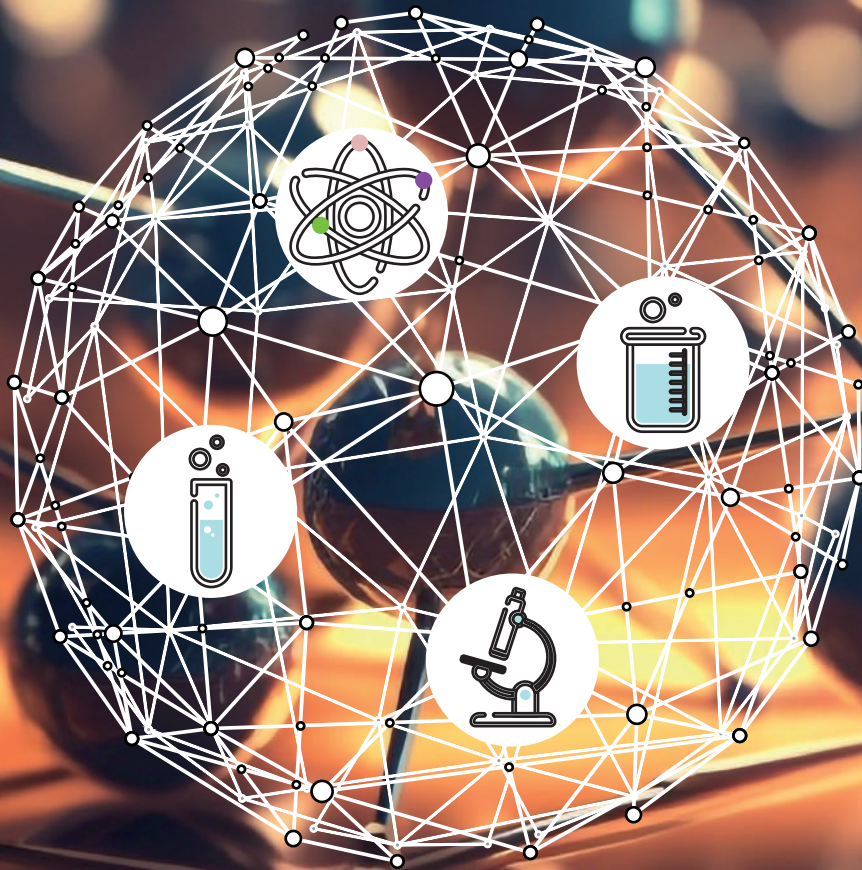


# 인증표준물질

Certified Reference Materials





## 중금속분석을 위한 시료전처리장치와 인증표준물질등 소모품 전문기업!



(주) 오디랩은 2008년 8월에 설립된 회사로 중금속분석에 사용되는 흑연블럭 산 분해장비인 에코프리 I, II, III 시리즈와 산 세척장치, 고순도 산 제조 장치, 유리분주기, ICP/ICP MS 소모품, 인증표준물질(CRM), 숙련도 평가물질 (PT) 등 을 제조, 수입판매하고 있습니다.

(주) 오디랩에서 제조 판매하는 흑연블럭 산 분해장비는 열선 가열판이나 마이크로웨이브의 단점을 보완한 제품으로 국내를 비롯하여 세계 7개국에 특허를 획득하였고 현재 해외로도 수출 중 에 있습니다.

또한 실험실에서 분석 데이터의 신뢰성확보를 위한 인증표준물질(CRM)과 표준물질(RM), 국제숙련도 물질을 전세계에서 수입하여 판매하고 있습니다. 인증표준물질은 고객이 찾으시는 제품을 탐색하여 드리고 있으며, 가장 근접한 제품으로 추천드리고 있습니다.

특히 유럽환경규제인 RoHS에 대응한 IEC62321시험법에 나오는 인증표준 물질을 국내 시험평가기관이나 국가기관에 공급하고 있으며, 환경부에서 실시하는 정도관리에 대응하여 LGC사에서 제공하는 환경관련 숙련도 물질을 공급하고 있습니다.

**저희 (주) 오디랩은 화학실험실의 동반자로서  
분석의 재현성과 정확성, 신뢰성 확보를 위해  
언제나 고객의 노력과 함께 하겠습니다**



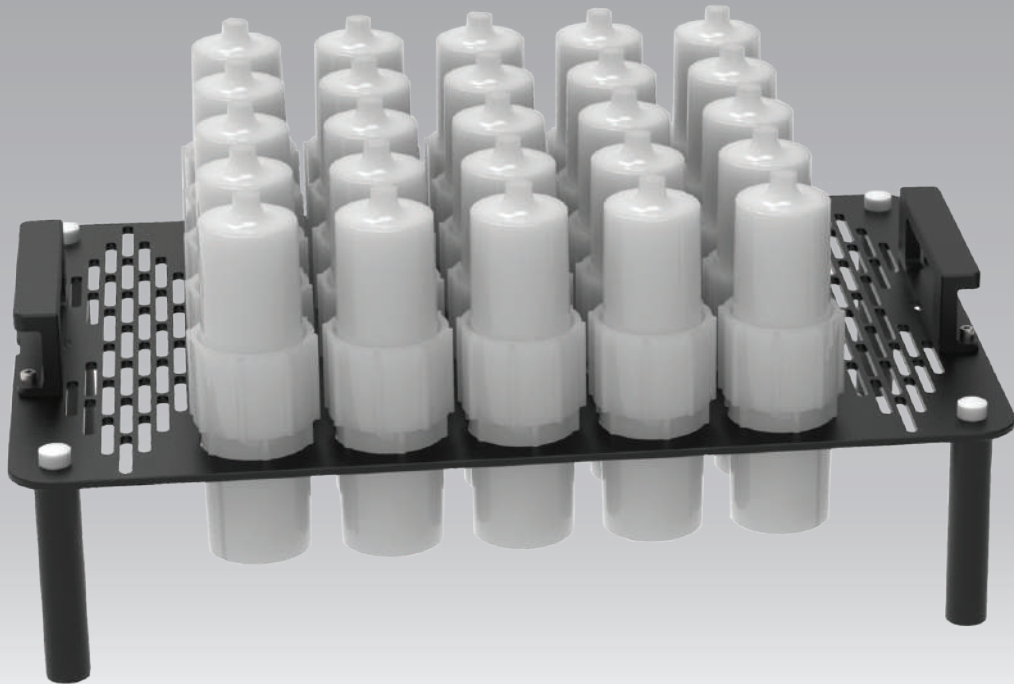
**ODLAB**

자동 산분해장비

**ADS25**



견적문의



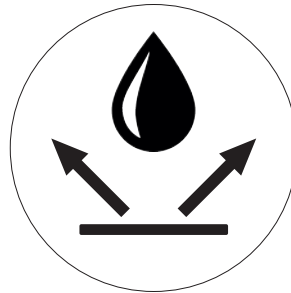
#### 경량화 & 벤틸레이션

경량화 & 벤틸레이션 -



#### 산순환 포집분해용기

산순환 포집분해용기 -



#### 오염방지&내구성

오염방지&내구성 -



#### 앱 연동 조작

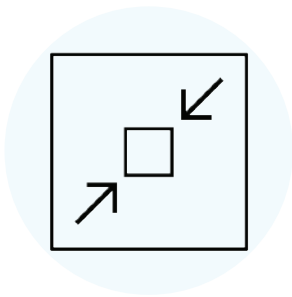
앱 연동 조작 -

이동 및 보관을 위해 플레이트를 타공디자인으로 경량화를 하였습니다 또한 타공을 통하여 원활하게 열기의 순환이 이루어 집니다.

