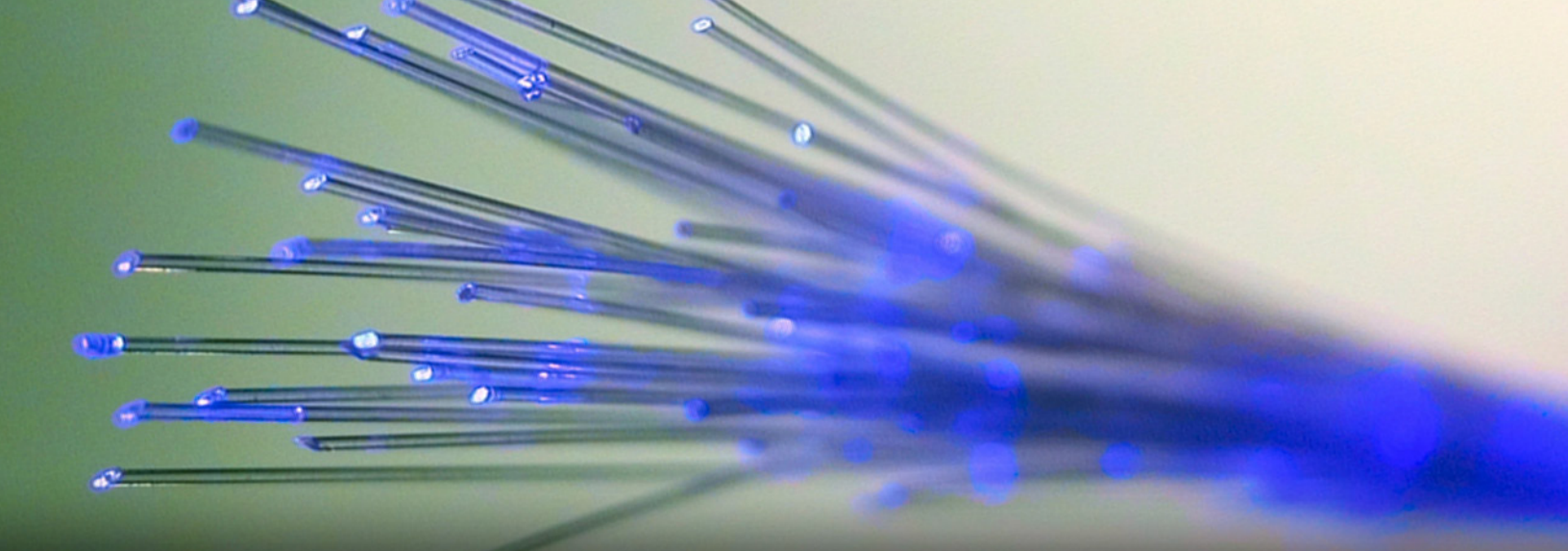
## Ion-Selective Electrode Calibration (powder form)

These SRMs 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 mol/L.

SRM	Description	Unit of Issue
2201	Sodium Chloride (Ion-Selective)	125 g
2203	Potassium Fluoride (Standard for Ion-Selective Electrodes)	125 g

See [Table 201.4](#) on the website for more information.

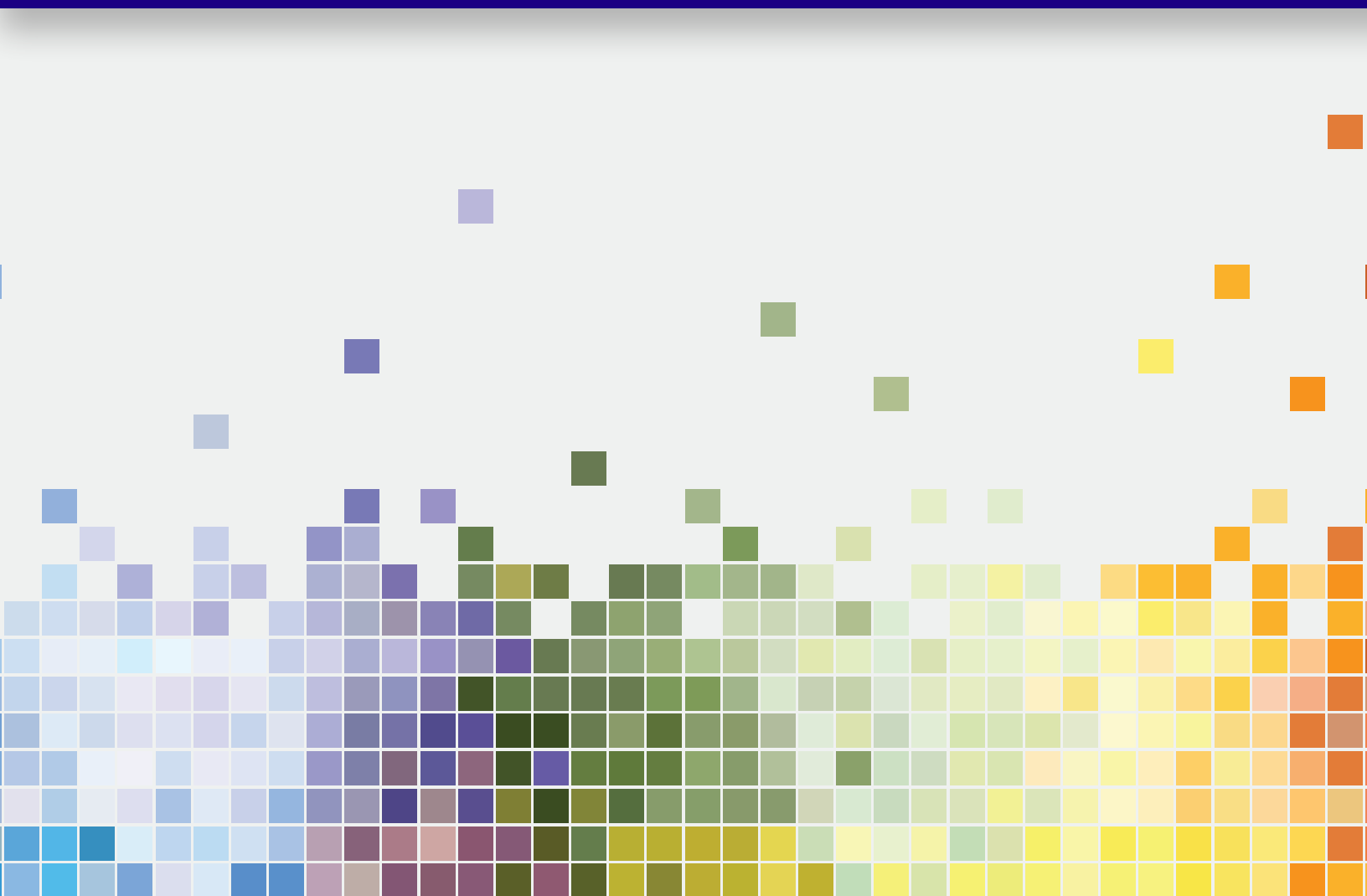




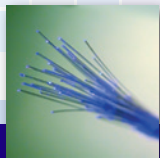
# 202

## Standard Reference Materials for Physical Properties

**Polymeric Properties**







## Polymers (liquid, pellet, and powder forms)

These SRMs are for the calibration of instrumentation used in polymer technology science for the determination of molecular weight and molecular weight distribution and as characterized samples for other physical properties of polymers.

### Polymers

SRM	Description	Unit of Issue
705a	Polystyrene (Narrow Molecular Weight Distribution)	5 g
706a	Polystyrene (Broad Molecular Mass Distribution)	18 g
1473c	Low Density Polyethylene Resin	60 g
1474b	Polyethylene Resin	60 g
1475a	Polyethylene, Linear	50 g
1476a	Branched Polyethylene Resin	12 g
1478	Polystyrene (Narrow Molecular Weight Distribution)	2 g
1479	Polystyrene (Narrow Molecular Weight Distribution)	2 g
1482a	Polyethylene	0.3 g
1483a	Linear Polyethylene	0.3 g
1484a	Linear Polyethylene	0.3 g
1487	Poly(Methyl Methacrylate) (6 K Narrow Molecular Weight Distribution)	2 g
1488	Poly(Methyl Methacrylate) (29 K Narrow Molecular Weight Distribution)	2 g
2881	Polystyrene Absolute Molecular Mass Distribution Standard	0.3 g
2885	Polyethylene (M <sub>w</sub> , 6 280 g/mol)	0.3 g
2886	Polyethylene (M <sub>w</sub> , 87 000 g/mol)	0.3 g
2887	Polyethylene (M <sub>w</sub> , 196 400 g/mol)	0.3 g

See [Table 202.1](#) on the website for more information.

## Melt Flow Rate

SRM	Description	Unit of Issue
1496	Unpigmented Polyethylene Gas Pipe Resin	0.9 kg

See [Table 202.1](#) on the website for more information.

## Viscosity

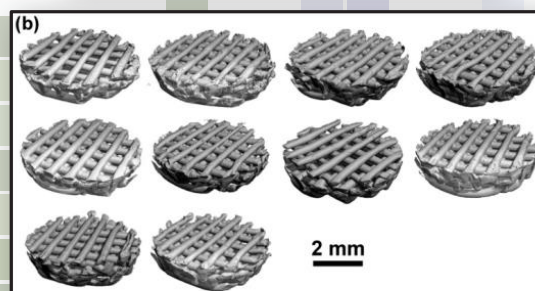
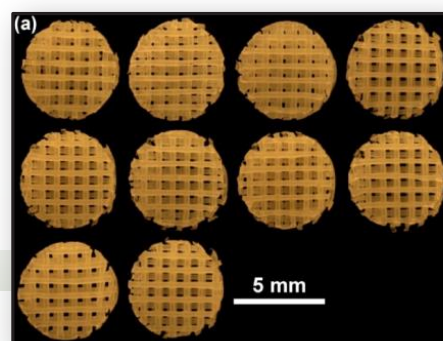
SRM	Description	Unit of Issue
2490	Non-Newtonian Polymer Solution for Rheological Measurements	100 mL
2492	Bingham Paste Mixture for Rheological Measurements	kit for two batches
2493	Bingham Mortar Mixture for Rheological Measurements	kit for two batches

See [Table 202.1](#) on the website for more information.

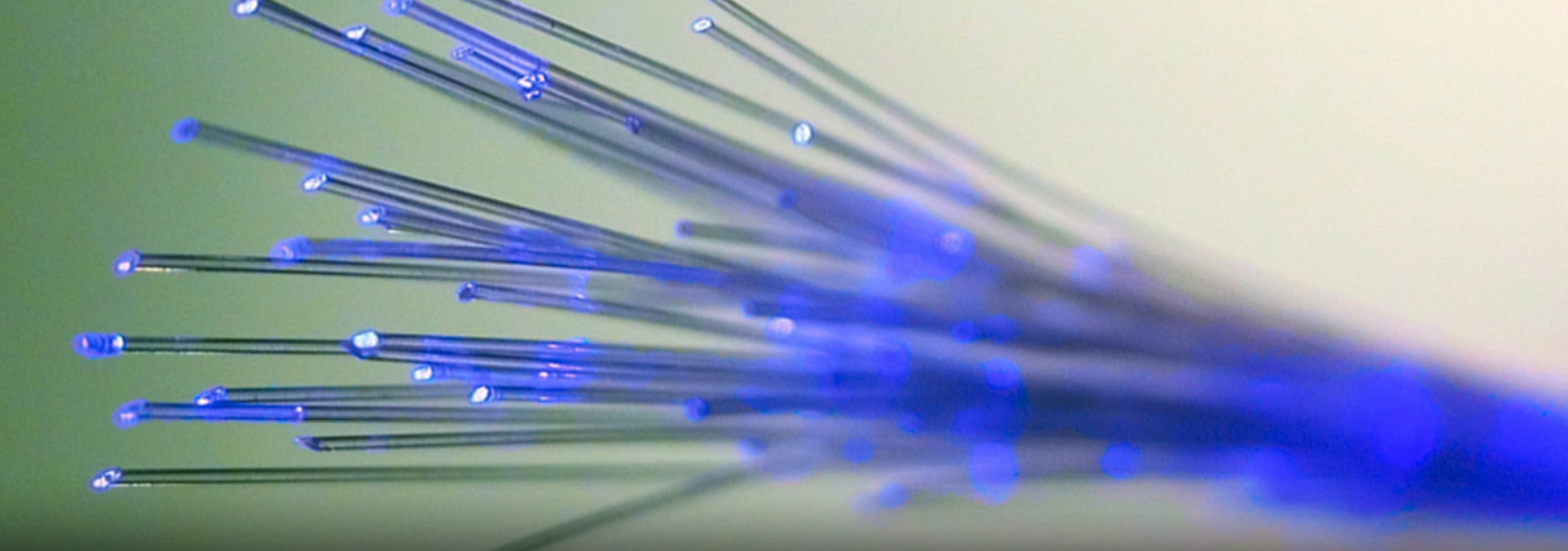
## Biomaterials

SRM	Description	Unit of Issue
8394	Tissue Engineering Reference Scaffolds for Cell Culture	24 scaffolds

See [Table 202.1](#) on the website for more information.



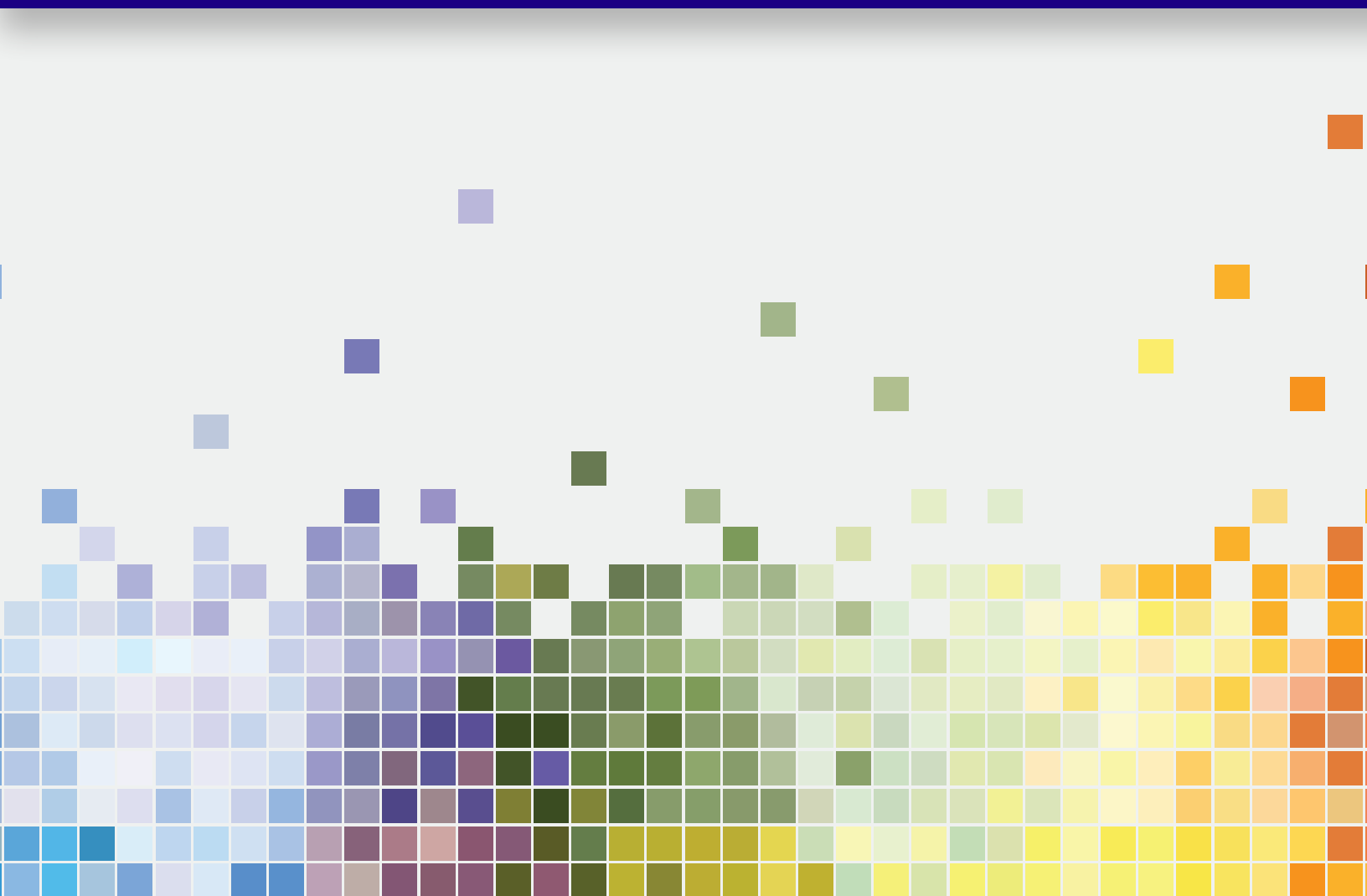
RM 8394: 10 scaffolds used for structural characterization as (a) Stereomicrographs and (b) X ray microcomputed 3D tomographs.

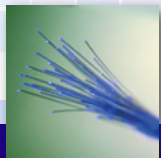


# 203

## Standard Reference Materials for Physical Properties

**Thermodynamic Properties**





### Combustion Calorimetry (powder form)

These SRMs are for use as standards for calibration of combustion bomb calorimeters used in checking the performance of apparatus and analytical procedures.

SRM	Description	Unit of Issue
39j	Benzoic Acid (Calorimetric Standard)	30 g
1656	Thianthrene Combustion Calorimetric Standard	30 g
1657	Synthetic Refuse-Derived Fuel Combustion Calorimetric Standard	100 g
2152	Urea Combustion Calorimetric Standard	25 g

See [Table 203.1](#) on the website for more information.

### Solution Calorimetry

This SRM is for calibration and validation of differential scanning calorimeters, differential thermal analyzers, and similar instruments.

SRM	Description	Unit of Issue
1655	Potassium Chloride, KCl (cr) for Solution Calorimetry	30 g

See [Table 203.2](#) on the website for more information.

### Enthalpy and Temperature of Fusion

These SRMs are for calibration and validation of differential scanning calorimeters, differential thermal analyzers, and similar instruments.