좌우에 있는 리프트 장치로 산 순환 포집분해 용기 내부의 산을 가열 / 냉각 시켜서 사이펀 현상에 의해 리사이클 시켜 시료를 분해할 수 있도록 디자인 하였습니다.

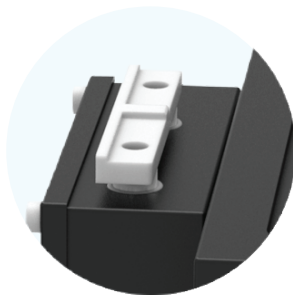
SUS 재질사용 및 테프론 특수코팅을 하여 표면이 쉽게 오염되지 않도록 제작하였습니다. 또한 상부 가열부와 하부 전자제어부는 서로 격리, 밀봉되어 열 또는 산 증기로 인하여 전자제어장치가 손상되지않도록 되어있습니다.

20 Step 으로 가열 / 냉각 으로 분해조건을 프로그램화 할 수 있으며, 앱을 사용하여 조절가능합니다.



#### 컴팩트한 사이즈

컴팩트한 사이즈 -



#### 오토메틱 리프팅

오토메틱 리프팅 -

메뉴얼 및 프로그래밍 기능으로 반복적인 가열 / 냉각을 할 수 있도록 리프팅 기능이 있습니다.



#### 균일한 온도

균일한 온도 -

흑연 소재를 사용하여 균일한 온도를 제공하고 ( $\pm 1^{\circ}\text{C}$  온도편차를 갖는다) 제어는  $0.2^{\circ}\text{C}$  로 제어된다.



#### 수동 승강버튼

수동 승강버튼 -

리프트 장치를 수동버튼을 사용하여 상부 랙(Rack)을 상하로 움직여 사용자가 원할 시 용기의 상태를 언제든지 확인 할 수 있습니다.



**GLASS EXPANSION**  
Quality By Design

# ICP-OES / ICP-MS

모든 메이커 (애질런트, 씨모, 퍼킨..etc) 전제품



견적문의

# **Rocks Metal Ceramic Glass Grass Minerals**

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>BAM-S003a</b>	<b>Silicon Carbide Powder (green micro F 800)</b> It is a silicon carbide powder (type green micro F800). The material is supplied in glass bottles containing 50 g each. It is based on the same batch of candidate material as BAM-S003. The mass fraction of the element O differs slightly from the original material. Therefore this element is given only for information with a higher uncertainty.  Mass fraction in mg/kg Al ..... 372      Mn ..... 1.44 B ..... 63      Na ..... 17.7 Cr ..... 3.5      Ni ..... 32.9 Cu ..... 1.5      Ti ..... 79 Fe ..... 149      V ..... 41 Mg ..... 6.3      Zr ..... 25.2 Free Carbon ..... 493	50 g
<b>BAM-S008</b>	<b>Silicon Carbide Powder (transparent 200/F)</b> It consists of silicon carbide powder (type transparent 200/F). The material is supplied in glass bottles containing 50 g each.  Certified Values - Mass fraction Aluminium ..... 47 mg/kg      Sodium ..... 0.17 mg/kg Boron ..... 3.0 mg/kg      Nickel ..... 0.9 mg/kg Calcium ..... 0.25 mg/kg      Titanium ..... 67 mg/kg Chromium ..... 0.16 mg/kg      Vanadium ..... 275 mg/kg Copper ..... 0.10 mg/kg      Zirconium ..... 4.4 mg/kg Iron ..... 4.8 mg/kg      Nitrogen ..... 18 mg/kg Magnesium ..... 0.07 mg/kg      Oxygen ..... 146 mg/kg Manganese ..... 0.05 mg/kg      Carbon total ..... 29.9 % Carbonfree ..... 0.045 %  Certified Values - Indicative Values Silicon dioxide ..... < 0.01 mg/kg      Silicon free ..... < 0.03 mg/kg	50 g
<b>BAM-S011</b>	<b>Niobium pentoxide powder</b> It consists of niobium pentoxide powder. The material is supplied in polyethylene bottles containing 50 g each.  Certified Values - Mass fraction Fluorine ..... 128 mg/kg  Indicative values - Mass fraction Aluminium ..... 0.29 mg/kg      Tantalum ..... 8 mg/kg Chromium ..... 0.031 mg/kg      Molybdenum ..... <0.05 mg/kg Copper ..... 0.040 mg/kg      Nickel ..... <0.3 mg/kg Iron ..... 0.26 mg/kg	50 g
<b>BAM-S012</b>	<b>Titanium Diboride Powder</b> It consists of a titanium diboride powder. The material is supplied in glass bottles containing 50 g each. Additionally, the remaining volume of the bottle is filled with argon.  Indicative values - Mass fraction Ti ..... 68.3 %      Al ..... 12.0 mg/kg B ..... 30.71 %      Ca ..... 44 mg/kg B <sub>2</sub> O <sub>3</sub> ..... 0.359 %      Cr ..... 97 mg/kg	50 g



## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Fe .....	640 mg/kg
	Mg .....	1.6 mg/kg
	Mn .....	3.8 mg/kg
	Mo .....	11.7 mg/kg
	Ni .....	23.5 mg/kg
	V .....	10.2 mg/kg
	Zr .....	121 mg/kg
Informative Values		
	C .....	0.169 %
	N .....	0.120 %
	O .....	0.480 %
	R <sub>acid</sub> .....	0.22 %
	Si .....	11 mg/kg
	Na .....	< 10 mg/kg
	Nb .....	1700 mg/kg
	S .....	2 mg/kg
	W .....	114 mg/kg

### ERM-ED102 Boron Carbide Powder 100 g

It consists of a boron carbide powder (type 305F422).  
 The material is supplied in glass bottles containing 100 g each.  
 The reference material is intended for use in the calibration of analytical instruments or to validate or verify analytical methods to be used for the determination of the certified parameters in boron carbide.