SRM	Description	Unit of Issue
2234	Gallium for Thermal Analysis	2 g
2235	Bismuth for Thermal Analysis	1.5 g

See [Table 203.5](#) on the website for more information.

### Differential Scanning Calorimetry and Differential Thermal Analysis

These SRMs are for calibration and validation of differential scanning calorimeters, differential thermal analyzers, and similar instruments.

### Enthalpy and Heat Capacity

SRM	Description	Unit of Issue
705a	Polystyrene (Narrow Molecular Weight Distribution)	5 g
720	Sapphire Heat Capacity	15 g
781D2	Molybdenum - Heat Capacity	10 cm

See [Table 203.5](#) on the website for more information.

### Thermal Analysis Purity Set

SRM 1514 is for evaluating methods of determining purity by differential scanning calorimetry. It consists of pure phenacetin and phenacetin doped with p-aminobenzoic acid.

SRM	Description	Unit of Issue
1514	Thermal Analysis Purity Set	set (4)

See [Table 203.5](#) on the website for more information.

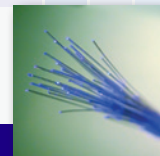
### Defining Fixed Point, International Temperature Scale of 1990, ITS-90 (solid forms)

These SRMs are for use in preparing defining fixed points of the International Temperature Scale of 1990, ITS-90.

SRM	Description	Unit of Issue
740a	Zinc Freezing Point Standard	200 g
741a	Tin Freezing-Point Standard	200 g
1746	Silver Freezing-Point Standard	300 g
1751	Gallium Melting-Point Standard	200 g

See [Table 203.8](#) on the website for more information.





## Reference Points (solid forms)

These moderate purity SRMs are for use in preparing reference point devices and for calibrating thermometers, thermocouples and other temperature measuring devices.

SRM	Description	Unit of Issue
45d	Copper Secondary Freezing Point	450 g
49e	Lead Secondary Freezing Point Standard	600 g
742	Aluminum Oxide Pyrometric Standard	10 g

See [Table 203.10](#) on the website for more information.

## Freezing Point, Melting Point, and Triple Point Cells (solid forms)

These SRM fixed point devices are for use in the realization of internationally accepted secondary reference points and/or triple points. They are not intended for calibration of differential scanning calorimeters.

SRM	Description	Unit of Issue
1968	Gallium Melting-Point Standard	25 g
1970	Succinonitrile Triple Point	60 g
1972	1,3-Dioxolan-2-one Triple Point	60 g

See [Table 203.11](#) on the website for more information.

## Thermocouple Materials

SRM	Description	Unit of Issue
1749	Gold versus Platinum Thermocouple Certified Thermometer	each
1750	Standard Platinum Resistance Thermometer Certified Thermometer	each
1967a	High-Purity Platinum Thermoelement (platinum wire)	0.51 x 1 m

See [Table 203.13](#) on the website for more information.

## Thermal Conductivity of Iron (rod form), Fibrous Glass, and Polystyrene

SRM	Description	Unit of Issue
1450d	Thermal Conductivity, Fibrous Glass Board	each
1453	Thermal Conductivity - Expanded Polystyrene Board	each
8420	Electrolytic Iron	0.64 D x 5.0

See [Table 203.15](#) on the website for more information.

## Thermal Expansion of Glass (rod form)

SRM	Description	Unit of Issue
731L1	Borosilicate Glass - Thermal Expansion	5 cm
731L2	Borosilicate Glass - Thermal Expansion	10 cm
731L3	Borosilicate Glass - Thermal Expansion	15 cm

See [Table 203.16](#) on the website for more information.

## Thermal Resistance Properties of Fibrous Glass and Fumed Silica Board

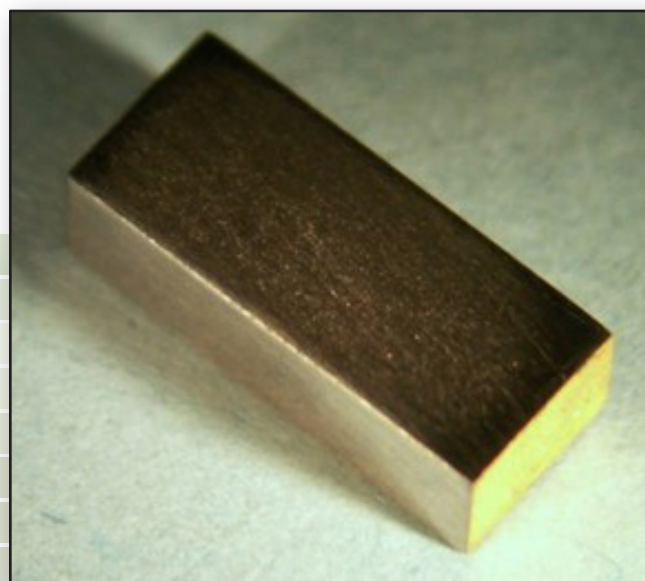
SRM	Description	Unit of Issue
1449	Thermal Resistance - Fumed Silica Board	each
1452	Thermal Resistance - Fibrous Glass Blanket for High Precision Measurements	each
1459	Thermal Resistance - Fumed Silica Board	each

See [Table 203.17](#) on the website for more information.

## Thermoelectric Materials

SRM	Description	Unit of Issue
3451	Low Temperature Seebeck Coefficient Standard	bar

See [Table 203.18](#) on the website for more information.



SRM 3451 Low-Temperature Seebeck Coefficient Standard

# NIST Measurement Services Websites of Interest

## Standard Reference Materials



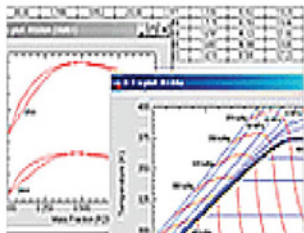
### Standard Reference Materials

<https://www.nist.gov/srm>

### Historical Archived Certificates/Reports of Investigation

<https://www-s.nist.gov/srmors/certArchive.cfm>

## Standard Reference Data



### NIST Scientific and Technical Databases

<https://www.nist.gov/srd>

### NIST Data Gateway

<https://srdata.nist.gov/gateway>

## Calibrations



### Calibrations Services

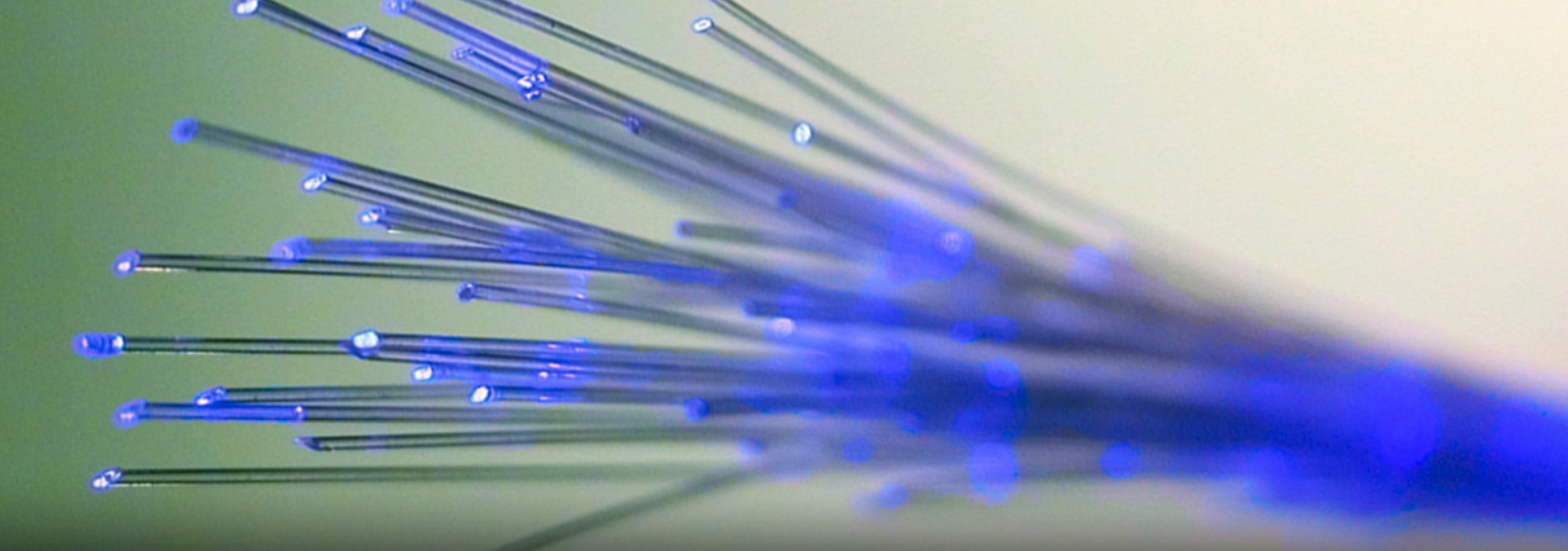
<https://www.nist.gov/calibrations>

## Standard Reference Instruments



### Standard Reference Instruments

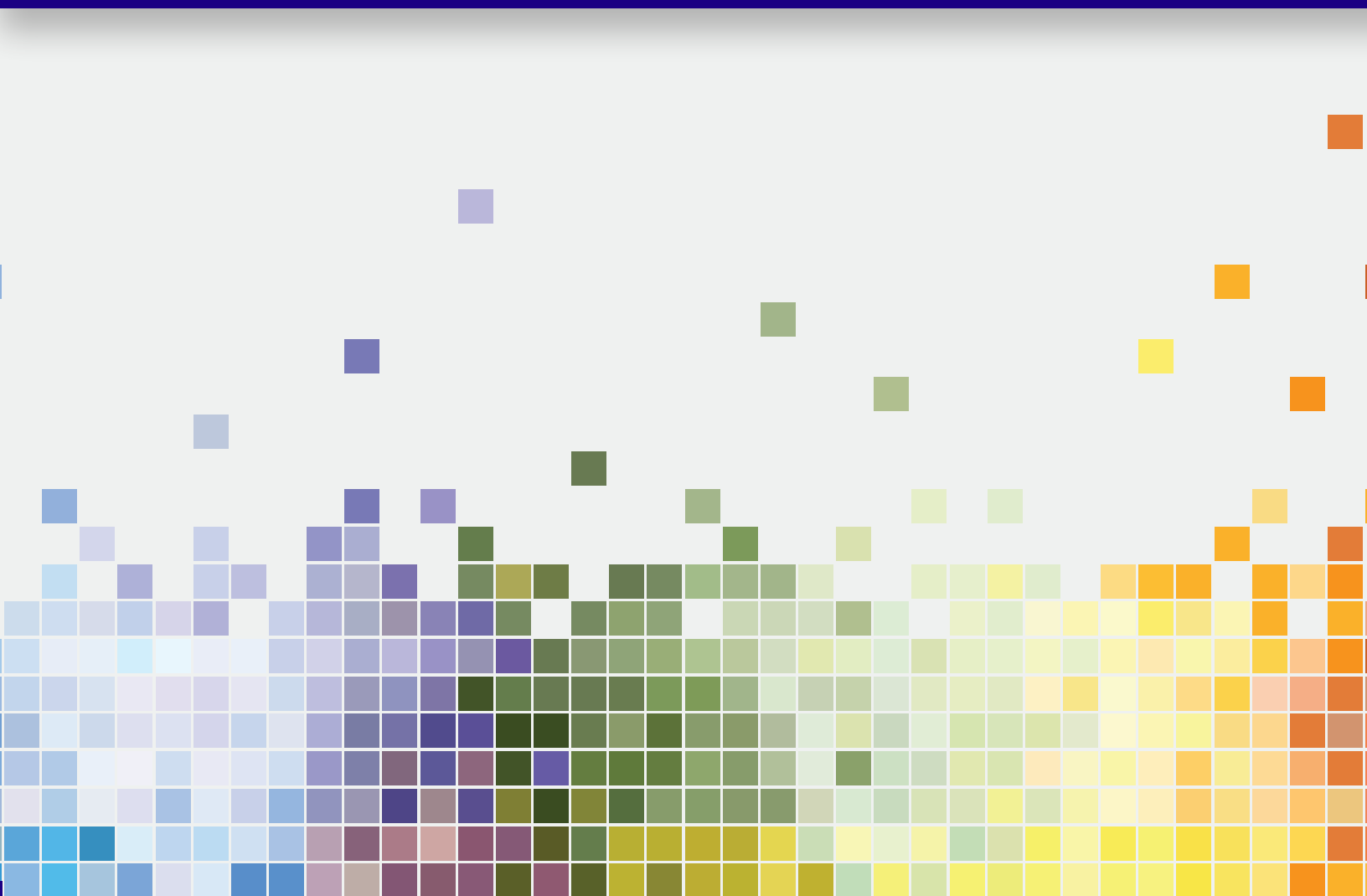
<https://www.nist.gov/srm/standard-reference-instruments.cfm>



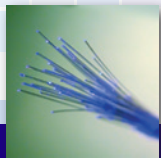
# 204

## Standard Reference Materials for Physical Properties

**Optical Properties**







## Molecular Absorption (film, filter, solid, and solution forms)

The optical SRMs for spectrophotometry are certified transfer standards that fall into three general categories: transmittance, wavelength, and stray radiant energy; each of which addresses a specific instrumental parameter of an absorption spectrometer that must be in control for accurate optical transmittance measurements. To obtain optimum verification results, each SRM must be used within the specified range of conditions for which it is intended.

SRM	Description	Unit of Issue
931h	Liquid Absorbance Filters, UV-VIS	set (12)
935a	Potassium Dichromate (Ultraviolet Absorbance Standard)	15 g
1921b	IR Transmission Wavelength (Polystyrene Film)	1 card
2031b	Metal-on-Fused-Silica Neutral Density Filters (250 nm to 635 nm)	set (3)
2034	Holmium Oxide Solution Wavelength from 240 nm to 650 nm	Cuvette
2035a	Ultraviolet-Visible-Near-Infrared Wavelength/Wavenumber Transmission Standard	each
2036	Near Infrared Wavelength/Wavenumber Reflection Standard	each
2082	Pathlength Absorbance Standards for Microliter Volume Spectrophotometers	3 vials

See [Table 204.1](#) on the website for more information.

## Fluorescence and Raman Spectroscopy

SRM	Description	Unit of Issue
1932	Fluorescein Solution	3 x 2 mL
1934	Fluorescent Dyes for Quantitative Flow Cytometry (Visible Spectral Range)	4 ampoules
2241	Relative Intensity Correction Standard for Raman Spectroscopy: 785 nm Excitation	each
2242	Relative Intensity Correction Standard for Raman Spectroscopy: 532 nm Excitation	each
2244	Relative Intensity Correction Standard for Raman Spectroscopy: 1064 nm Excitation	each
2245	Relative Intensity Correction Standard for Raman Spectroscopy: 633 nm Excitation	each
2246	Relative Intensity Correction Standard for Raman Spectroscopy: 830 nm Excitation	each

SRM	Description	Unit of Issue
2940	Relative Intensity Correction Standard for Fluorescence Spectroscopy: Orange Emission	each
2941	Relative Intensity Correction Standard for Fluorescence Spectroscopy: Green Emission	each
2942	Relative Intensity Correction Standard for Fluorescence Spectroscopy: Ultraviolet Emission	each
2943	Relative Intensity Correction Standard for Fluorescence Spectroscopy: Blue Emission	each
2944	Relative Intensity Correction Standard for Fluorescence Spectroscopy: Red Emission	each

See [Table 204.2](#) on the website for more information.

## Infrared Reflectance (solid form)

SRM	Description	Unit of Issue
2036	Near Infrared Wavelength/Wavenumber Reflection Standard	each

See [Table 204.2](#) on the website for more information.

## Optical Rotation (powder form)

SRM 17f is intended for calibrating or checking polarimetric apparatus. In aqueous solution, the optical rotation of SRM 17f is value assigned at four wavelengths.

SRM	Description	Unit of Issue
17f	Sucrose Optical Rotation	60 g

See [Table 204.2](#) on the website for more information.

## Photography (chart form)

SRM 1010a is used to test the resolving power of cameras or of whole microcopying systems. It consists of 5 charts printed photographically on paper, that have 26 high-contrast, 5-line patterns ranging in spatial frequency of 1 mm<sup>-1</sup> to 18 mm<sup>-1</sup>.

SRM	Description	Unit of Issue
1010a	Microcopy Resolution Test Charts	set (5)

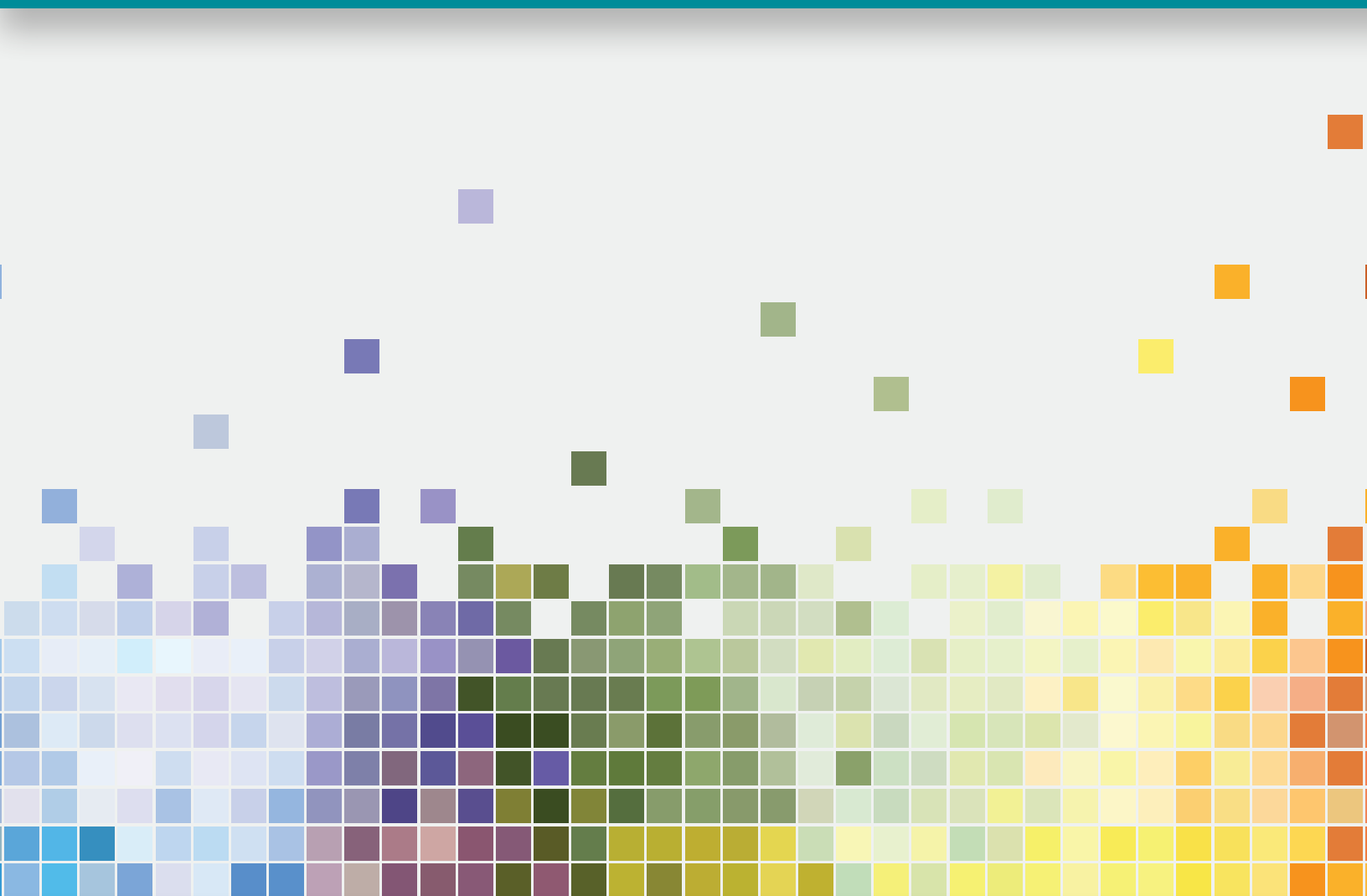
See [Table 204.2](#) on the website for more information.