Certified value / Uncertainty - Mass fraction in mg/kg

Aluminium .....	157 ± 5	Manganese .....	10.4 ± 0.5
Calcium .....	97 ± 8	Sodium .....	6.3 ± 0.9
Cobalt .....	0.39 ± 0.09	Nickel .....	8.0 ± 1.6
Chromium .....	5.6 ± 1.2	Silicon .....	268 ± 22
Copper .....	2.2 ± 0.4	Titanium .....	96 ± 5
Iron .....	686 ± 22	Zirconium .....	48.9 ± 2.3

Certified value / Uncertainty - Mass fraction in %

Total Carbon .....	21.01 ± 0.28	Total Boron .....	78.47 ± 0.31
Oxygen .....	0.10 ± 0.04	Soluble Boron .....	0.116 ± 0.013
Nitrogen .....	0.209 ± 0.026	Boron Oxide .....	0.075 ± 0.023

Certified value / Uncertainty - Isotopic abundance in %

<sup>10</sup> Boron .....	19.907 ± 0.014
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### ERM-ED103 Boron Nitride Powder 50 g

Certified value - Mass fraction in mg/kg

Aluminium .....	7.0	Magnesium .....	56
Calcium .....	273	Sodium .....	12.3
Chromium .....	4.7	Silicon .....	17
Iron .....	15.0	Titanium .....	4.91

Certified value - Mass fraction in %

Oxygen .....	0.68	Total Boron .....	43.5
Nitrogen .....	55.6	Adherent Boron oxide .....	0.070

### ERM-ED105 Boron Nitride Powder 47 g

It consists of an yttrium stabilized zirconium oxide powder.  
 The material is supplied in glass bottles containing 47 g each.

Certified value - Mass fraction in mg/kg

Aluminium .....	660	Silicon .....	195
Calcium .....	242	Thorium .....	112
Iron .....	95	Titanium .....	497
Magnesium .....	12.9	Uranium .....	292

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Certified value - Mass fraction in %	
	Hafnium ..... 1.535	Yttrium ..... 6.11
<b>BAM-S002</b>	<b>Tungsten metal powder</b>	100 g
	Certified Values - Mass fraction in mg/kg	
	Al ..... 29.4	Mg ..... 38.8
	Ca ..... 46	Mn ..... 16.7
	Co ..... 45	Mo ..... 59
	Cr ..... 47.0	Na ..... 41
	Cu ..... 28.4	Ni ..... 29
	Fe ..... 53	Si ..... 106
	K ..... 40.0	Sn ..... 4
<b>BAM-S009</b>	<b>Certified Reference Material</b>	40 g
	It consists of a medium purity graphite powder.	
	The material is supplied in polypropylene bottles containing 40 g each.	
	Certified Values - Mass fraction in mg/kg	
	Al ..... 0.27	Mo ..... 0.20
	B ..... 0.83	Na ..... 0.32
	Ba ..... 0.80	Ni ..... 5.6
	Be ..... 0.00050	P ..... 0.26
	Ca ..... 5.1	Pb ..... 0.052
	Co ..... 0.143	S ..... 10.7
	Cr ..... 1.39	Si ..... 41
	Cu ..... 0.067	Sr ..... 0.32
	Fe ..... 28	Ti ..... 8.6
	K ..... 1.04	V ..... 1.30
	Li ..... 0.022	W ..... 3.0
	Mg ..... 0.135	Y ..... 0.049
	Mn ..... 0.094	Zn ..... 0.070
		Zr ..... 0.81
	Values for information - Mass fraction in mg/kg	
	Ag ..... 0.0018	Eu ..... 0.0021
	As ..... 0.016	Sb ..... 0.022
	Bi ..... 0.016	Sc ..... 0.012
	Cd ..... 0.0022	Sn ..... 0.16
		Ta ..... 0.018
<b>BAM-RS 1</b>	<b>Pure substances-Silicium dioxide</b>	100 g
	Silicium dioxide, > 99,99%, mean particle size 150µm	
	Indicative values - Mass fraction in w / µg/g	
	Al Aluminium ..... 8.7	Ge Germanium ..... < 1
	As Arsen ..... < 0.1	Hg Quecksilber ..... < 0.05
	Ca Calcium ..... 0.42	K Kalium ..... 0.48
	Cd Cadmium ..... < 0.05	Li Lithium ..... 0.25
	Cr Chrom ..... 0.062	Mg Magnesium ..... < 0.5
	Cu Kupfer ..... < 0.1	Mn Mangan ..... < 0.2
	Fe Eisen ..... 0.62	Na Natrium ..... < 2

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Ni Nickel ..... < 0.2	Ti Titan ..... 1.3
	Pb Blei ..... < 0.15	Zn Zink ..... < 1.3
		Zr Zirconium ..... < 0.1
<b>BAM-RS 2</b>	<b>Aluminium oxide</b>	100 g
	Aluminium oxide, 99,76%	
	It consists of powdered alpha alumina with an average surface area (BET according to DIN 66131) of approx. 5.6 m <sup>2</sup> /g and a bulk density of approx. 1.1 kg/l. Due to the During the manufacturing process, the product contains small amounts of chlorine, which evaporates when heated at approx	
	Certified value - Mass fraction in w / µg/g	
	Ca Calcium ..... 3.1	Mn Mangan ..... < 1.5
	Co Cobalt ..... < 1	Na Natrium ..... < 15
	Cr Chrom ..... < 1.5	Ni Nickel ..... < 10
	Cu Kupfer ..... < 2.5	Si Silicium ..... < 20
	Fe Eisen ..... 3.3	Ti Titan ..... < 2
	Mg Magnesium ..... < 3	Zn Zink ..... < 2
		Zr Zirconium ..... 3.2
<b>BAM-RS 3</b>	<b>Calcium carbonate</b>	100 g
	Calcium carbonate, 99,79%	
	It consists of pure calcite in powder form with a water content of approx. 0.13%. If the sample is to be used to produce synthetic calibration samples for calcium or carbon determination, it must be dried for one hour at 105 °C.	
	Certified value - Mass fraction in w / µg/g	
	Ba Barium ..... 45.3	Mg Magnesium ..... 183
	Cr Chrom ..... < 1	Mn Mangan ..... 3.0
	Cu Kupfer ..... < 1	Na Natrium ..... 47.5
	Fe Eisen ..... < 5	Sr Strontium ..... 173
		Zn Zink ..... < 2
<b>BAM-RS 4</b>	<b>Nickel 99,995%, chips (weight 2 - 4 mg per chip)</b>	100 g
	Certified value - Mass fraction in w / µg/g	
	Ag ..... < 1	Ga ..... < 0.2
	Al ..... < 1	Mg ..... < 0.8
	As ..... < 0.5	Mn ..... < 0.5
	C ..... 9.4	N ..... 2.5
	Ca ..... < 1	Pb ..... < 1
	Cd ..... < 0.2	Sb ..... < 0.2
	Co ..... < 1	Se ..... < 1
	Cr ..... < 0.5	Sn ..... < 0.3
	Cu ..... < 2	Tl ..... < 0.2
	Fe ..... 4.2	Zn ..... < 4
<b>BAM-RS 5</b>	<b>Nickel oxide, powder with a grain size of 5 - 20 µm.</b>	100 g
	Certified value - Mass fraction in w / µg/g	
	Ag ..... < 1	K ..... < 2
	As ..... < 0.2	Mg ..... < 1