# 205

## Standard Reference Materials for Physical Properties

**Radioactivity**





## Radiation Dosimetry (wire form)

This SRM is a cobalt-in-aluminum alloy wire 0.5 mm in diameter and 1 m in length for use as a neutron density monitor standard.

“Radionuclide Calibration Services”

SRM	Description	Unit of Issue
953	Neutron Density Monitor Wire	1 m

See [Table 205.1](#) on the website for more information.

## Special Nuclear Materials

The U.S. Department of Energy New Brunswick Laboratory issues special nuclear reference materials as NBL Certified Reference Materials (CRMs). These CRMs include the plutonium and uranium assay and isotopic materials previously issued by the National Institute of Standards and Technology. All orders or inquiries should be addressed to: U.S. Department of Energy, New Brunswick Laboratory, 9800 S. Cass Avenue, Bldg. 350, Argonne, IL 60439-4899. Attn: Reference Materials Sales; Phone (630) 252-2767; Fax (630) 252-6256; E-mail [usdoe.nbl@ch.doe.gov](mailto:usdoe.nbl@ch.doe.gov)

## Radioactive Solutions

These SRMs are intended for the calibration of radioactivity measuring instruments and for the monitoring of chemical and geochemical processes. They are calibrated in terms of activity per gram of solution. Each SRM is contained in a flame-sealed glass ampoule or bottle and, except as noted, consists of the radionuclide dissolved in an aqueous solution (usually acidic).

When an import permit for radioactive material is required of a customer outside the U.S., NIST must have a copy to complete an order and facilitate shipment.

SRM	Description	Unit of Issue
4222c	Carbon-14 Radioactivity Standard for Liquid Scintillation Counting	5 mL
4226d	Nickel-63 Radioactivity Standard	5 mL
4233e	Cesium-137 Radioactivity Standard Solution	5 mL
4239	Strontium-90 Radioactivity Standard Solution	5 mL
4251C	Barium-133 Radioactivity Standard Solution	5 mL

SRM	Description	Unit of Issue
4274	Holmium-166m Gamma-ray Emission Rate Standard Solution	5 mL
4288b	Technetium-99 Radioactivity Standard	5 mL
4320b	Curium-244 Radioactivity Standard	5 mL
4321c	Natural Uranium Radioactivity Standard Solution	5 mL
4322c	Americium-241 Radioactivity Standard	5 mL
4323b	Plutonium-238 Radioactivity Standard	5 mL
4324b	Uranium-232 Radioactivity Standard Solution	5 mL
4326a	Polonium-209 Radioactivity Standard	5 mL
4328c	Thorium-229 Radioactivity Standard Solution	5 mL
4329	Curium-243 Radioactivity Standard Solution	5 mL
4330c	Plutonium-239 Radioactivity Standard	3 mL
4332e	Americium-243 Radioactivity Standard	5 mL
4334i	Plutonium-242 Radioactivity Standard Solution	5 mL
4337	Lead-210 Radioactivity Standard Solution	5 mL
4338a	Plutonium-240 Radioactivity Standard Solution	5 mL
4339b	Radium-228 Radioactivity Solution	5 mL
4340b	Plutonium-241 Radioactivity Standard	5 mL
4341a	Neptunium-237 Radioactivity Standard	5 mL
4342a	Thorium-230 Radioactivity Standard	5 mL
4361c	Hydrogen-3 Radioactivity Standard	500 mL
4370c	Europium-152 Radioactivity Standard Solution	5 mL
4915f	Cobalt-60 Radioactivity Standard Solution	5 mL
4919i	Strontium-90 Radioactivity Standard	5 mL
4926e	Hydrogen-3 Radioactivity Standard	20 mL
4927f	Hydrogen-3 Water Radioactivity Standard	5 mL
4929f	Iron-55 Radioactivity Standard	5 mL
4943	Chlorine-36 Radioactivity Standard	3 mL
4949d	Iodine-129 Radioactivity Standard Solution	5 mL
4965	Radium-226 Radioactivity Standard Solution	5 mL
4966a	Radium-226 Radioactivity Standard	5 mL
4967a	Radium-226 Radioactivity Standard Solution	5 mL
4969	Radium-226 Radioactivity Standard	5 mL

See [Table 205.4](#) on the website for more information.





## Radiopharmaceuticals (solution and gaseous forms)

These SRMs are intended for the calibration of radioactivity-measuring instruments. They are calibrated in terms of activity per gram of solution (except SRM 4415, which is calibrated in terms of activity). Each SRM is contained in a 5 mL flame-sealed glass ampoule and, except for SRM 4415, consists of the radionuclide dissolved in an aqueous solution (usually acidic). These SRMs are produced in collaboration with the NRMAP, Inc. and, because of the short half lives, are available only at specific times.

When an import permit for radioactive material is required of a customer outside the U.S., NIST must have a copy to complete an order and facilitate shipment.

SRM	Description	Unit of Issue	Approximate Activity	Half Life (days)	Month Produced*
4401L	Iodine-131 Radioactivity Standard	5 mL	5 MBq/g	8	February
4401H**	Iodine-131 Radioactivity Standard	5 mL	600 MBq/g	8	February
4404L	Thallium-201 Radioactivity Standard	5 mL	10 MBq/g	3	June
4404H**	Thallium-201 Radioactivity Standard	5 mL	500 MBq/g	3	June
4407L	Iodine-125 Radioactivity Standard	5 mL	5 MBq/g	59.4	December
4407H**	Iodine-125 Radioactivity Standard	5 mL	370 MBq/g	59.4	December
4410H	Technetium-99m Radioactivity Standard	5 mL	1.0 GBq/g	0.3	September
4412L	Molybdenum-99 Radioactivity Standard	5 mL	10 MBq/g	2.74	April
4412H**	Molybdenum-99 Radioactivity Standard	5 mL	700 MBq/g	2.74	April
4415L	Xenon-133 Radioactivity Standard	5 mL	150 MBq/g	5.243	September
4415H**	Xenon-133 Radioactivity Standard	5 mL	12 GBq/g	5.243	September
4416L	Gallium-67 Radioactivity Standard	5 mL	5 MBq/g	3.3	May
4416H**	Gallium-67 Radioactivity Standard	5 mL	370 MBq/g	3.3	May
4417L	Indium-111 Radioactivity Standard	5 mL	10 MBq/g	2.8	August
4417H**	Indium-111 Radioactivity Standard	5 mL	500 MBq/g	2.8	August
4427L	Yttrium-90 Radioactivity Standard	5 mL	5 MBq/g	2.67	October
4427H**	Yttrium-90 Radioactivity Standard	5 mL	50 MBq/g	2.67	October

See [Table 205.5](#) on the website for more information.

\*Check the website for details as to the order date deadline for these SRMs.

\*\*Only available to members of NRMAP, Inc. For information on membership: NRMAP/NIST Program <https://www-s.nist.gov/srmors/certificates/documents/NRMAP-PharmBroch2012.pdf>



## Carbon-14 Dating (solid form)

This SRM is an international standard for contemporary carbon-14 against which world-wide measurements can be compared. Each SRM consists of approximately 225 g of a 450 kg lot of oxalic acid prepared by fermentation of French beet molasses from the 1977 spring, summer, and autumn harvests.

SRM	Description	Unit of Issue
4990c	Oxalic Acid	8 x 28 g

See [Table 205.7](#) on the website for more information.

## Radioactive Natural Matrix Materials (powder form)

When an import permit for radioactive material is required of a customer outside the U.S., NIST must have a copy to complete an order and facilitate shipment.

SRM	Description	Unit of Issue
4350b	River Sediment Environmental Radioactivity Standard	85 g
4351	Human Lung Environmental Radioactivity Standard	45 g
4352	Human Liver Powder	45 g
4353a	Rocky Flats Soil Number 2	90 g
4354	Lake Sediment Powder	25 g
4355	Peruvian Soil Powder	75 g
4356	Ashed Bone (Radioactivity)	15 g
4357	Ocean Sediment Powder	85 g
4358	Ocean Shellfish Radionuclide Standard	150 g
4359	Seaweed Radionuclide Standard	300 g

See [Table 205.11](#) on the website for more information.

## Considering a Radioactive SRM(s) Order?

Start by submitting a request to our SRM Sales Office, via email ([srminfo@nist.gov](mailto:srminfo@nist.gov)) or fax (301-948-3730). After it has been received, you will be contacted for any additional information needed. Based on the regulations that apply to you as a customer either *within the United States* (United States includes Puerto Rico and all territories and possessions of the United States) or *outside the United States*, NIST will determine if your request can be cleared for processing. Requirements for the different customer locations are outlined below.

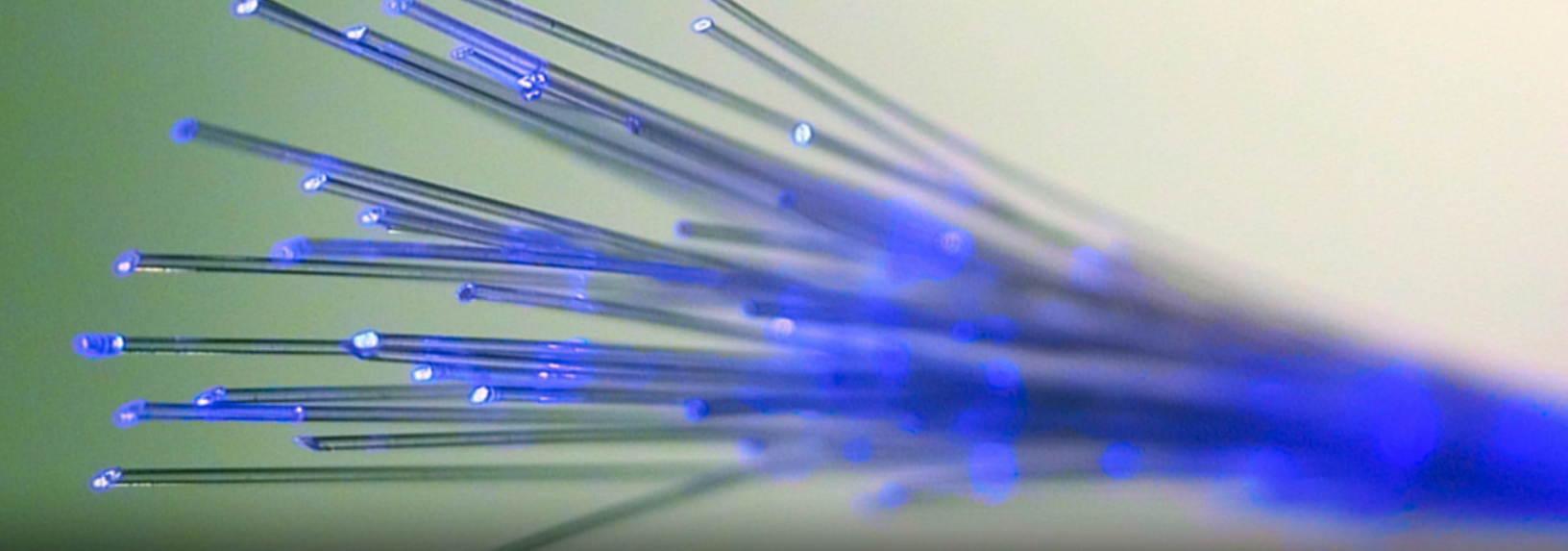
### *Customers in Organizations within the United States:*

If the material(s) requested is/are subject to license requirements by the Nuclear Regulatory Commission (NRC). Prior to shipment, NIST is required by law to verify the domestic customer's authorization to receive and possess radioactive material. Once NIST makes a determination, you will be notified with the disposition of your request. For approved requests, your order confirmation or quote will be forwarded to you.

### *Customers in Organizations outside the United States:*

- **Import permit for radioactive material:** Your country may require an import permit for radioactive material. Prior confirmation of your import permit status is necessary for the disposition of your request.
  - If your country *requires an import permit*, NIST must have a copy in order to complete your order and facilitate shipment with the carrier.
- **Export controls:** NIST is required to determine if your country is subject to export controls as determined by the Nuclear Regulatory Commission (NRC) and the U.S. Department of Commerce, Bureau of Industry and Security. NIST will review those controls and determine the disposition of your request.
- Once NIST has received your import permit (if applicable) and approved your request for export, your order confirmation or quote will be forwarded.

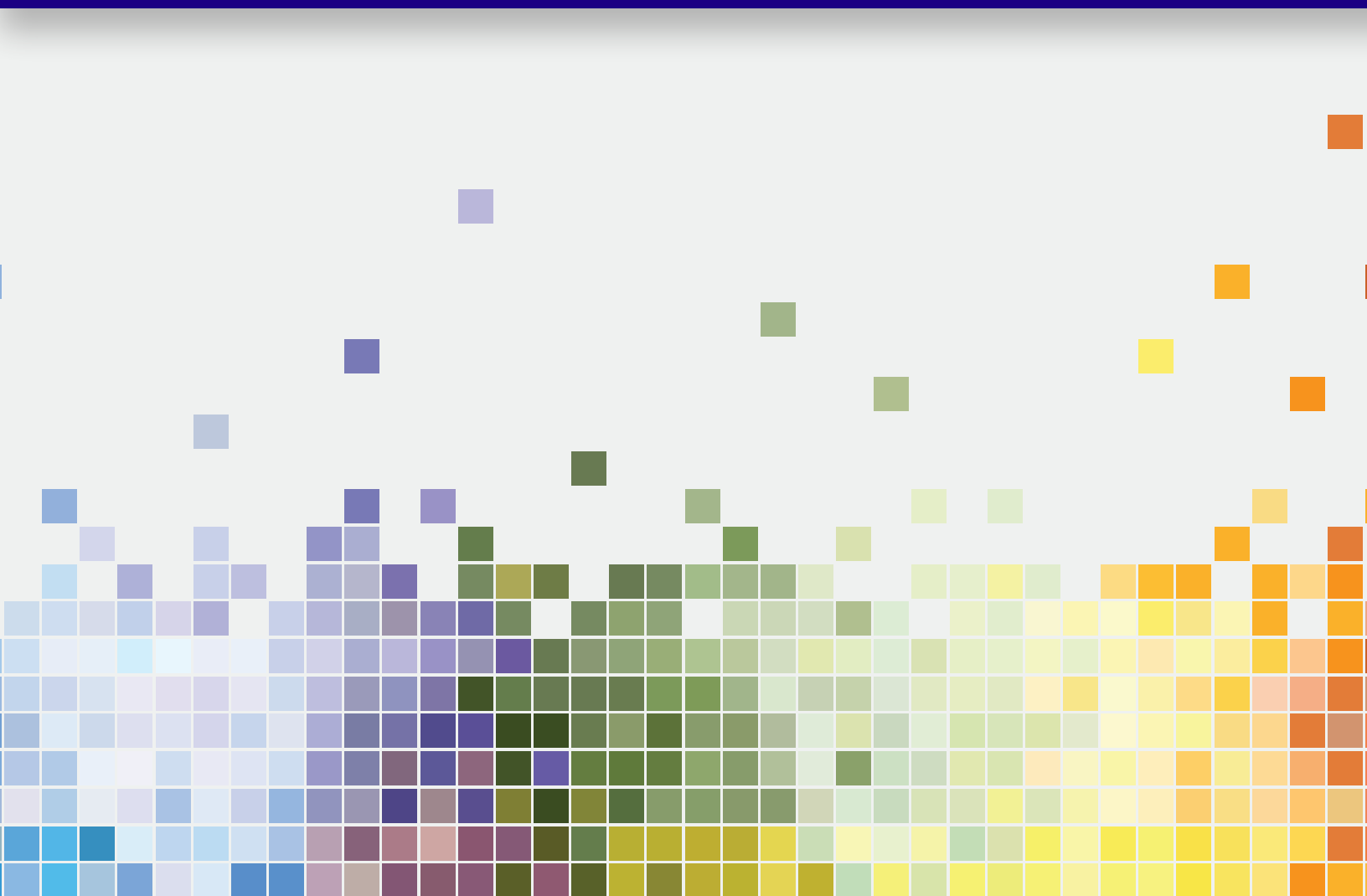
If you have any technical questions, please contact the NIST Radiation Physics Division at [radsrms@nist.gov](mailto:radsrms@nist.gov).



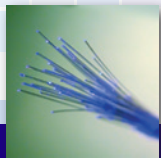
# 206

## Standard Reference Materials for Physical Properties

**Electrical Properties**







### Electrical Resistivity and Conductivity of Iron (rod form)

SRM	Description	Unit of Issue
8420	Electrolytic Iron	0.64 D x 5.0

See [Table 206.1](#) on the website for more information.

### Electrical Resistivity and Conductivity of Silicon (block and wafer forms)

SRMs 2541 and 2543 consist of single wafers intended for use as reference standards for sheet resistance and resistivity measurements utilizing the four-point probe method. SRMs 2543 are made of Czochralski-grown, boron-doped silicon with (100) crystallographic orientation.

SRM	Description	Unit of Issue
2541	Silicon Resistivity Standard - 0.01 ohm•cm Level	each
2543	Silicon Resistivity Standard - 1 ohm•cm Level	each

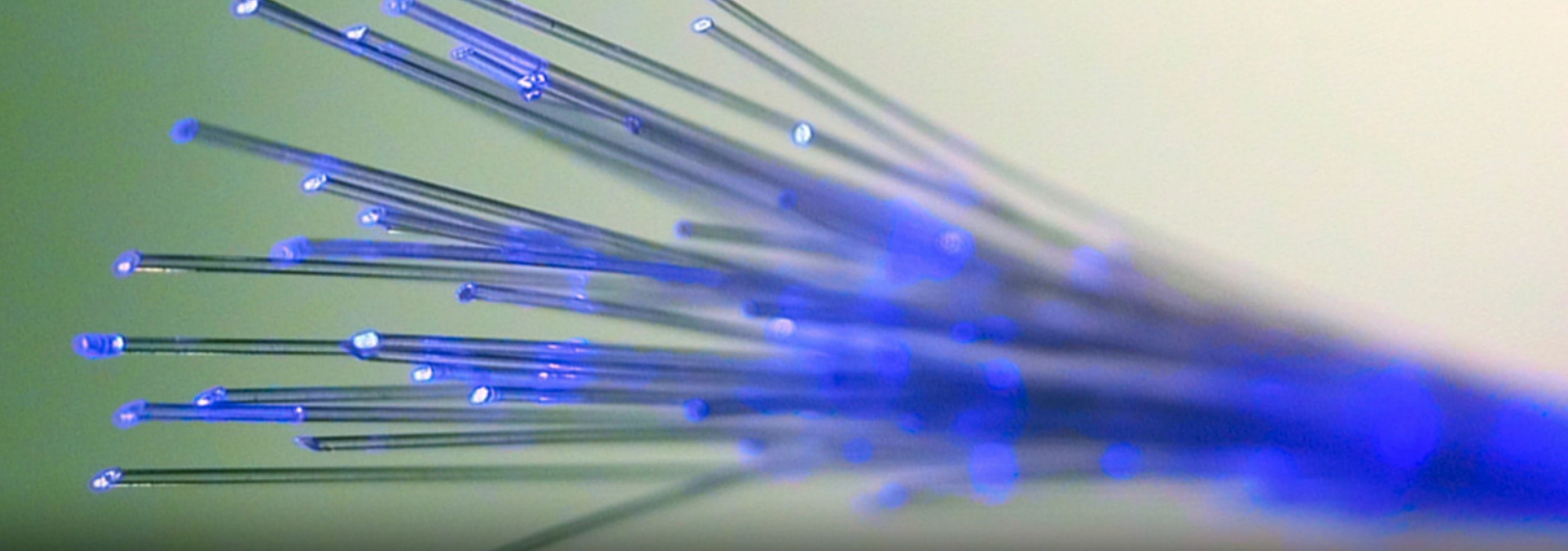
See [Table 206.2](#) on the website for more information.

### Superconducting Critical Current (wire form)

This SRM is for checking the performance of measurement systems used in superconductor technology. It consists of 2.2 m of a multifilamentary niobium titanium, copper-stabilized superconducting wire wound in a single layer onto a spool with a core diameter of 8.7 cm.

SRM	Description	Unit of Issue
1457	Superconducting Critical Current - Nb Ti Wire	each

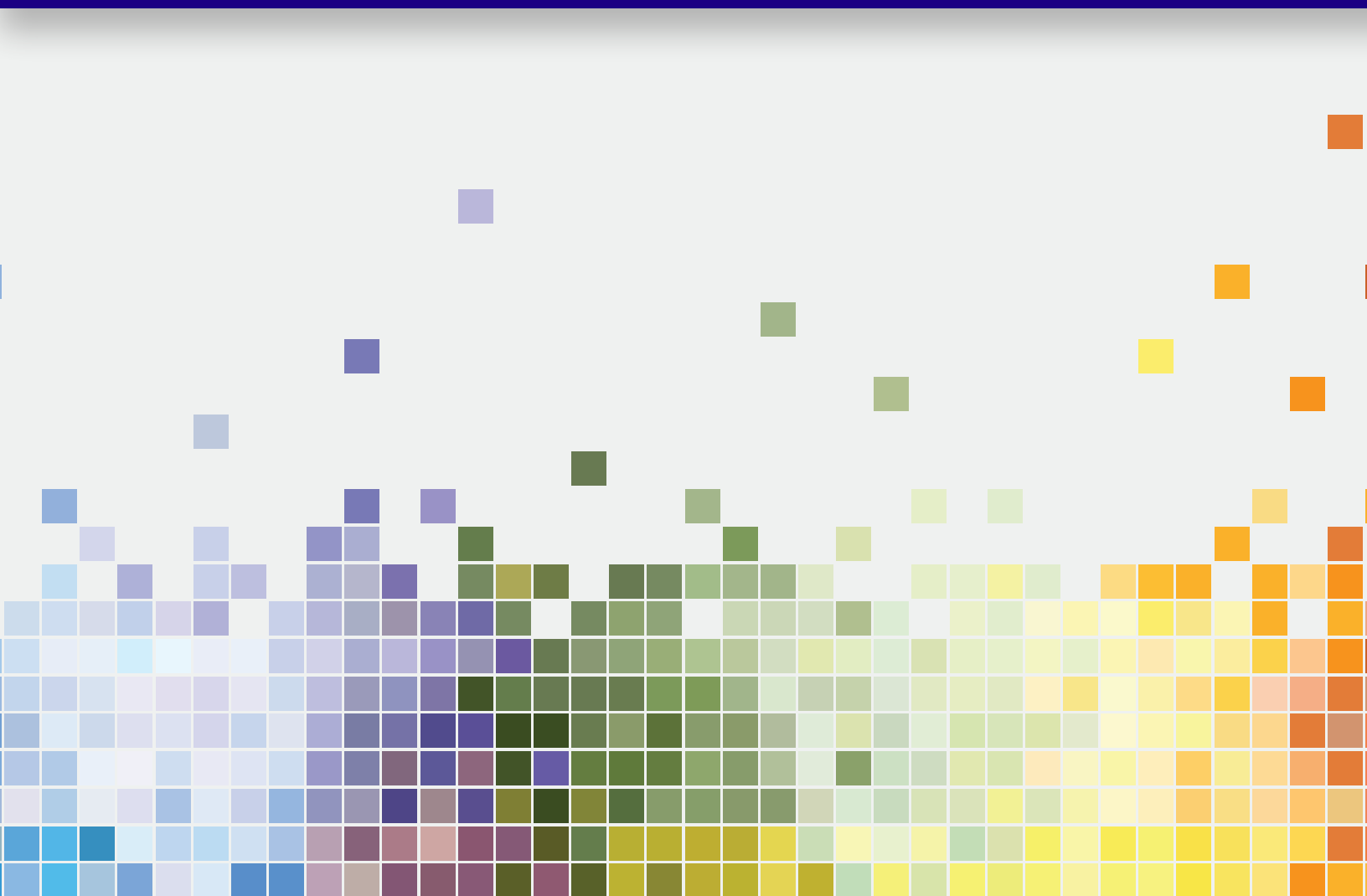
See [Table 206.4](#) on the website for more information.

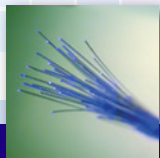


# 207

## Standard Reference Materials for Physical Properties

**Metrology**





## Scanning Electron Microscope (SEM)

These RMs are for calibrating the magnification scale and evaluating the performance of scanning electron microscopes. RM 8091 is used in checking the sharpness performance of scanning electron microscopes.

SRM	Description	Unit of Issue
8091	Scanning Electron Microscope Sharpness Standard	each
8820	Scanning Electron Microscope Scale Calibration Artifact	each

See [Table 207.1](#) on the website for more information.

## Depth Profiling (wafer form)

SRMs 2133, 2134 and 2137 are for calibrating the secondary ion response to minor and trace element levels in a silicon matrix. SRM 2133 is certified for phosphorus; SRM 2134 is certified for arsenic; SRM 2137 is certified for boron. SRM 2135c is for calibrating equipment used to measure sputtered depth and erosion rates in surface analysis. SRM 2135c is certified for total chromium and total nickel thickness, for individual layer uniformity, for nickel/chromium bilayer uniformity, and for individual layer thickness.

SRM	Description	Unit of Issue
2133	Phosphorus Implant in Si Depth Profile	each
2134	Arsenic Implant in Silicon Depth Profile Standard	each
2135c	Ni/Cr Thin Film Depth Profile	each
2137	Boron Implant in Silicon Standard for Calibration of Concentration in a Depth Profile	each

See [Table 207.3](#) on the website for more information.

## Optoelectronics (solid forms)

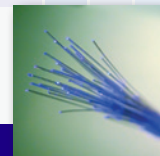
These SRMs are intended for calibrating equipment (tunable diode lasers, video microscopes, optical spectrum analyzers, etc.) and measurement systems used in optoelectronics manufacturing and in the testing of optoelectronics components (lasers and detectors, optical fiber and fiber components, etc.). SRMs 2514, 2515, 2517a and 2519a are fiber-connected molecular gas absorption cells with lines in the 1510 to 1630 nm region. SRM 2520 is an optical fiber specimen with a known cladding diameter value.

SRM	Description	Unit of Issue
2514	Wavelength Calibration Reference for 1560 nm to 1595 nm	each
2515	Wavelength Calibration Reference for 1595 nm to 1630 nm	each
2517a	High Resolution Wavelength Calibration Reference for 1510 to 1540 nm Acetylene $^{12}\text{C}_2\text{H}_2$	each
2519a	High Resolution Wavelength Calibration Reference for 1530 nm -1565 nm Hydrogen Cyanide	each
2520	Optical Fiber Diameter Standard	each
2553	Optical Fiber Coating Diameter (Nominal Refractive Index 1.504)	each
2554	Optical Fiber Coating Diameter (Nominal Refractive Index 1.515)	each

See [Table 207.4](#) on the website for more information.







## Nonmagnetic Coating Thickness (plate form)

These SRMs are suitable for calibrating instruments used in the measurement of organics and nonmagnetic inorganic coatings over steel. They consist of fine grained copper of varying thicknesses electrodeposited onto low carbon steel substrates having the properties of AISI 1010 steel. These uniform coatings are then overplated with a thin protective layer of chromium and the total coating thickness is then certified. The thickness range covered is between 6  $\mu\text{m}$  and 2000  $\mu\text{m}$ . Each unit is also supplied with a blank substrate.

SRM	Description	Unit of Issue
1358b	Coating Thickness Standard, (Nonmagnetic Coating on Steel)	set (5)
1359b	Coating Thickness Standard (Nonmagnetic Coating on Steel)	set (5)
1361b	Coating Thickness Standard (Nonmagnetic Coating on Steel)	set (5)
1362b	Coating Thickness Standard (Nonmagnetic Coating on Steel)	set (5)
1363b	Coating Thickness Standard (Nonmagnetic Coating on Steel)	set (5)
1364b	Coating Thickness Standard (Nonmagnetic Coating on Steel)	set (5)

See [Table 207.5](#) on the website for more information.

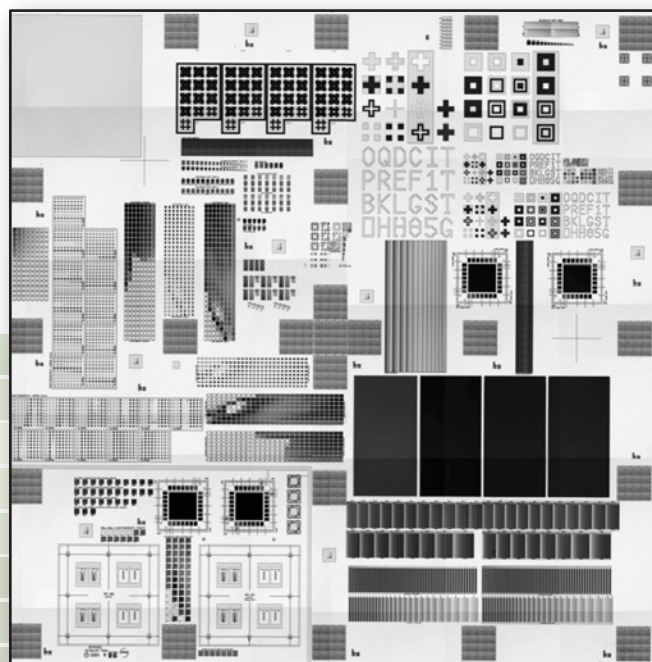


## Microscale Dimensional Measurement Standards

SRM 5001 is intended primarily for calibrating high accuracy two dimensional (X-Y) Photomask/Reticle registration metrology tools. In particular, this calibration artifact can also be used in the metrology tools capable of holding any artifact with these dimensions in need of a calibrated measurement field. An example of additional tools are defect inspection and classification tools, optical tools used in manufacture of flat panel displays or scanning electron microscopy tools used in photomask and wafer inspection.

SRM	Description	Unit of Issue
5001	Two-Dimensional Grid Photomask Standard	each
8820	Scanning Electron Microscope Scale Calibration Artifact	each

See [Table 207.9](#) on the website for more information.



RM 8820. Optical microscope view of the 20 mm  $\times$  20 mm chip.

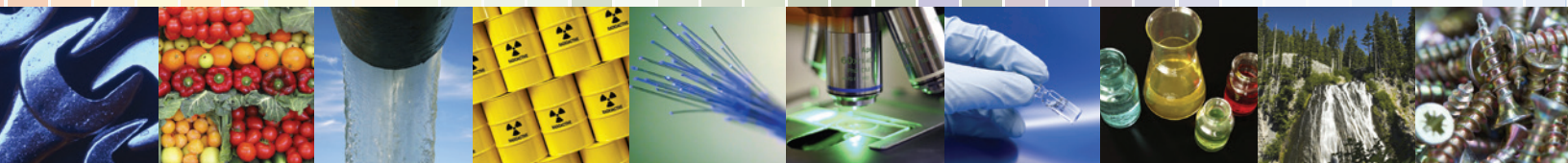


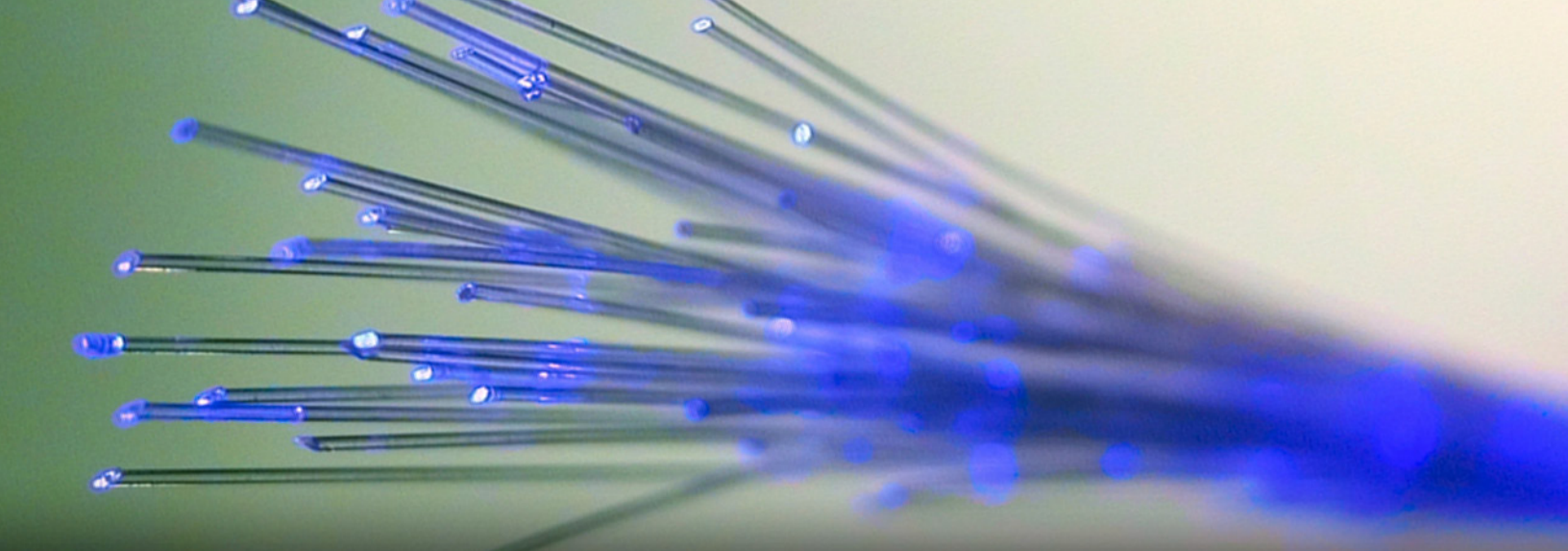
# SRM SPOTLIGHT

*Would you like to be on our mailing list to receive updates  
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Join our mailing list to receive the SRM Spotlight newsletter which features information on our newly released SRMs, renewals and revisions. It also includes our exhibit schedule along with other helpful resources.