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Ba ..... < 1      Mn ..... < 1 C ..... 14      Mo ..... < 5 Ca ..... 2.2      Na ..... < 2 Cd ..... < 0.2      Pb ..... < 2 Co ..... < 2      Se ..... < 1 Cr ..... 16.1      Tl ..... < 0.5 Cu ..... 1.53      V ..... < 1 Fe ..... 41      Zn ..... 3.4 Ga ..... < 0.5      O ..... w(O) = 21.41%	
	Total content of impurities (as elements):      0.01%      u = 0.001% Water content:      0.015%      u = 0.002 (n = 6) Mass fraction of nickel:      78.57%      u = 0.06%	
<b>BAM-RS 6A</b>	<b>Magnesium oxide 100 - 350 µm partikel size</b>	100 g
	Certified value - Mass fraction in w / µg/g Al ..... 45      Ni ..... 3.9 Ca ..... 880      Sr ..... 2.0 Cr ..... 9.2      Ti ..... 1.3 Fe ..... 72      V ..... 8.4 Mn ..... 5.4      H <sub>2</sub> O ..... 110	
	Total impurity content (as certified mass fractions):      0.114%      uc = 0.02% Mass fraction of magnesium:      60.190%      uc = 0.02%	
<b>BAM-RS 6B</b>	<b>Magnesium oxide 50 - 100 µm partikel size</b>	100 g
	Certified value - Mass fraction in w / µg/g Al ..... 47      Ni ..... 3.3 Ca ..... 830      Sr ..... 2.1 Cr ..... 8.1      Ti ..... 1.2 Fe ..... 71      V ..... 7.8 Mn ..... 5.2      H O ..... 283	
	Total impurities (as elements):      0.13%      uc = 0.02% Mass fraction of magnesium:      60.17%      uc = 0.02%	
<b>BAM-S004</b>	<b>Glass Containing Hexavalent Chromium</b>	50 g
	Certified value - Mass fraction in mg/kg Cr-hexavalent ..... 94      Cr-total ..... 471	
<b>BAM-S005c</b>	<b>Multielement Glass</b>	Disc diameter 38 mm x height 4 mm
	Certified value - Mass fraction in % Al (Al <sub>2</sub> O <sub>3</sub> ) ..... 0.587 (1.109)      Mg (MgO) ..... 1.37 (2.28) Ca (CaO) ..... 7.43 (10.39)      Na (Na <sub>2</sub> O) ..... 10.33 (13.92) K (K <sub>2</sub> O) ..... 0.595 (0.717)      Si (SiO <sub>2</sub> ) ..... 33.1 (70.8)	
	Certified value - Mass fraction in mg/kg As (As <sub>2</sub> O <sub>3</sub> ) ..... 81 (107)      Mo (MoO <sub>3</sub> ) ..... 215 (323) Ba (BaO) ..... 102 (114)      Ni (NiO) ..... 41.3 (52.6) Cd (CdO) ..... 47 (54)      Pb (PbO) ..... 182 (196) Ce (CeO <sub>2</sub> ) ..... 80 (98)      Sb (Sb <sub>2</sub> O <sub>3</sub> ) ..... 103 (123)	



## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Co (CoO) ..... 33.2 (42.3)	Sn (SnO <sub>2</sub> ) ..... 72.9 (92.5)
	Cr (Cr <sub>2</sub> O <sub>3</sub> ) ..... 10.8 (15.8)	Sr (SrO) ..... 134 (158)
	Cu (CuO) ..... 86 (107)	Ti (TiO <sub>2</sub> ) ..... 101 (169)
	Fe (Fe <sub>2</sub> O <sub>3</sub> ) ..... 295 (422)	V (V <sub>2</sub> O <sub>5</sub> ) ..... 189 (337)
	Mn (MnO) ..... 69.6 (89.9)	Zn (ZnO) ..... 157 (196)
		Zr (ZrO <sub>2</sub> ) ..... 544 (735)
<b>BAM-S050</b>	<b>Iron in Flat Glass</b>	Flat glass slide 100 mm x 50 mm, 3.2 mm thickness
	Soda lime glass for establishing and checking the calibration of wet chemical and physical methods for the determination of Fe <sup>2+</sup> , Fe <sup>3+</sup> and total iron	
	Certified value - Mass fraction in %	
	Fe (II) ..... 0.0026	Fe (total) ..... 0.0084
<b>BAM-S051</b>	<b>Iron in Flat Glass</b>	Flat glass slide 100 mm x 50 mm, 5.9 mm thickness
	Soda lime glass for establishing and checking the calibration of wet chemical and physical methods for the determination of Fe <sup>2+</sup> , Fe <sup>3+</sup> and total iron	
	Certified value - Mass fraction in %	
	Fe (II) ..... 0.0155	Fe (total) ..... 0.0481
<b>BAM-S052</b>	<b>Iron in Flat Glass</b>	Flat glass slide 100 mm x 50 mm, 3.8 mm thickness
	Soda lime glass for establishing and checking the calibration of wet chemical and physical methods for the determination of Fe <sup>2+</sup> , Fe <sup>3+</sup> and total iron	
	Certified value - Mass fraction in %	
	Fe (II) ..... 0.160	Fe (total) ..... 0.597
<b>BAM-S053</b>	<b>Hydrolytic Resistance of Borosilicate Glass</b>	Cardbord, glass rods 2 kg
	Glass rods Reference material for the determination of hydrolytic resistance according to ISO 720, USP and Ph.Eur. 3.2.1 (ISO 719 for information) length: 185 mm, diameter: 9 mm, weight per rod: 27.5 g	
	Acid consumption according to - Consumption of 0.02M HCl per g in mL	
	ISO 720 ..... 0.0422	
	USP<660> ..... 0.0428	
	Ph.Eur. 3.2.1 ..... 0.0429	
<b>BAM-D001</b>	<b>Nickel oxide, powder with a grain size of 5 - 20 µm.</b>	100 g
	Particle Size Distribution by Laser Diffraction Methods according to ISO 13320	
	Specific Particle Diameter Corresponding to the Cumulative Undersize Volume Distribution Q3 - Equivalent Spherical Diameter in µm	
	d10 ..... 7.02	
	d50 ..... 12.48	
	d90 ..... 20.8	
<b>BAM-I012</b>	<b>Cadmium in dilute nitric acid</b>	Quartzampule aqueous solution, 7 mL
	Certified Isotopic Reference Material	