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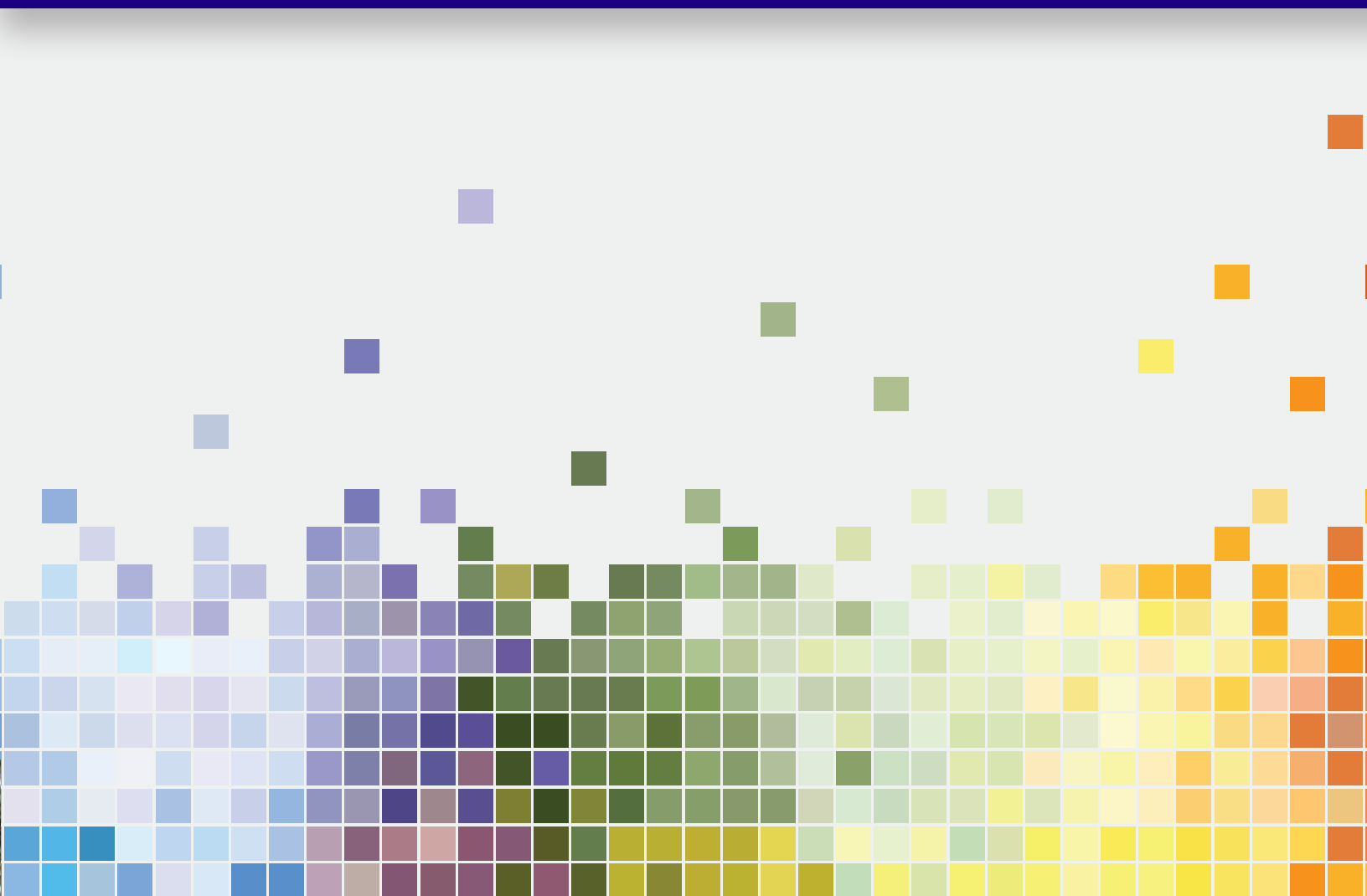




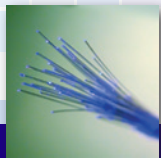
# 208

## Standard Reference Materials for Physical Properties

Liquids & Glasses







## Chemical Resistance [Durability] of Glass (solid form)

This SRM is for checking test methods and calibrating equipment used to determine the resistance of glass containers to chemical attack.

SRM	Description	Unit of Issue
622	Soda-Lime-Silica Glass	2.2 kg

See [Table 208.1](#) on the website for more information.

## Electrical Properties of Dielectrics

SRM 624 is intended to validate test methods and for calibrating equipment used to determine the dc volume resistivity of glass per ASTM C 657.

SRM 2870 is a cross-linked polystyrene puck that is intended to validate techniques used to measure the high-frequency relative permittivity and loss tangent of insulating materials. Certified values for relative permittivity and loss tangent are specified at 10 GHz, including supplemental data between 1 GHz and 25 GHz.

SRM	Description	Unit of Issue
624	Lead-Silica Glass for dc Volume Resistivity	200 g
2870	Relative Permittivity and Loss Tangent 1422 Cross-Linked Polystyrene	circular-cylindrical puck

See [Table 208.2](#) on the website for more information.

## Viscosity of Glass (bar form)

SRM 717a is for checking the performance of high temperature viscosity equipment (rotating cylinders) and low temperature viscosity equipment (fiber elongation, beam bending, parallel plates, etc.).

SRM	Description	Unit of Issue
717a	Hi Boron Glass Viscosity	block

See [Table 208.3](#) on the website for more information.

## Glass Liquidus Temperature (solid form)

This SRM is for checking test methods and for calibrating equipment used to determine the liquidus temperature of glass by the gradient furnace methods per ASTM C 829.

SRM	Description	Unit of Issue
1416	Aluminosilicate Glass for Liquidus Temperature	250 g

See [Table 208.4](#) on the website for more information.

## Viscosity Fixpoints (solid forms)

These SRMs are for the calibration of equipment for the determination of the softening, annealing, and strain points of glass.

SRM	Description	Unit of Issue
709	Extra Dense Lead Glass	block
717a	Borosilicate Glass	block

See [Table 208.5](#) on the website for more information.

## Relative Stress Optical Coefficient (bar form)

SRM	Description	Unit of Issue
709	Extra Dense Lead Glass	block

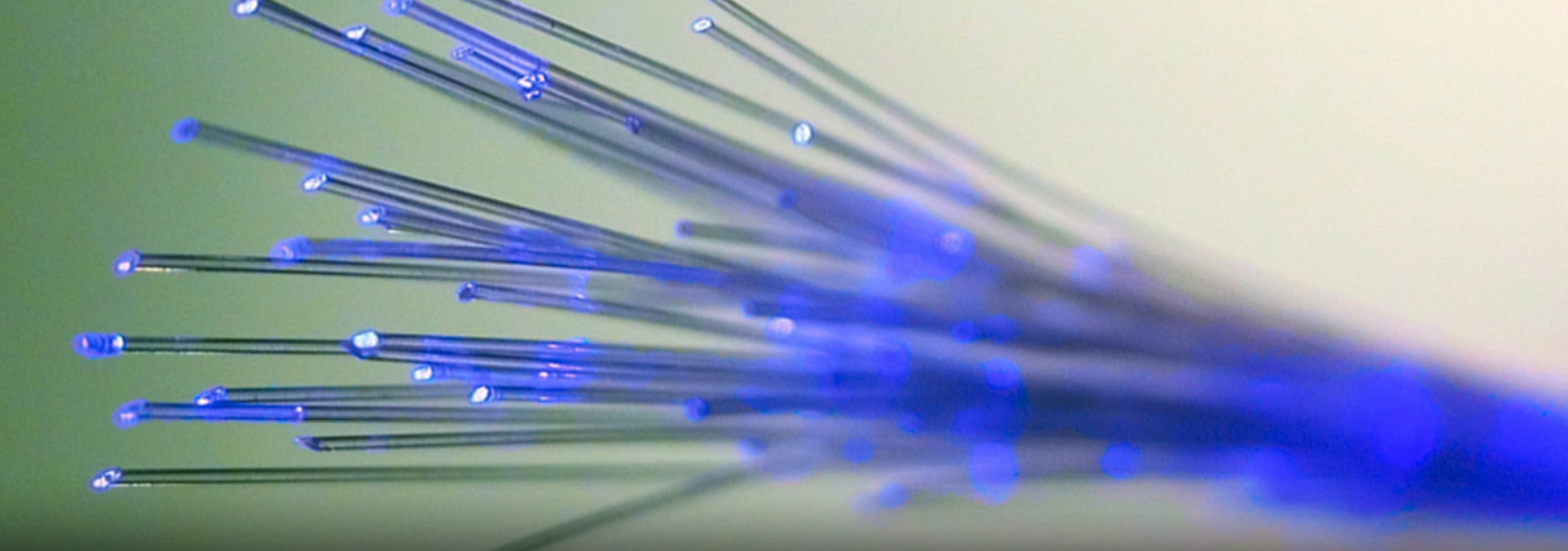
See [Table 208.6](#) on the website for more information.

## Density

SRMs 211d and 2214 are for reference in the determination of the density of liquids. The certified densities were determined by means of hydrostatic weighing and are provided at 15 °C, 20 °C, and 25 °C

SRM	Description	Unit of Issue
211d	Toluene Liquid Density - Extended Range	4 x 5 mL
2214	Isooctane Liquid Density	4 x 5 mL

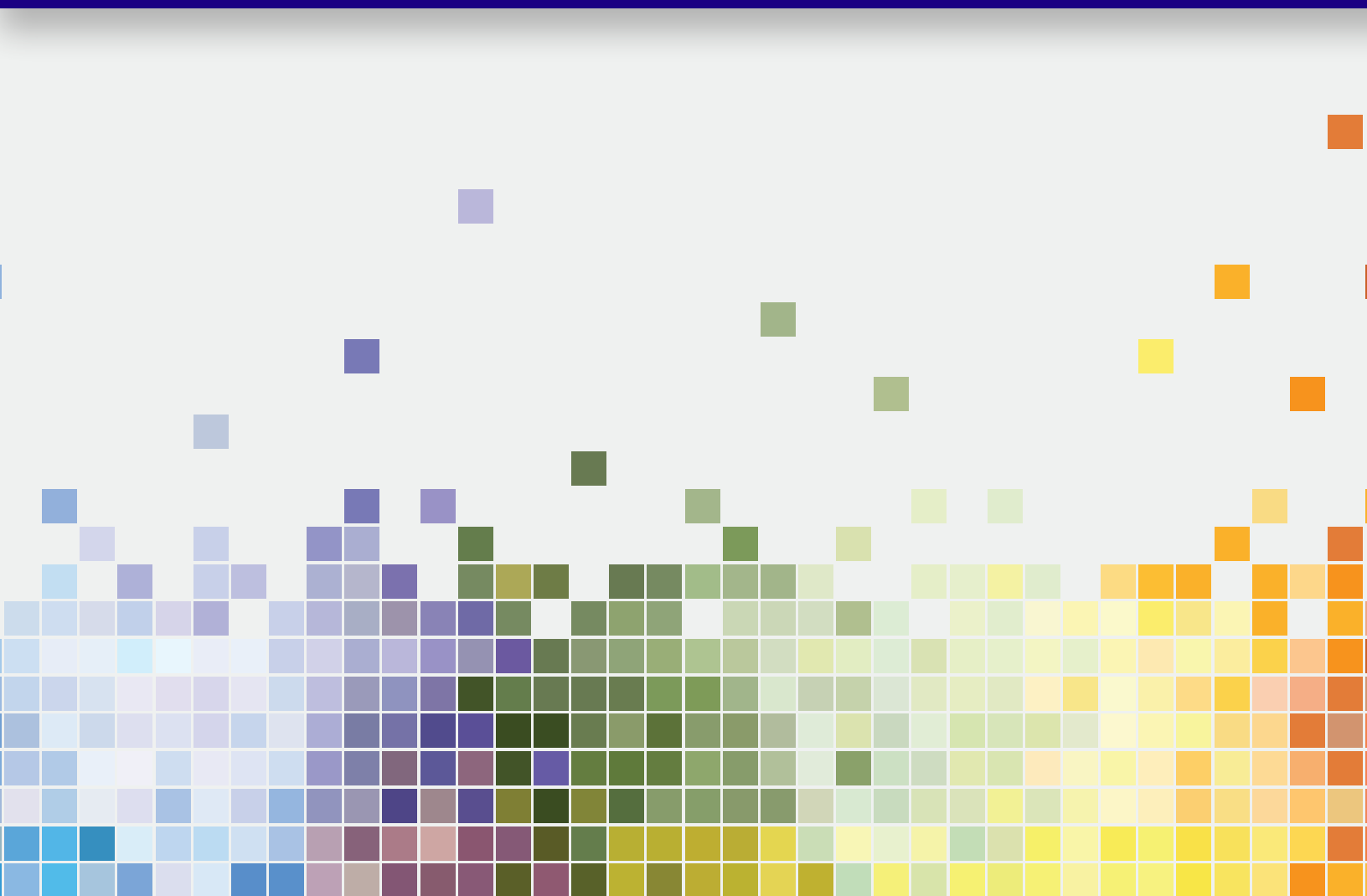
See [Table 208.8](#) on the website for more information.

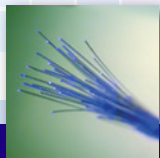


# 209

## Standard Reference Materials for Physical Properties

**X-Ray Diffraction**





## X-Ray Diffraction (powder and solid forms)

SRMs 656, 676a, 674b, 1878b, and 1879b consist of high phase purity materials for use in the quantitative analysis of samples by the internal standard method. SRM 656 consists of 2 silicon nitride powders, one high in a, the other high in b. SRMs 640e, 660c, 675, and 1976b consist of materials with select crystallographic and microstructure properties used in the evaluation of diffraction equipment for the following variables; 1) d-spacing or line position, 2) line or instrument intensity, and 3) instrumental or sample contributions to the shape of reflection profiles. SRM 1976b, a sintered alumina plate, is also certified with respect to lattice parameters as well as 13 relative intensity values from 22° to 155° 2 $\theta$  (Cu K $\alpha$ ). SRM 1990 is certified for lattice parameter. SRM 1994 is certified for mis-orientation of the crystal axis relative to the surface normal.

SRM	Description	Unit of Issue
640e	Line Position and Line Shape Standard for Powder Diffraction (Silicon Powder)	7.5 g
656	Silicon Nitride for Quantitative Analysis by Powder Diffraction	2 x 10 g
660c	Line Position and Line Shape Standard for Powder Diffraction (Lanthanum Hexaboride Powder)	6 g
674b	X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)	10 g
675	Line Position, Mica (XRD)	7.5 g
676a	Alumina Powder for Quantitative Analysis by X-Ray Diffraction	20 g
1878b	Respirable Alpha Quartz (Quantitative X-Ray Powder Diffraction Standard)	5 g
1879b	Respirable Cristobalite	5 g
1976b	Instrument Response Standard for X-Ray Powder Diffraction	disc
1979	Powder Diffraction Line Profile Standard for Crystallite Size Analysis (Nano-Crystalline ZnO Powder)	2 x 3 g
1990	Single Crystal Diffractometer Alignment Standard - Ruby Sphere	3 spheres
1994	Standard Silicon Single Crystal Wafer for Crystalline Orientation	100-mm wafer
1995	Standard Sapphire Single Crystal Wafer for Crystalline Orientation	50-mm wafer
2000	Calibration Standard for High-Resolution X-Ray Diffraction	block
2012	Calibration Standard for High-Resolution X-Ray Diffraction (200 mm Wafer)	wafer
3600	Absolute Intensity Calibration Standard for Small-Angle X-Ray Scattering	coupon

See [Table 209.1](#) on the website for more information.



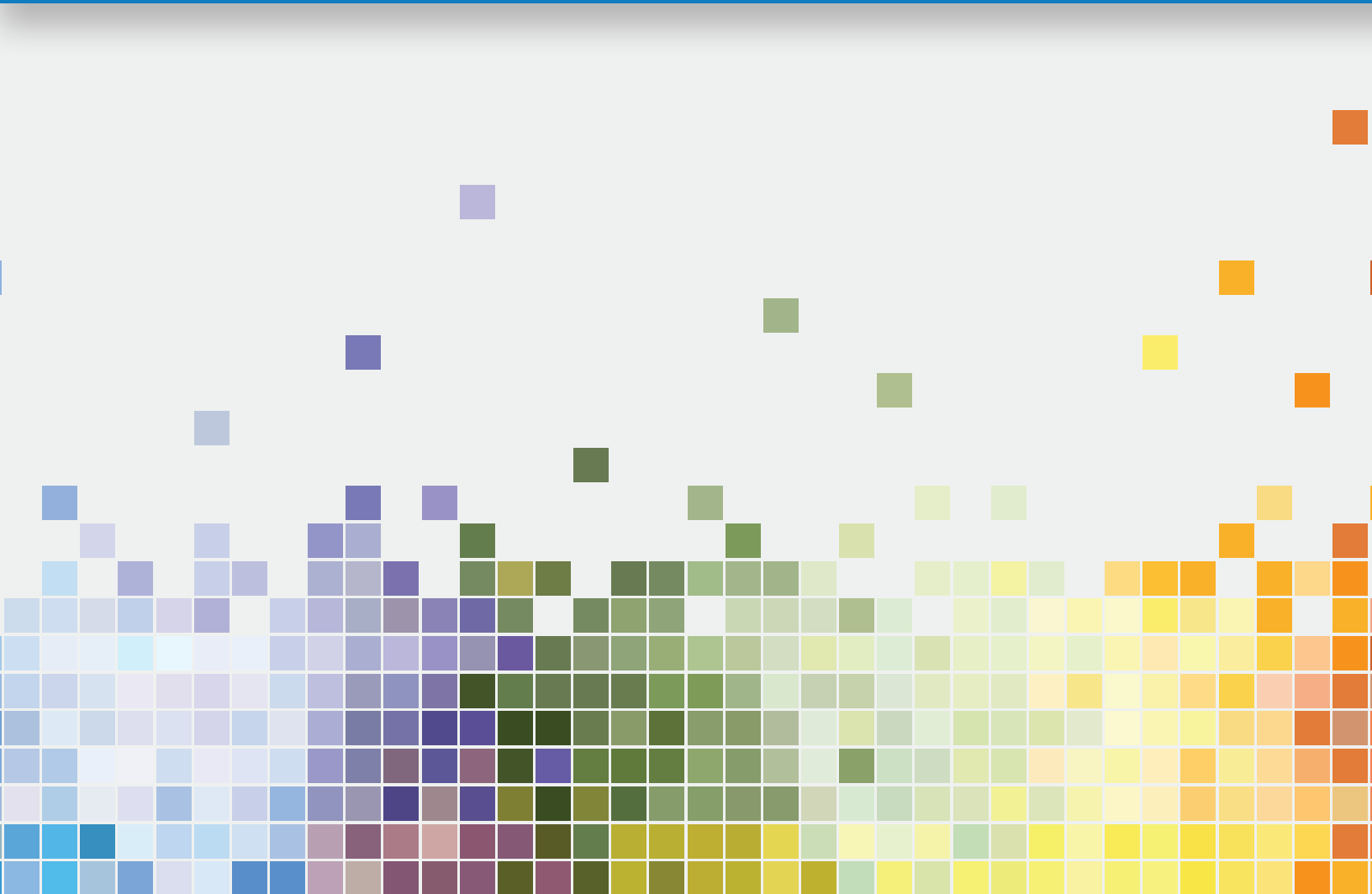


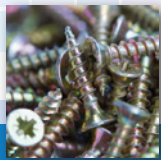


# 301

## Standard Reference Materials for Engineering Materials

Sizing





## Particle Size (powder and solid forms)

These SRMs are for evaluating and calibrating specific types of particle size measuring instruments, including light scattering, electrical zone flow-through counters, optical and scanning electron microscopes, sedimentation systems, and wire cloth sieving devices.

SRMs 1003c, 1004b, 1017b, 1018b and 1019b each consist of soda-lime glass beads covering a particular size distribution (PSD) range. RM 8010 is a three bottle set of different sands (A, C and D), intended for use in sieving only, and covers the sieve size range from 30 mesh to 325 mesh.

SRM 659 consists of equiaxed silicon nitride particles measured using sedimentation. SRM 1978 consists of granular, irregular shaped zirconium oxide particles measured using sedimentation. SRM 1982 consists of spheroidal particles measured using scanning electron microscopy, laser scattering, and sieving.

SRMs 1961 is monodisperse latex particles in a water suspension produced by the National Aeronautics and Space Administration (NASA). SRM 1965 consists of two different groupings of particles mounted on a microscope slide.

RMs 8011, 8012, and 8013 are gold nanoparticles in water.

SRM	Description	Unit of Issue
659	Particle Size Distribution Standard for Sedigraph Calibration	set (5)
1003c	Glass Beads - Particle Size Distribution	28 g
1004b	Glass Beads - Particle Size Distribution	43 g
1017b	Glass Beads - Particle Size Distribution (100 $\mu\text{m}$ to 400 $\mu\text{m}$ diameter range)	70 g
1018b	Glass (Particle Size)	87 g
1019b	Glass (Particle Size)	200 g
1021	Glass ( Particle Size)	4 g
1690	Polystyrene Spheres (1 $\mu\text{m}$ Diameter Particle Size)	5 mL
1691	Polystyrene Spheres (0.3 $\mu\text{m}$ Diameter Particle Size)	5 mL
1961	Polystyrene Spheres (30 $\mu\text{m}$ Diameter Particle Size)	5 mL
1963a	Polystyrene Spheres (100 nm Diameter Particle Size)	5 mL
1964	Polystyrene Spheres (60 nm Diameter Particle Size)	5 mL
1965	Microsphere Slide (10 $\mu\text{m}$ Polystyrene Spheres)	slide

SRM	Description	Unit of Issue
1978	Particles Size Distribution Standard for Gravity Sedimentation	5 g
1982	Zirconia Thermal Spray Powder - Particle Size Distribution	10 g
1984	Thermal Spray Powder - Particle Size Distribution Tungsten Carbide/Cobalt (Acicular)	14 g
1985	Thermal Spray Powder - Particle Size Distribution Tungsten Carbide/Cobalt (Spheroidal)	14 g
8010	Sand for Sand Sieve Analysis	3 x 150 g
8011	Gold Nanoparticles, Nominal 10 nm Diameter	2 x 5 mL
8012	Gold Nanoparticles, Nominal 30 nm Diameter	2 x 5 mL
8013	Gold Nanoparticles, Nominal 60 nm Diameter	2 x 5 mL
8988	Titanium Dioxide Powder - Particle Size Distribution	6 g

See [Table 301.1](#) on the website for more information.





## Cement and Coal Fly Ash Fineness

SRM 46h is only to determine sieve residue according to ASTM C430. Each set consists of 10 sealed vials, each containing approximately 5 g of cement.

SRM 114q is for calibrating the Blaine fineness meter according to the latest issue of ASTM C204, to calibrate the Wagner turbidimeter according to ASTM C115, to determine sieve residue according to ASTM C430, and to verify procedure for particle size distribution by a laser diffraction method (no-standard method available). Each set consists of 20 sealed vials, each containing approximately 5 g of cement.

SRM	Description	Unit of Issue
46h	Portland Cement Fineness Standard	10 x 5 g
114q	Portland Cement Fineness Standard	20 vials
2689	Coal Fly Ash	3 x 10 g
2690	Coal Fly Ash	3 x 10 g
2691	Coal Fly Ash	3 x 10 g

See [Table 301.2](#) on the website for more information.

## Electrophoretic Mobility, E (suspension form)

SRM 1980 is intended for use in the calibration and evaluation of equipment used to measure electrophoretic mobility. It consists of a goethite suspension saturated with phosphate in a sodium perchlorate electrolyte solution.

SRM	Description	Unit of Issue
1980	Positive Electrophoretic (+ $\mu\text{E}$ ) Mobility Standard	500 mg/L

See [Table 301.3](#) on the website for more information.



## Surface Area of Powders and Mercury Porosimetry Standards

These SRMs are intended for calibrating and verifying the performance of instruments used to determine the specific surface area of powders by the Brunauer, Emmett, and Teller (BET) method or instruments that use mercury intrusion to measure the pore size and porosity of porous materials. The surface areas of SRMs 1898, 1900, 2206 and 2207 are based on both multi-point and single point analysis of the BET equation.

SRM	Description	Unit of Issue
1898	Titanium Dioxide Nanomaterial	15 g
1900	Specific Surface Area Standard	4 g
1917	Mercury Porosimetry Standard	10 g
2206	Controlled Pore Glass - BET Specific Surface Area (300 nm)	5 g
2207	Controlled Pore Glass - BET Specific Surface Area (Nominal Pore Diameter 18 nm)	5 g
2696	Silica Fume	70 g

See [Table 301.4](#) on the website for more information.

## Particle Count Materials (powder and suspension forms)

These SRM and RM materials are intended for use in calibrating the response of particle sizing instrumentation, including optical counters, in accordance with National Fluid Power Association (NFPA) and ISO standard methods (NFPA/T2.9.6 R2-1998, ISO/FDIS 11171, ISO/FDIS 12103) for determining particle contamination in oils. SRM 2806b is certified for particle concentration and projected area diameter. It consists of a polydisperse, irregularly-shaped mineral dust suspended in 5606 hydraulic fluid. RMs 8631a and 8632 are mineral test dusts of medium and ultrafine particle size and can be used to prepare suspensions in other types of oils. NOTE: The same lot of medium test dust was used to produce SRM 2806b and RM 8631a, and is a derivative of Arizona Road Dust.

SRM	Description	Unit of Issue
2806b	Medium Test Dust (MTD) in Hydraulic Fluid	2 x 400 mL
8631a	Medium Test Dust (MTD)	20 g
8632	Ultra Fine Test Dust (UFTD)	20 g

See [Table 301.5](#) on the website for more information.



# Please Register Your SRM Online!

Registering will ensure that you will be notified of any technical updates or developments.

[https://www.nist.gov/srm\\_reg](https://www.nist.gov/srm_reg)

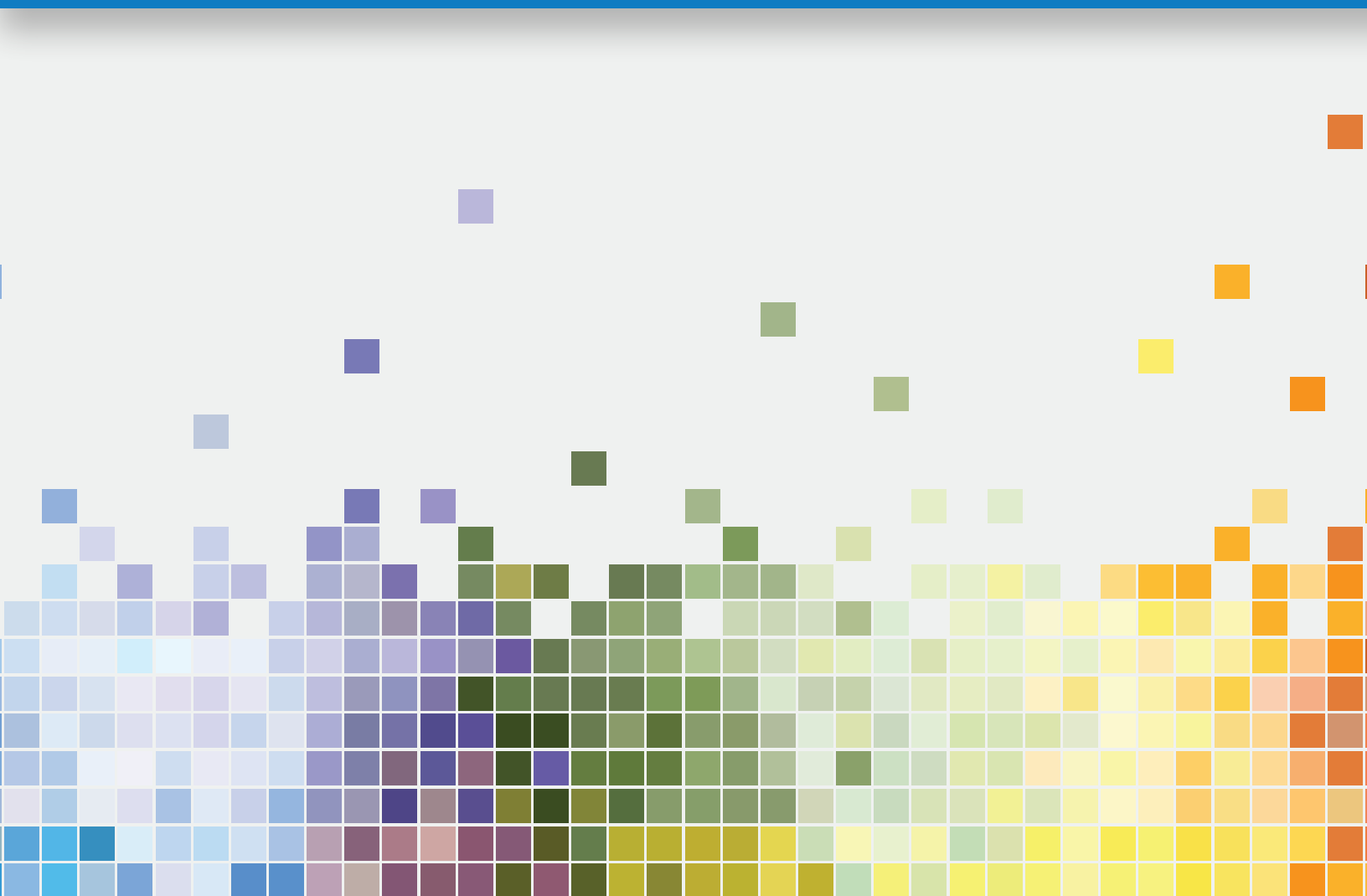


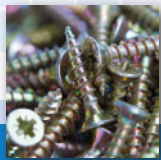


# 302

## Standard Reference Materials for Engineering Materials

**Surface Finish**





## Microindentation Hardness (block form)

These SRMs are for use in calibrating and checking the performance of microhardness testers and may be used in conjunction with ASTM E 384. SRMs 1893 through 1907 are 1.25 cm x 1.25 cm (SRM 2798 is 1.35 cm x 1.35 cm) and were made by electroforming the test metal on AISI 1010 steel substrate. SRMs 2830 and 2831 are intended to meet the needs of the structural, electronic, and biomedical ceramics communities.

SRM	Description	Unit of Issue
1893	Copper Microhardness Test Block (Knoop)	each
1894a	Vickers Microhardness of Copper	each
1895	Nickel Microhardness Test Block (Knoop)	each
1896b	Vickers Microhardness of Nickel	each
1905	Nickel Microhardness Test Block (Knoop)	each
1906	Nickel Microhardness Test Block (Knoop)	each
1907	Nickel Microhardness Test Block (Knoop)	each
1908	Vickers Microhardness of Nickel	each
1909	Vickers Microhardness of Nickel	each
2798a	Vickers Microhardness of Nickel	each
2828	Knoop Microhardness of Steel	each
2829	Vickers Microhardness of Steel	each
2830	Knoop Hardness of Ceramics	each
2831	Vickers Hardness of Ceramics and Hardmetals	each

See [Table 302.1](#) on the website for more information.

## Abrasive Wear (block form)

This SRM is for use in the dry sand/rubber wheel abrasion test per ASTM G 65, Procedure A.

SRM	Description	Unit Size
1857	Tool Steel for Abrasive Wear Standard	2 blocks

See [Table 302.2](#) on the website for more information.

## Surface Roughness (block form)

These SRMs are for calibrating stylus instruments that measure surface roughness. These electroless-nickel coated steel blocks have a sinusoidal roughness profile machined on the top surface.

SRM	Description	Unit of Issue
2073a	Sinusoidal Roughness Specimen	each
2074	Sinusoidal Roughness Specimen	each
2075	Sinusoidal Roughness Specimen	each

See [Table 302.4](#) on the website for more information.

## Rockwell Hardness (block form)

These Standard Reference Materials (SRMs) are transfer standards intended primarily for use in the calibration and verification of the performance of Rockwell hardness equipment using the applicable Rockwell hardness C scale (HRC), Rockwell hardness 15N scale (HR15N), or Rockwell hardness 30N scale (HR30N). Each SRM unit is a steel test block, nominally 64 mm in diameter and 15 mm thick, having a polished test surface described by a micro-engraved circle 52 mm in diameter. Each SRM unit is individually certified and bears a unique serial number on the edge of the block.

SRM	Description	Unit of Issue
2810	Rockwell C Hardness - Low Range	1 block
2811	Rockwell C Hardness - Mid Range	1 block
2812	Rockwell C Scale Hardness - High Range	1 block
2816	Rockwell Hardness 15N Scale - Low Range (Nominal 72 HR15N)	1 block
2817	Rockwell Hardness 15N Scale - Mid Range (Nominal 83 HR15N)	1 block
2818	Rockwell Hardness 15N Scale - High Range (Nominal 91 HR15N)	1 block
2819	Rockwell Hardness 30N Scale - Low Range (Nominal 45 HR30N)	1 block
2820	Rockwell Hardness 30N Scale - Mid Range (Nominal 64 HR30N)	1 block
2821	Rockwell Hardness 30N Scale - High Range (Nominal 79 HR30N)	1 block

See [Table 302.5](#) on the website for more information.

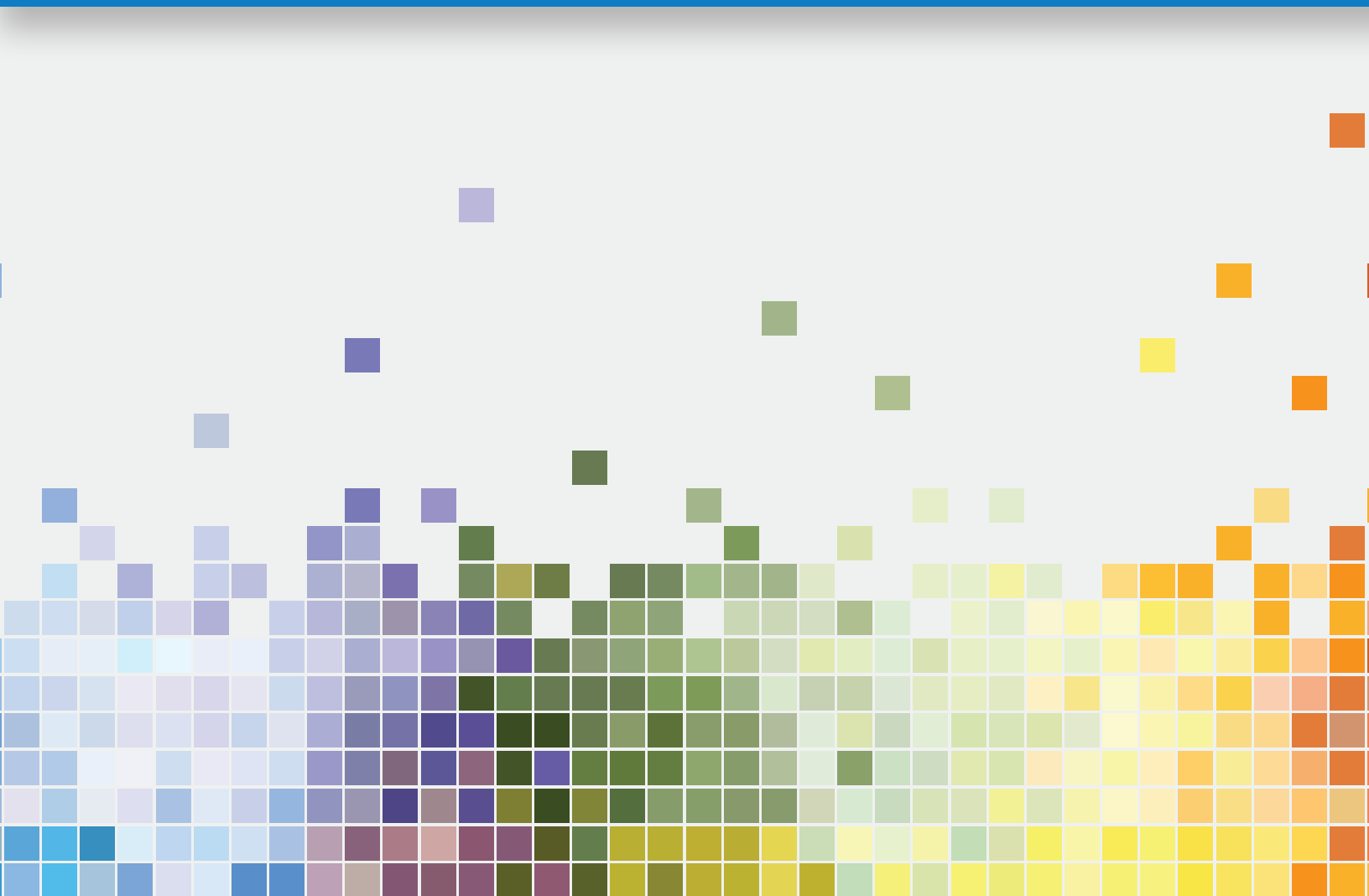


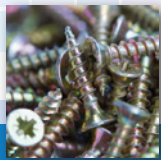


# 305

## Standard Reference Materials for Engineering Materials

**Fire Research**





## Flooring Radiant Panel (sheet form)

This SRM consists of three sheets of kraft paperboard. It is for checking the operation of flooring radiant panel test apparatus used to measure critical radiant flux as per ASTM E 648.