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Certified value - Quantity / Unit (mol/mol)/ Value	
	Isotope amount ratios:	
	$n(^{106}\text{Cd})/n(^{111}\text{Cd})$ ..... 0.09751	$n(^{112}\text{Cd})/n(^{111}\text{Cd})$ ..... 1.8835
	$n(^{108}\text{Cd})/n(^{111}\text{Cd})$ ..... 0.06951	$n(^{113}\text{Cd})/n(^{111}\text{Cd})$ ..... 0.95479
	$n(^{110}\text{Cd})/n(^{111}\text{Cd})$ ..... 0.97504	$n(^{114}\text{Cd})/n(^{111}\text{Cd})$ ..... 2.2437
		$n(^{116}\text{Cd})/n(^{111}\text{Cd})$ ..... 0.58583
	Certified value - Quantity / Unit (mol/mol)/ Value	
	Isotope amount fractions:	
	$n(^{106}\text{Cd})/n(\text{Cd})$ ..... 0.012485	$n(^{112}\text{Cd})/n(\text{Cd})$ ..... 0.24117
	$n(^{108}\text{Cd})/n(\text{Cd})$ ..... 0.008901	$n(^{113}\text{Cd})/n(\text{Cd})$ ..... 0.122254
	$n(^{110}\text{Cd})/n(\text{Cd})$ ..... 0.124846	$n(^{114}\text{Cd})/n(\text{Cd})$ ..... 0.28729
	$n(^{111}\text{Cd})/n(\text{Cd})$ ..... 0.128043	$n(^{116}\text{Cd})/n(\text{Cd})$ ..... 0.07501
	Certified value - Quantity / Unit (g/mol)/ Value	
	Molar mass in solution:	
	M(Cd) ..... 112.41218	

<b>ERM-AE142</b>	<b>Pb solution in 1mol/L nitric acid certified for the Pb isotope amount ratios</b>	PFA-bottle aqueous solution, 20 mL
	Certified quantity / Unit / Certified value	
	Isotope amount ratio $n(^{206}\text{Pb})/n(^{204}\text{Pb})$ ..... mol/mol ..... 21.114	
	Isotope amount ratio $n(^{207}\text{Pb})/n(^{204}\text{Pb})$ ..... mol/mol ..... 15.944	
	Isotope amount ratio $n(^{208}\text{Pb})/n(^{204}\text{Pb})$ ..... mol/mol ..... 39.850	
	Isotope amount ratio $n(^{208}\text{Pb})/n(^{206}\text{Pb})$ ..... mol/mol ..... 1.8874	
	Isotope amount fraction $n(^{204}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.012 8357	
	Isotope amount fraction $n(^{206}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.271 01	
	Isotope amount fraction $n(^{207}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.204 65	
	Isotope amount fraction $n(^{208}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.511 50	
	Molar mass of Pb in solution M(Pb) ..... g/mol ..... 207.177 83	

<b>ERM-EB400</b>	<b>Pb in bronze</b>	crimp vials swarf, 1 g
	Certified quantity / Unit / Certified value	
	Isotope amount ratio $n(^{206}\text{Pb})/n(^{204}\text{Pb})$ ..... mol/mol ..... 18.072	
	Isotope amount ratio $n(^{207}\text{Pb})/n(^{204}\text{Pb})$ ..... mol/mol ..... 15.578	
	Isotope amount ratio $n(^{208}\text{Pb})/n(^{204}\text{Pb})$ ..... mol/mol ..... 38.075	
	Isotope amount ratio $n(^{208}\text{Pb})/n(^{206}\text{Pb})$ ..... mol/mol ..... 2.1068	
	Isotope amount fraction $n(^{204}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.013 7504	
	Isotope amount fraction $n(^{206}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.248 50	
	Isotope amount fraction $n(^{207}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.214 20	
	Isotope amount fraction $n(^{208}\text{Pb})/n(\text{Pb})$ ..... mol/mol ..... 0.523 55	
	Molar mass of Pb in solution M(Pb) ..... g/mol ..... 207.209 68	

<b>ERM-CD281</b>	<b>ERM-CD281 RYE GRASS (trace elements)</b>	10 g
	The material consists of about 10 g of dried and ground rye grass packed into an amber glass vial under argon atmosphere.	
	Certified value (mg/kg)	
	As ..... 0.042	Mo ..... 2.22
	B ..... 5.5	Ni ..... 15.2
	Cd ..... 0.120	Pb ..... 1.67
	Cr ..... 24.8	Sb ..... 0.042

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Cu ..... 10.2    Se ..... 0.023	
	Hg ..... 0.0164    Sn ..... 0.062	
	Mn ..... 82    Zn ..... 30.5	
<b>IRMM-435</b>	<b>PHARMACEUTICAL GLASS CONTAINERS</b>	357 g
	Each unit of reference material consists of 20 vials of 18.9 mL brimful capacity, made of a semidurable type of glass, with screw caps (holes to be drilled by the user).	
	Certified value (mL)	
	Volume of titration solution 0.01 mol/L HCl per 50 mL of leachate ..... 0.38	
	Certified value (mg/L)	
	Sodium release per volume of leachate ..... 1.41	
	Release of Na <sub>2</sub> O per volume of leachate ..... 1.91	
<b>BCR -724</b>	<b>GLASS-CERAMIC</b>	21 g
	The sample consists of a glass-ceramic cylinder. Different shapes are available BCR-724A: diameter = 13.0 mm, height > 18 mm BCR-724B: diameter = 13.9 mm, height > 21 mm BCR-724D: diameter = 26.9 mm, height > 22 mm).	
	Thermal Diffusivity, $\alpha$	
	Certified value ( $\text{m}^2/\text{s} \cdot 10^{-6}$ )	
	$\alpha = 4.406 - 1.351 \cdot 10^{-2} \cdot T + 2.133 \cdot 10^{-5} \cdot T^2 - 1.541 \cdot 10^{-8} \cdot T^3 + 4.147 \cdot 10^{-12} T^4$	
	Thermal Conductivity, $\lambda$	
	Certified value ( $\text{W}/(\text{m} \cdot \text{K})$ )	
	$\lambda = 2.332 + 515.1 / T$	
<b>BCR -066</b>	<b>QUARTZ (particle size 0.35 - 3.50 microns)</b>	10 g
	Stokes diameter $x_{\text{st}}$ [ $\mu\text{m}$ ]	
	Certified value of particles undersize [g/g]	
	0.35 $\mu\text{m}$ ..... 0.024    1.05 $\mu\text{m}$ ..... 0.45	
	0.50 $\mu\text{m}$ ..... 0.063    1.20 $\mu\text{m}$ ..... 0.54	
	0.60 $\mu\text{m}$ ..... 0.11    1.50 $\mu\text{m}$ ..... 0.72	
	0.75 $\mu\text{m}$ ..... 0.20    1.85 $\mu\text{m}$ ..... 0.85	
	0.90 $\mu\text{m}$ ..... 0.33    2.50 $\mu\text{m}$ ..... 0.955	
		3.50 $\mu\text{m}$ ..... 0.996
<b>BCR-067</b>	<b>QUARTZ (particle size 2.40 - 32.00 microns)</b>	10 g
	Stokes diameter $x_{\text{st}}$ [ $\mu\text{m}$ ]	
	Certified value of particles undersize [g/g]	
	2.40 $\mu\text{m}$ ..... 0.012    11.30 $\mu\text{m}$ ..... 0.57	
	3.40 $\mu\text{m}$ ..... 0.025    16.00 $\mu\text{m}$ ..... 0.842	
	4.00 $\mu\text{m}$ ..... 0.029    22.60 $\mu\text{m}$ ..... 0.975	
	5.70 $\mu\text{m}$ ..... 0.12    32.00 $\mu\text{m}$ ..... 0.991	
	8.00 $\mu\text{m}$ ..... 0.31	
<b>BCR-068</b>	<b>QUARTZ (particle size 160 - 630 microns)</b>	100 g
	Stokes diameter $x_{\text{st}}$ [ $\mu\text{m}$ ]	
	Certified value of particles undersize [g/g]	