SRM	Description	Unit of Issue
1012	Flooring Radiant Panel	set (3)

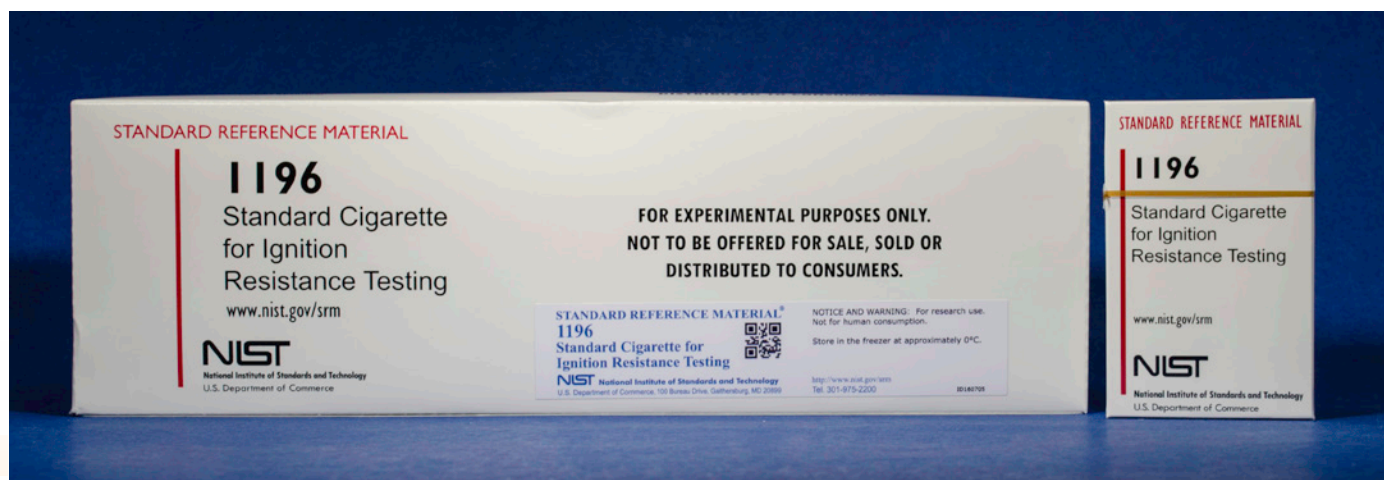
See [Table 305.4](#) on the website for more information.

## Standard Cigarettes for Ignition Strength and Ignition Resistance Testing

SRM 1082 is intended for use by test laboratories to assess and control their testing of cigarette ignition in accordance with ASTM Standard Methods E 2187-04 (or ASTM E 2187-02b). SRM 1196 is intended for use by test laboratories to test mattresses, upholstered furniture and its components, and thermal insulation for resistance to cigarette ignition in accordance with 16 CFR 1632, 16 CFR 1634 (proposed) and 16 CFR 1209.

SRM	Description	Unit of Issue
1082	Cigarette Ignition Strength Standard (200 cigarettes)	1 carton
1196	Standard Cigarette for Ignition Resistance Testing (400 cigarettes)	2 cartons

See [Table 305.5](#) on the website for more information.

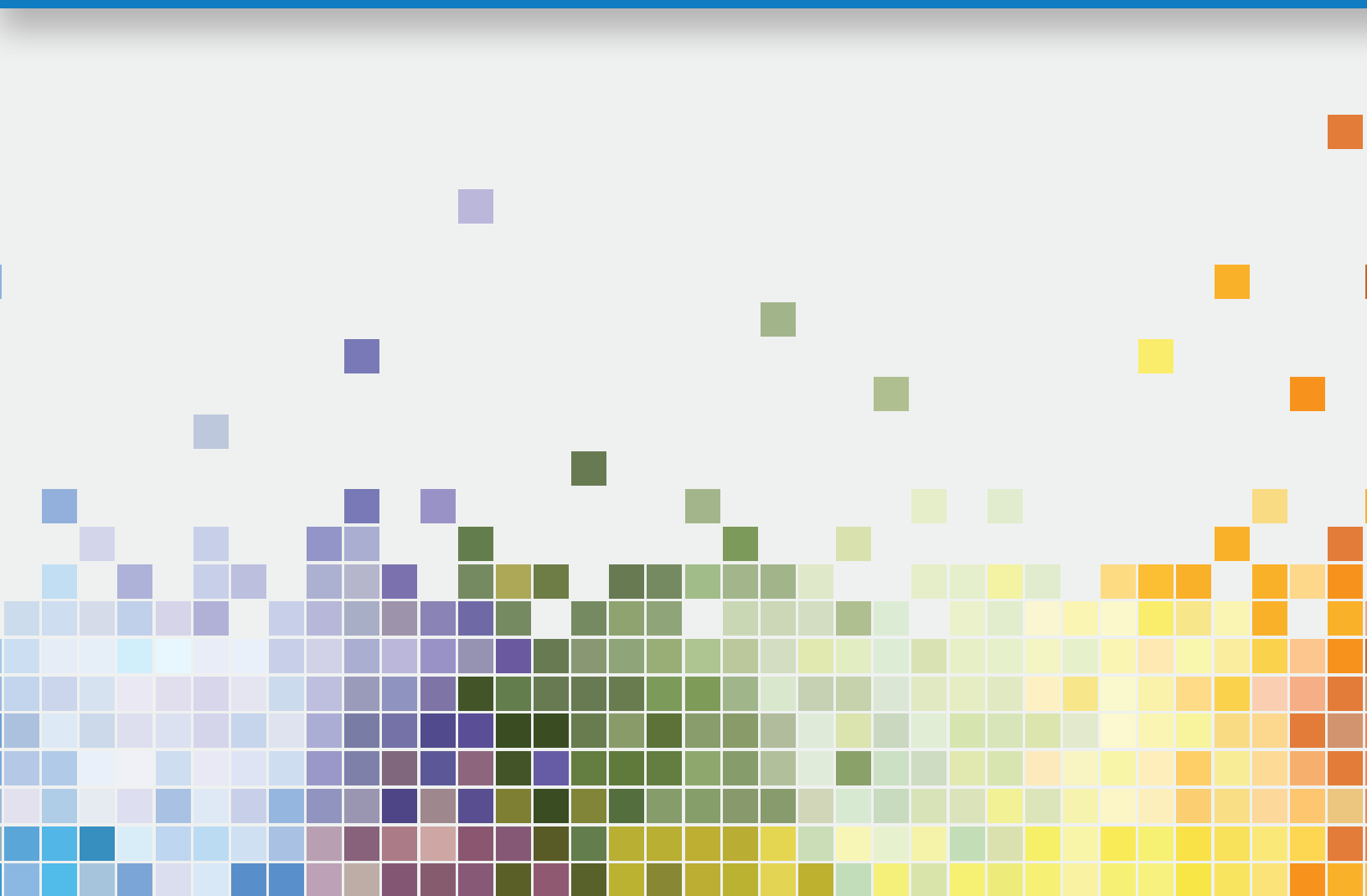




# 308

## Standard Reference Materials for Engineering Materials

**Nanomaterials**







## Nanomaterials (less than or equal to 100 nm)

SRM	Description	Unit of Issue
1898	Titanium Dioxide Nanomaterial	15 g
1963a	Polystyrene Spheres (Nominal 100 nm Diameter)	5 mL
1964	Polystyrene Spheres (Nominal 60 nm Diameter)	5 mL
2483	Single-Wall Carbon Nanotubes (Raw Soot)	250 mg
2484	Multiwall Carbon Nanotubes (Raw Soot)	6 g
8011	Gold Nanoparticles, Nominal 10 nm Diameter	2 x 5 mL
8012	Gold Nanoparticles, Nominal 30 nm Diameter	2 x 5 mL
8013	Gold Nanoparticles, Nominal 60 nm Diameter	2 x 5 mL
8017	Polyvinylpyrrolidone Coated Silver Nanoparticles (Nominal Diameter 75 nm)	5 vials
8027	Silicon Nanoparticles (Nominal Diameter 2 nm)	5 x 1.0 mL
8281	Single-Wall Carbon Nanotubes (Dispersed, Three Length-Resolved Populations)	4 x 2.5 mL

See [Table 308.1](#) on the website for more information.

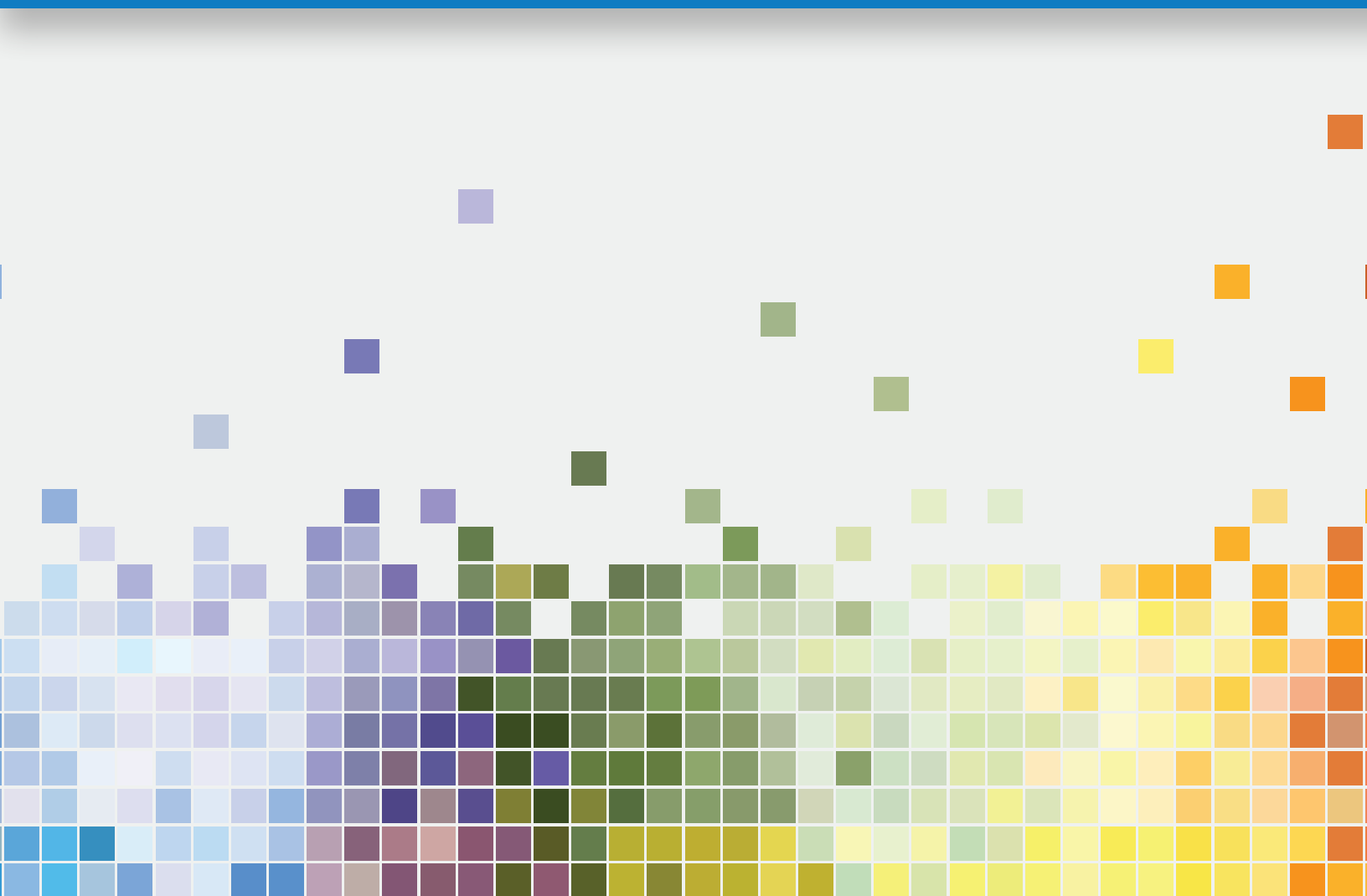


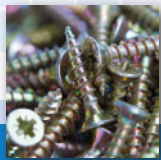


# 309

## Standard Reference Materials for Engineering Materials

**Miscellaneous Performance**





## Impact Standards: Charpy V-Notch Specimens

These SRMs are test specimens intended primarily for the verification of Charpy testing machines. The dimensions of these SRMs comply with the current ASTM Standard E23 and the current ISO 148-1 Standard.

SRMs 2092, 2096, and 2098 are NIST-Verification Charpy V-notch specimens that have a post-test evaluation service and proficiency test data available with them. SRMs 2092 and 2096 are to be tested at  $-40^{\circ}\text{C}$ ; SRM 2098 is to be tested at room temperature ( $21^{\circ}\text{C}$ ). These SRMs should be tested (broken) at the same time, then returned to NIST Boulder for evaluation. An acceptable machine will produce an average value within 1.4 J or 5 % of the certified energy value, whichever is greater.

SRMs 2093 and 2097 are Self-Verification Charpy V-notch specimens that do not have any post-test services available with them. These SRMs provide a lower cost option for the Self-Service user. SRMs 2093 and 2097 are to be tested at  $-40^{\circ}\text{C}$ . These SRMs are not returned to NIST Boulder for evaluation.

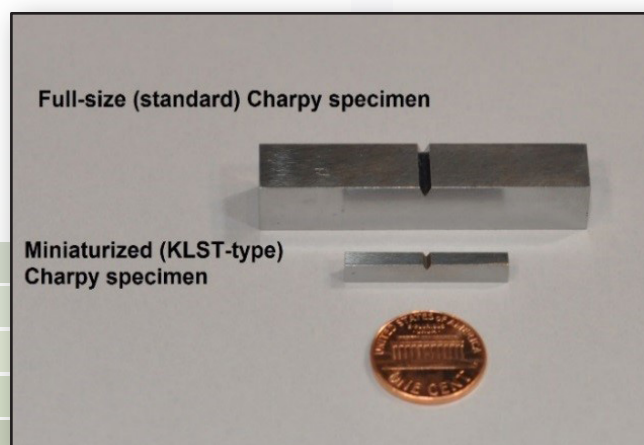
SRMs 2112 and 2113 are NIST-Verification Charpy V-notch specimens that are certified for absorbed energy at  $-40^{\circ}\text{C}$  and room temperature and for maximum force at room temperature. These SRMs provide a means to verify the performance of both the energy and force scales of an instrumented

Charpy impact machine at room temperature ( $21^{\circ}\text{C}$ ). They can also be used to verify just the energy scale of a machine at  $-40^{\circ}\text{C}$ , interchangeably with SRMs 2092 and 2096. An acceptable machine will produce an average value within 1.4 J or 5 % of the certified energy value, whichever is greater. Currently, specific requirements are not available to verify the performance of the force scale for a Charpy test machine.

SRMs 2216, 2218, and 2219 are intended for the verification of maximum force and absorbed energy values measured at room temperature using a small-scale Charpy impact machine, in accordance with the current standards ASTM E2248 or ISO 14556. Each SRM unit consists of a set of three KLST-type specimens needed to perform a single verification.

SRM	Description	Unit of Issue
2092	Low-Energy Charpy V-Notch Impact Specimens (NIST-Verification, 8-mm Striker)	set
2093	Low-Energy Charpy V-Notch Impact Specimens (Self-Verification, 8-mm Striker)	set
2096	High-Energy Charpy V-Notch Impact Specimens (NIST-Verification, 8-mm Striker)	set
2097	High-Energy Charpy V-Notch Impact Specimens (Self-Verification, 8-mm Striker)	set
2098	Super High-Energy Charpy V-Notch Impact Specimen (NIST-Verification)	set
2112	Dynamic Impact Force Verific Specimens (Self-Verification, 8-mm Striker, 24 kN nominal)	set
2113	Dynamic Impact Force Verification Specimens (Self-Verification, 8-mm Striker, 33 kN nominal)	set
2197	Low-Energy Charpy V-Notch Specimens (Self-Verification, 2-mm Striker)	set
2198	High-Energy Charpy V-Notch Specimens (Self-Verification, 2-mm Striker)	set
2216	Miniaturized Low Energy Charpy, V-Notch KLST Impact Specimen	set
2218	Miniaturized Hi Energy Charpy, V-Notch KLST Impact Specimen	set
2219	Miniaturized Super High Energy, Charpy V-Notch KLST Impact Specimen	set

See [Table 309.1](#) on the website for more information.







## Tape Adhesion Testing (sheet form)

This SRM is intended as a uniform source of linerboard for use with ASTM Standards D 2860 Standard Test Method for Adhesion of Pressure-Sensitive Tape to Fiberboard at 90° Angle and Constant Stress, D 3654 Standard Test Method for Holding Power of Pressure-Sensitive Tapes, and D 3889 Standard Method for Adherence to Linerboard of Pressure-Sensitive Tapes at Low Temperature.

SRM	Description	Unit of Issue
1810a	Linerboard	50 each

See [Table 309.4](#) on the website for more information.

## Bleached Kraft Pulps (sheet form)

RM 8495 Northern Softwood Bleached Kraft Pulp and RM 8496 Eucalyptus Hardwood Bleached Kraft Pulp are intended primarily for use in fundamental studies on the physical properties of fibers and paper sheets. The materials selected for these two RMs are bleached dried lap pulp, each from a single lot of a standard commercial production run. The materials were selected because of their differing fiber size, differing papermaking properties, and similarity to commercially available materials.

RMs 8495 and 8496 were developed and prepared with input and support from the Pulp Material Research Committee (PMRC), a subcommittee of the Fundamental Research Committee.