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	160.0 µm ..... 0.042	400.0 µm ..... 0.689
	250.0 µm ..... 0.23	500.0 µm ..... 0.888
	320.0 µm ..... 0.449	630.0 µm ..... 0.974
<b>BCR-069</b>	<b>QUARTZ (particle size 14 - 90 microns)</b>	10 g
	Stokes diameter $x_{st}$ [µm]	
	Certified value of particles undersize [g/g]	
	14.0 µm ..... 0.028	45.0 µm ..... 0.64
	16.0 µm ..... 0.049	64.0 µm ..... 0.83
	23.0 µm ..... 0.199	90.0 µm ..... 0.966
	32.0 µm ..... 0.388	
<b>BCR-070</b>	<b>QUARTZ (1.20 - 20.00 microns)</b>	10 g
	Stokes diameter $x_{st}$ [µm]	
	Certified value of particles undersize [g/g]	
	1.20 µm ..... 0.100	4.80 µm ..... 0.768
	1.40 µm ..... 0.134	5.70 µm ..... 0.832
	4.70 µm ..... 0.22	6.70 µm ..... 0.881
	2.00 µm ..... 0.274	8.00 µm ..... 0.924
	2.40 µm ..... 0.37	9.50 µm ..... 0.954
	2.90 µm ..... 0.50	11.30 µm ..... 0.976
	3.50 µm ..... 0.602	20.00 µm ..... 0.998
<b>BCR-130</b>	<b>QUARTZ (particle size 50 - 220 microns)</b>	50 g
	Mass fraction of particles undersize $Q_3$ [g/g]	Certified equivalent volume diameter $X_v$ [µm]
	0.01 ..... 46.4	
	0.02 ..... 48.5	
	0.03 ..... 50.1	
	0.04 ..... 51.5	
	0.05 ..... 52.7	
	0.06 ..... 53.9	
	0.07 ..... 55.0	
	0.08 ..... 56.1	
	0.09 ..... 57.2	
	0.10 ..... 58.3	
	0.11 ..... 59.4	
	0.12 ..... 60.6	
	0.13 ..... 61.8	
	0.14 ..... 63.0	
	0.15 ..... 64.4	
	0.16 ..... 65.8	
	0.17 ..... 67.7	
	0.18 ..... 70.1	
	0.19 ..... 71.3	
	0.20 ..... 72.8	
	0.21 ..... 74.3	



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
0.22	.....	75.9
0.23	.....	77.5
0.24	.....	78.8
0.25	.....	80.3
0.26	.....	82.1
0.27	.....	83.9
0.28	.....	85.3
0.29	.....	87.5
0.30	.....	89.1
0.31	.....	90.7
0.32	.....	92.3
0.33	.....	94.0
0.34	.....	95.4
0.35	.....	97.5
0.36	.....	99.0
0.37	.....	99.7
0.38	.....	102.6
0.39	.....	104.3
0.40	.....	106.0
0.41	.....	107.7
0.42	.....	109.3
0.43	.....	111.3
0.44	.....	113.0
0.45	.....	115.1
0.46	.....	116.8
0.47	.....	118.5
0.48	.....	120.6
0.49	.....	122.3
0.50	.....	124.0

BCR-131	QUARTZ (particle size 480 - 1800 microns)	200 g
	Mass fraction of particles undersize $Q_3$ [g/g]	Certified equivalent volume diameter $X_v$ [ $\mu\text{m}$ ]
0.01	.....	517
0.02	.....	535
0.03	.....	547
0.04	.....	557
0.05	.....	566
0.06	.....	574
0.07	.....	582
0.08	.....	589
0.09	.....	596
0.10	.....	602
0.11	.....	609
0.12	.....	615
0.13	.....	621
0.14	.....	628
0.15	.....	634
0.16	.....	640

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
0.17	.....	646
0.18	.....	653
0.19	.....	659
0.20	.....	666
0.21	.....	672
0.22	.....	679
0.23	.....	685
0.24	.....	692
0.25	.....	699
0.26	.....	706
0.27	.....	713
0.28	.....	721
0.29	.....	728
0.30	.....	736
0.31	.....	744
0.32	.....	752
0.33	.....	759
0.34	.....	767
0.35	.....	775
0.36	.....	785
0.37	.....	793
0.38	.....	801
0.39	.....	808
0.40	.....	817
0.41	.....	825
0.42	.....	833
0.43	.....	841
0.44	.....	851
0.45	.....	859
0.46	.....	870
0.47	.....	879
0.48	.....	888
0.49	.....	898
0.50	.....	906

BCR-132	QUARTZ (particle size 1400 - 5000 microns)	700 g
	Mass fraction of particles undersize $Q_3$ [g/g]	Certified equivalent volume diameter $X_v$ [ $\mu\text{m}$ ]
0.01	.....	517
0.02	.....	535
0.03	.....	547
0.04	.....	557
0.05	.....	566
0.06	.....	574
0.07	.....	582
0.08	.....	589
0.09	.....	596
0.10	.....	602
0.11	.....	609
0.12	.....	615

Rocks, Metal, Ceramic  
Glass, Grass, and Minerals

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
0.13	.....	621
0.14	.....	628
0.15	.....	634
0.16	.....	640
0.17	.....	67.7
0.18	.....	653
0.19	.....	659
0.20	.....	666
0.21	.....	672
0.22	.....	679
0.23	.....	685
0.24	.....	692
0.25	.....	699
0.26	.....	706
0.27	.....	713
0.28	.....	721
0.29	.....	728
0.30	.....	736
0.31	.....	744
0.32	.....	752
0.33	.....	759
0.34	.....	767
0.35	.....	775
0.36	.....	785
0.37	.....	793
0.38	.....	801
0.39	.....	808
0.40	.....	817
0.41	.....	825
0.42	.....	833
0.43	.....	841
0.44	.....	851
0.45	.....	859
0.46	.....	870
0.47	.....	879
0.48	.....	888
0.49	.....	898
0.50	.....	906

## ERM-FD066

### CORUNDUM (1.4-7.5 microns)

20 g

Volume-weighted equivalent diameter  
laser diffraction, Mie theory, wet dispersion

Number-weighted equivalent diameter  
Scanning Electron Microscopy (SEM)

Diameter	Certified value [µm]	Diameter	Certified value [µm]
X <sub>5,3</sub> .....	1.44	X <sub>5,0</sub> .....	1.07
X <sub>10,3</sub> .....	1.73	X <sub>10,0</sub> .....	1.28
X <sub>25,3</sub> .....	2.35	X <sub>25,0</sub> .....	1.71
X <sub>50,3</sub> .....	3.36	X <sub>50,0</sub> .....	2.4
X <sub>75,3</sub> .....	4.81	X <sub>75,0</sub> .....	3.3
X <sub>90,3</sub> .....	6.42	X <sub>90,0</sub> .....	4.4
X <sub>95,3</sub> .....	7.45	X <sub>95,0</sub> .....	5.1

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
ERM-FD069	CORUNDUM (14-80 microns)	40 g
	Volume-weighted equivalent diameter Laser diffraction, Fraunhofer approximation	
	Diameter Certified value [ $\mu\text{m}$ ]	
	X <sub>5,3</sub> ..... 13.9	
	X <sub>10,3</sub> ..... 17.4	
	X <sub>25,3</sub> ..... 24.9	
	X <sub>50,3</sub> ..... 36.8	
	X <sub>75,3</sub> ..... 52.3	
	X <sub>90,3</sub> ..... 68.6	
	X <sub>95,3</sub> ..... 79.8	
	Volume-weighted equivalent diameter Laser diffraction, Mie theory	
	Diameter Certified value [ $\mu\text{m}$ ]	
	X <sub>5,3</sub> ..... 15.0	
	X <sub>10,3</sub> ..... 18.1	
	X <sub>25,3</sub> ..... 25.1	
	X <sub>50,3</sub> ..... 36.7	
	X <sub>75,3</sub> ..... 52.8	
	X <sub>90,3</sub> ..... 70.5	
	X <sub>95,3</sub> ..... 82	
	Number-weighted area-equivalent diameter Optical microscopy	
	Diameter Certified value [ $\mu\text{m}$ ]	
	X <sub>5,0</sub> ..... 12.4	
	X <sub>10,0</sub> ..... 15.8	
X <sub>25,0</sub> ..... 19.9		
X <sub>50,0</sub> ..... 23.9		
X <sub>75,0</sub> ..... 30		
X <sub>90,0</sub> ..... 40		
X <sub>95,0</sub> ..... 46		
<hr/>		
BCR-172	Quartz (2.50 m <sup>2</sup> /g) (nitrogen BET specific surface area)	10 g
Each sample consists of a glass bottle filled with approximately 10 g of quartz powder obtained by subdividing a bulk quantity of the material using a multi-stage procedure involving 2 riffles.		
Certified value [m <sup>2</sup> /g]		
Nitrogen 'BET' Specific Surface Area ..... 2.56		
<hr/>		
BCR-704	FAUJASITE TYPE ZEOLITE	10 g
Certified value		
Micropore volume ..... 2.56 cm <sup>3</sup> /g    Median micropore width ..... 0.668 nm		
<hr/>		
BCR-705	LINDE TYPE A ZEOLITE	10 g
Certified value		
Micropore volume ..... 0.181 cm <sup>3</sup> /g    Median micropore width ..... 0.592 nm		
<hr/>		