SRM	Description	Unit of Issue
8495	Northern Softwood	10 sheets
8496	Eucalyptus Hardwood	10 sheets

See [Table 309.5](#) on the website for more information.

## Healthcare Equipment Standards

SRM	Description	Unit of Issue
2087	Dimensional Standard for Medical Computed Tomography	each
2088	Density Standard for Medical Computed Tomography	five foam blocks

See [Table 309.10](#) on the website for more information.

## Fracture Toughness of Ceramics

SRMs 2100a and 2100b Fracture Toughness of Ceramic are intended for verification of fracture toughness testing procedures and may be used in conjunction with ASTM Standard Test Method ASTM C1421-99 "Standard Test Methods for Fracture Toughness of Advanced Ceramics."

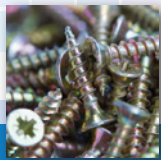
A unit of SRMs 2100a or 2100b consists of five hot-pressed silicon nitride flexure specimens. Each specimen is 3 mm x 4 mm x (45 to 47) mm. The SRM may be used with any fracture toughness test method, but is optimized for beam bending test configurations.

SRM	Description	Unit of Issue
2100a	Fracture Toughness of Ceramic	5 bars
2100b	Fracture Toughness of Ceramic	5 bars

See [Table 309.7](#) on the website for more information.



SRM 2087 Dimensional Standard for Medical Computed Topography



## Magnetic Moment

These Standard Reference Materials are intended for use in the calibration of magnetometers (such as vibrating sample magnetometers) that are used in the measurement of magnetic properties of materials.

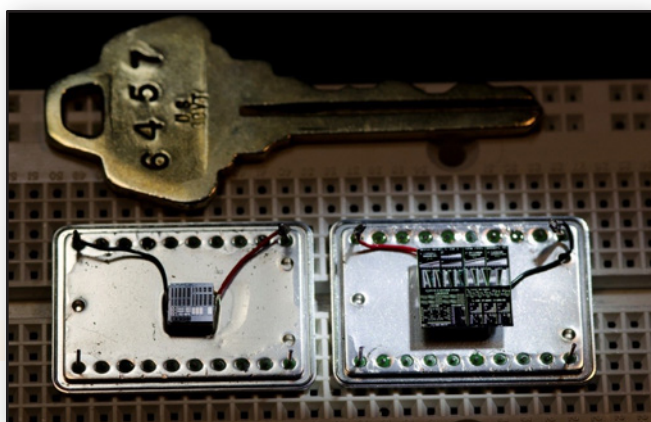
SRM	Description	Unit of Issue
762	Magnetic Moment Standard - Nickel Disk	6 mm
764a	Magnetic Susceptibility Standard - Platinum Cylinder	3 mm x 3.42 mm
772a	Magnetic Moment Standard - Nickel Sphere	each

See [Table 309.8](#) on the website for more information.

## Standard Bullet and Cartridge Case

SRM	Description	Unit of Issue
2460	Standard Bullet	each
2461	Standard Cartridge Case	each

See [Table 309.11](#) on the website for more information.



RM 8096 - CMOS MEMS 5-in-1 Test Chip

## Microelectromechanical Systems (MEMS)

The MEMS 5-in-1 RM is a single test chip with test structures for the measurement of dimensional and material properties with the use of five documentary standard test methods (from which its name is derived). To validate the use of the test methods, companies can compare their measurements with NIST measurements on the same test structures. The MEMS Calculator (<https://srdata.nist.gov/gateway/> with the keyword “MEMS Calculator”) can be used for the calculations.

The five test methods are for measuring Young’s modulus, residual strain, strain gradient, step height, and in-plane length. Eight properties are reported; the five mentioned plus residual stress, stress gradient, and beam thickness. Residual stress and stress gradient are obtained from calculations given in the Young’s modulus test method. Beam thickness is obtained using the step height test method (as described in NIST SP 260-177). Therefore, five test methods are used to obtain the reported eight properties.

The instruments used for the MEMS 5-in-1 measurements are:

- an optical vibrometer, stroboscopic interferometer, or comparable instrument for the measurement of Young’s modulus, and
- an interferometric microscope and/or stylus profilometer or comparable instrument(s) for the measurement of residual strain, strain gradient, step height, in-plane length, and thickness.

There are two types of chips (RM 8096 and RM 8097). RM 8096 was fabricated on a multi-user 1.5µm complementary metal oxide semiconductor (CMOS) process followed by a bulk-micromachining etch. The supply of RM 8096 is limited.

RM 8097 was fabricated using a polysilicon multi user surface micromachining MEMS process with a backside etch.

Additional information is available on the website.

Email [mems-support@nist.gov](mailto:mems-support@nist.gov) for further assistance.

SRM	Description	Unit of Issue
8096	CMOS MEMS 5-in-1 Test Chip	1 computer chip
8097	MEMS 5-in-1 Test Chip	1 computer chip

See [Table 309.12](#) on the website for more information.

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4l	Cast Iron.....	5	129c	LA Steel, High Sulfur (SAE 112).....	2
5m	Cast Iron.....	5	131h	Refined Cast Iron .....	2
6g	Cast Iron.....	5	132b	Tool Steel (AISI M2).....	4
8k	Bessemer Steel (Simulated), 0.1 % Carbon.....	2	133b	Chromium-Molybdenum Steel.....	4
12h	Basic Open-Hearth Steel, 0.4 % Carbon.....	2	134a	Molybdenum-Tungsten-Chromium-Vanadium Steel .....	4
13g	0.6% Carbon Steel .....	2	136f	Potassium Dichromate, (Oxidimetric Standard).....	14
14g	Carbon Steel (AISI 1078) .....	2	139b	Chromium-Nickel-Molybdenum Steel.....	2
16f	Basic Open- Hearth Steel, 1 % carbon .....	2	141d	Acetanilide.....	14
17f	Sucrose Optical Rotation .....	14,66	143d	Cystine.....	14
18	Cr-10 Ni Steel (AISI 304L) (powder form).....	4	148	Nicotinic Acid .....	14
19h	Basic Electric Steel, 0.2 % Carbon .....	2	152a	Basic Open-Hearth Steel 0.5 % Carbon (Tin Bearing) .....	2
20g	AISI 1045 Steel .....	2	154c	Titanium Dioxide.....	14, 46
23c	Stainless Steel, Cr-Ni-Nb (AISI 348).....	4	155	Chromium-Tungsten Steel .....	2
25d	Manganese Ore.....	46	158a	Silicon Bronze.....	8
30f	Cr-V Steel (SAE 6150).....	2	160b	Stainless Steel (Cr 18-Ni 12-Mo 2) (AISI 316).....	4
32e	Nickel-Chromium Steel (SAE 3140) .....	2	163	Chromium Steel .....	2
33e	Nickel Steel.....	2	165a	Glass Sand .....	46, 50
36b	Chromim-Molybdenum Steel .....	2	166c	Stainless Steel, Low-Carbon (AISI 316L).....	4
39j	Benzoic Acid (Calorimetric Standard) .....	62	173c	Titanium Alloy (6Al-4V).....	10
45d	Copper Secondary Freezing Point.....	63	178	0.4C Basic Oxygen Furnace Steel.....	2
46h	Portland Cement Fineness Standard.....	83	179	LA Steel, High Silicon.....	2
49e	Lead Secondary Freezing Point Standard.....	63	180	Fluorspar, High Grade.....	46
50c	Tungsten-Chromium-Vanadium Steel.....	4	181	Lithium Ore (Spodumene).....	46
53e	Lead-Base Bearing Metal (84Pb-10Sb-6Sn).....	9	182	Lithium Ore (Petalite) .....	46
54d	Bearing Metal (Tin Base).....	10	183	Lithium Ore (Lepidolite) .....	46
57b	Silicon Metal.....	4	185i	Potassium Hydrogen Phthalate .....	58
58a	Ferrosilicon (73 % Si Regular Grade).....	4	186g	Disodium Hydrogen Phosphate (186-II-g)	
59a	Ferrosilicon .....	4	187e	Sodium Tetraborate (Borax), pH.....	58
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72g	Low Alloy Steel (AISI 4130) .....	2	194a	Ammonium Dihydrogen Phosphate .....	43
76a	Burnt Refractory (Al <sub>2</sub> O <sub>3</sub> -40%) .....	46	195	Ferrosilicon (75 % Si-HP Grade).....	4
77a	Burnt Refractory (Al <sub>2</sub> O <sub>3</sub> -60%) .....	46	196	Ferrochromium, (Low-Carbon) .....	4
78a	Burnt Refractory (Al <sub>2</sub> O <sub>3</sub> -70%) .....	46	198	Silica Brick .....	46
79a	Fluorspar .....	46	199	Silica Brick .....	46
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81a	Glass Sand.....	46, 50	211d	Toluene Liquid Density - Extended Range.....	78
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84L	Potassium Hydrogen Phthalate.....	14	278	Obsidian Rock.....	46
87a	Silicon-Aluminum Alloy.....	8	291	Cr-Mo Steel (ASTM A-213) .....	2
88b	Dolomitic Limestone.....	46	293	Cr-Ni-Mo (AISI 8620).....	2
89	Glass, Lead Barium.....	50	330a	Copper Ore Mill Heads.....	46
90	Ferrophosphorus.....	4	331a	Copper Ore Mill Tails.....	46
92	Soda-Lime Glass (Low Boron).....	50	333a	Molybdenum Sulfide Concentrate.....	46
93a	Borosilicate Glass.....	50	334	Gray Cast Iron .....	5
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95	1-Nitropyrene in Methylene Chloride .....	38	341	Ductile Cast Iron.....	5
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98b	Plastic Clay.....	46	343a	Stainless Steel (AISI 431) .....	4
99b	Soda Feldspar .....	46	344	15 Chromium-7 Nickel Steel (Mo Precipitation Hardening).....	3
100b	Manganese Steel.....	2	345b	Fe-Cr-Ni Alloy UNS J92180 (chip form).....	3
101g	Stainless Steel (AISI 304L) (powder form).....	4	346a	Valve Steel .....	3
107c	Cast Iron (Ni-Cr-Mo).....	5	349a	Waspaloy .....	9
114q	Portland Cement Fineness Standard.....	83	350c	Benzoic Acid (Acidimetric).....	14
115a	Copper-Nickel-Chromium Cast Iron .....	5	351a	Sodium Carbonate.....	14
120c	Phosphate Rock (Florida) .....	43, 46			
122i	Cast Iron.....	5			
123c	Stainless Steel, Cr-Ni-Nb (AISI 348).....	4			
125b	LA Steel, High Silicon.....	2			
126c	High-Nickel Steel (36 % Ni) .....	3			



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360b	Zirconium (Sn-Fe-Cr) Alloy	10	663	Chromium-Vanadium Steel (Modified)	3
361	AISI 4340 Steel	2	665	Electrolytic Iron	3
363	Chromium-Vanadium Steel (Modified)	2	670	Rutile Ore	46
364	LA Steel, High C (Modified)	2	674b	X-diffraction Intensity Set	80
368	Carbon Steel (AISI 1211)	2	675	Line Position, Mica (XRD)	80
399	Unalloyed Copper - Cu VI	9	676a	Alumina Powder for Quantitative Analysis by X-ray Diffraction	80
400	Unalloyed Copper - Cu VII	9	679	Brick Clay	46
423	Molybdenum Oxide Concentrate	46	682	High-Purity Zinc	14
454	Unalloyed Copper XI (chips)	9	683	Zinc, Metal	14
457	Unalloyed Copper IV (solid)	9	685r	High Purity Gold (rod)	14
458	Beryllium-Copper (17510)	8	688	Basalt Rock	46
459	Beryllium-Copper (17200)	8	689	Ferrochromium Silicon	4
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494	Unalloyed Copper I (solid)	9	694	Phosphate Rock, Western	43,46
495	Unalloyed Copper II (solid)	9	695	Trace Elements in Multi-Nutrient Fertilizer	43
498	Unalloyed Copper V (solid)	9	696	Bauxite, Surinam	46
499	Unalloyed Copper VI (solid)	9	697	Bauxite, Dominican	46
500	Unalloyed Copper - Cu VII	9	698	Bauxite, Jamaican	46
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616	Trace Elements in Glass	50	728	Intermediate-Purity Zinc (pin)	14
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620	Soda Lime, Flat	50	731L2	Borosilicate Glass - Thermal Expansion	63
622	Soda-Lime-Silica Glass	78	731L3	Borosilicate Glass - Thermal Expansion	63
624	Lead-Silica Glass for dc Volume Resistivity	78	740a	Zinc Freezing Point Standard 419.527 °C	62
625	Spectrographic Zinc-Base Die-Casting Alloy A	10	741a	Tin Freezing-Point Standard	62
626	Spectrographic Zinc-Base Die-Casting Alloy B	10	742	Aluminum Oxide Pyrometric Standard	63
627	Spectrographic Zinc-Base Die-Casting Alloy C	10	762	Magnetic Moment Standard - Nickel Disk	94
628	Spectrographic Zinc-Base Die-Casting Alloy D	10	764a	Magnetic Susceptibility Standard - Platinum Cylinder	94
629	Spectrographic Zinc-Base Die-Casting Alloy E	10	772a	Magnetic Moment Standard - Nickel Sphere	94
630	Spectrographic Zinc-Base Die-Casting Alloy F	10	781D2	Molybdenum - Heat Capacity	62
631	Spectrographic Zinc Spelter (Modified)	10	853a	Aluminum Alloy 3004	8
633a	Portland Cement	52	854a	Aluminum Alloy 5182	8
634a	Portland Cement	52	855a	Aluminum Casting Alloy 356	8
635a	Portland Cement (Blended with Slag)	52	856a	Aluminum Casting Alloy 380	8
640e	Shape Standard for Powder Diffraction (Silicon Powder)	80	858	Aluminum Alloy 6011	8
641	Spectroscopic Titanium-Base Standards Titanium Alloy, 8 Mn (A)	10	861	Nickel-based Superalloy PWA 1484 (chip form)	9
642	Spectroscopic Titanium-Base Standards Titanium Alloy, 8 Mn (B)	10	862	High-Temperature Alloy L 605	3,8
643	Spectroscopic Titanium-Base Standards Titanium Alloy, 8 Mn (C)	10	864	Inconel 600	9
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648	Titanium-Base Alloy (5Al-2Sn-2Zr-4Cr-4Mo)	10	866	Incoloy® 800	3
649	Titanium-Base Alloy (15V-3Al-3Cr-3Sn)	10	867	Ni-Fe-Cr Alloy UNS N08825 (chip form)	3
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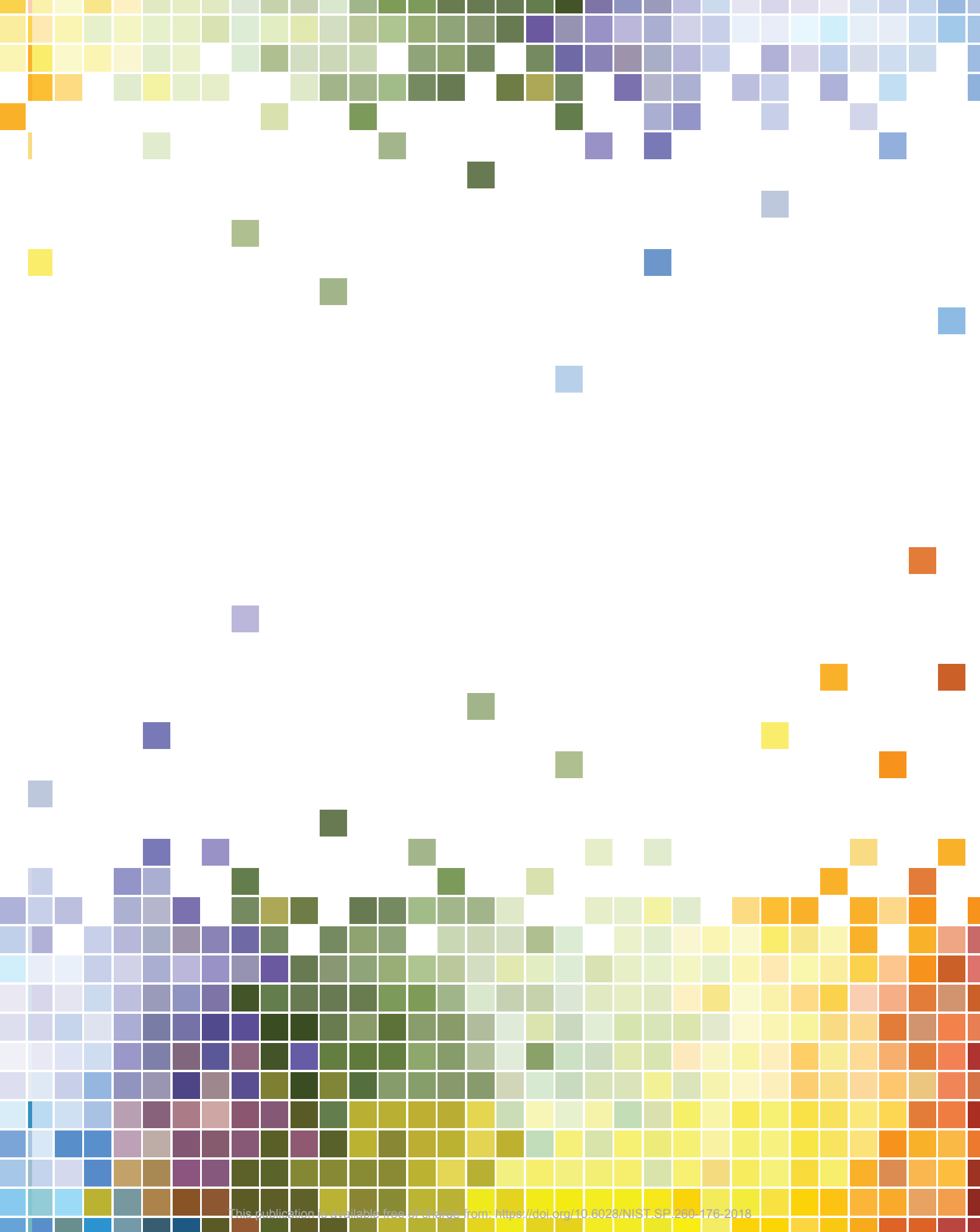


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