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit																												
<b>BCR-302</b>	<b>NATURAL MOROCCAN PHOSPHATE ROCK</b>	10 g																												
	<p>The sample consists of approximately 100 g of thoroughly mixed finely ground material (particle size &lt; 100 µm) taken from a batch of a natural Moroccan phosphate rock usually employed for the production of phosphate fertilizers.</p> <p>Certified value [g/kg]</p> <table> <tr> <td>Ca expressed as CaO .....</td> <td>518</td> </tr> <tr> <td>Total P expressed as P<sub>2</sub>O<sub>5</sub> .....</td> <td>329.8</td> </tr> <tr> <td>Carbonate Carbon expressed as CO<sub>2</sub> .....</td> <td>51.0</td> </tr> <tr> <td>F .....</td> <td>40.4</td> </tr> <tr> <td>Si expressed as SiO<sub>2</sub> .....</td> <td>20.9</td> </tr> <tr> <td>Total S expressed as SO<sub>3</sub> .....</td> <td>18.4</td> </tr> <tr> <td>Al expressed as Al<sub>2</sub>O<sub>3</sub> .....</td> <td>5.5</td> </tr> <tr> <td>Mg expressed as MgO .....</td> <td>4.0</td> </tr> <tr> <td>Fe expressed as Fe<sub>2</sub>O<sub>3</sub> .....</td> <td>2.3</td> </tr> </table>		Ca expressed as CaO .....	518	Total P expressed as P <sub>2</sub> O <sub>5</sub> .....	329.8	Carbonate Carbon expressed as CO <sub>2</sub> .....	51.0	F .....	40.4	Si expressed as SiO <sub>2</sub> .....	20.9	Total S expressed as SO <sub>3</sub> .....	18.4	Al expressed as Al <sub>2</sub> O <sub>3</sub> .....	5.5	Mg expressed as MgO .....	4.0	Fe expressed as Fe <sub>2</sub> O <sub>3</sub> .....	2.3										
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<b>BCR-126B</b>	<b>LEAD GLASS</b>	300 g																												
	<p>The reference material is supplied in the form of a slab 100 mm x 100 mm x 10 mm weighing about 300 g.</p> <p>Certified value - Mass Fraction</p> <table> <tr> <td>SiO<sub>2</sub> .....</td> <td>57.87</td> <td>BaO .....</td> <td>57.87</td> </tr> <tr> <td>PbO .....</td> <td>24.09</td> <td>CaO .....</td> <td>24.09</td> </tr> <tr> <td>K<sub>2</sub>O .....</td> <td>9.98</td> <td>MgO .....</td> <td>9.98</td> </tr> <tr> <td>Al<sub>2</sub>O<sub>3</sub> .....</td> <td>0.137</td> <td>ZnO .....</td> <td>0.137</td> </tr> <tr> <td>Fe<sub>2</sub>O<sub>3</sub> .....</td> <td>0.0060</td> <td>Na<sub>2</sub>O .....</td> <td>0.0060</td> </tr> <tr> <td>Sb<sub>2</sub>O<sub>3</sub> .....</td> <td>0.291</td> <td>Li<sub>2</sub>O .....</td> <td>0.291</td> </tr> </table> <p>Certified value - Physical properties</p> <table> <tr> <td>Density at 20 °C .....</td> <td>2.9947</td> </tr> <tr> <td>Refractive index n<sub>D</sub><sup>20</sup> at 589 nm .....</td> <td>1.56004</td> </tr> </table>		SiO <sub>2</sub> .....	57.87	BaO .....	57.87	PbO .....	24.09	CaO .....	24.09	K <sub>2</sub> O .....	9.98	MgO .....	9.98	Al <sub>2</sub> O <sub>3</sub> .....	0.137	ZnO .....	0.137	Fe <sub>2</sub> O <sub>3</sub> .....	0.0060	Na <sub>2</sub> O .....	0.0060	Sb <sub>2</sub> O <sub>3</sub> .....	0.291	Li <sub>2</sub> O .....	0.291	Density at 20 °C .....	2.9947	Refractive index n <sub>D</sub> <sup>20</sup> at 589 nm .....	1.56004
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<b>BCR-664</b>	<b>GLASS (trace elements)</b>	50 x 50 x 7 mm																												
	<p>The material consists of a glass plate (50 x 50 x 7 mm).</p> <p>Certified value [mg/kg] - Mass fraction based on dry mass</p> <table> <tr> <td>As .....</td> <td>1.44</td> <td>Cr .....</td> <td>6.42</td> </tr> <tr> <td>Ba .....</td> <td>1.73</td> <td>Pb .....</td> <td>7.45</td> </tr> <tr> <td>Cd .....</td> <td>2.35</td> <td>Sb .....</td> <td>7.45</td> </tr> <tr> <td>Cl .....</td> <td>3.36</td> <td>Se .....</td> <td>7.45</td> </tr> <tr> <td>Co .....</td> <td>4.81</td> <td></td> <td></td> </tr> </table>		As .....	1.44	Cr .....	6.42	Ba .....	1.73	Pb .....	7.45	Cd .....	2.35	Sb .....	7.45	Cl .....	3.36	Se .....	7.45	Co .....	4.81										
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Co .....	4.81																													
<b>NIST-1003c</b>	<b>Glass Beads - Particle Size Distribution</b>	28 g																												
	<p>It is intended for use in the evaluation and calibration of equipment used to measure particle size distributions (PSD) in the 20 µm to 50 µm diameter range.</p> <p><b>Certified Diameter Values</b></p> <table> <thead> <tr> <th>Cumulative Mass Fraction (%)</th> <th>Diameter (µm)</th> <th>Standard Uncertainty Homogeneity (µm)</th> <th>Standard Uncertainty Measurement (µm)</th> <th>Type B Standard Uncertainty (µm)</th> <th>Combined Standard Uncertainty (µm)</th> <th>Expanded Uncertainty (µm)</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Cumulative Mass Fraction (%)	Diameter (µm)	Standard Uncertainty Homogeneity (µm)	Standard Uncertainty Measurement (µm)	Type B Standard Uncertainty (µm)	Combined Standard Uncertainty (µm)	Expanded Uncertainty (µm)																					
Cumulative Mass Fraction (%)	Diameter (µm)	Standard Uncertainty Homogeneity (µm)	Standard Uncertainty Measurement (µm)	Type B Standard Uncertainty (µm)	Combined Standard Uncertainty (µm)	Expanded Uncertainty (µm)																								

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product						Unit
5	18.9	0.00	0.43	0.41	0.59	1.0	
10	21.8	0.15	0.24	0.41	0.50	1.0	
15	23.7	0.14	0.26	0.41	0.50	1.0	
20	25.3	0.10	0.30	0.41	0.51	1.0	
25	26.7	0.10	0.30	0.41	0.51	1.0	
30	27.9	0.09	0.27	0.41	0.50	1.0	
35	29.0	0.12	0.25	0.41	0.49	1.0	
40	30.1	0.12	0.24	0.41	0.49	1.0	
45	31.1	0.09	0.26	0.41	0.49	1.0	
50	32.1	0.03	0.29	0.41	0.50	1.0	
55	33.1	0.00	0.33	0.41	0.52	1.0	
60	34.1	0.00	0.37	0.41	0.55	1.1	
65	35.2	0.00	0.41	0.41	0.58	1.2	
70	36.2	0.00	0.47	0.41	0.62	1.2	
75	37.4	0.00	0.48	0.41	0.63	1.3	
80	38.6	0.00	0.46	0.41	0.62	1.2	
85	39.8	0.00	0.49	0.41	0.64	1.3	
90	41.4	0.00	0.36	0.41	0.54	1.1	
95	43.3	0.00	0.25	0.41	0.48	1.0	

### Certified Diameter Values

Cumulative Mass Fraction Finer (%)	Diameter ( $\mu\text{m}$ )	Standard Uncertainty Homogeneity ( $\mu\text{m}$ )
5	18.9	0.9
10	22.1	1.1
15	23.8	1.2
20	25.6	1.3
25	27.0	1.3
30	28.2	1.4
35	29.3	1.5
40	30.7	1.5
45	31.6	1.6
50	32.7	1.6
55	33.8	1.7
60	34.7	1.7
65	35.4	1.8
70	36.4	1.8
75	37.6	1.9
80	38.2	1.9
85	39.3	2.0
90	40.5	2.0
95	42.6	2.1

Diameters ( $\mu\text{m}$ ) Measured by Electric Sensing Zone Instrument

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product										Unit
Cumulative Mass Fraction Finer (%)	Bottle Identification										
	1	2	3	4	5	6	7	8	9	10	
	Diameter (µm)										
5	19.3	18.9	19.3	19.3	19.4	19.3	19.7	18.8	19.1	19.0	
10	21.9	21.6	21.9	21.9	22.0	21.8	22.2	21.4	21.7	21.5	
15	23.8	23.4	23.7	23.8	23.9	23.6	24.1	23.3	23.6	23.3	
20	25.2	24.9	25.2	25.4	25.4	25.1	25.6	24.7	25.1	24.8	
25	26.6	26.3	26.6	26.8	26.8	26.5	26.9	26.1	26.5	26.2	
30	27.8	27.6	27.8	28.0	28.0	27.7	28.1	27.3	27.7	27.5	
35	28.9	28.7	29.0	29.2	29.3	28.9	29.3	28.5	28.9	28.5	
40	30.0	29.9	30.1	30.4	30.4	30.0	30.4	29.7	30.1	29.7	
45	31.1	31.0	31.3	31.4	31.5	31.2	31.5	30.8	31.2	30.8	
50	32.2	32.1	32.3	32.5	32.5	32.2	32.5	31.9	32.3	31.9	
55	33.3	33.2	33.4	33.6	33.6	33.3	33.6	33.0	33.4	33.0	
60	34.4	34.2	34.4	34.7	34.7	34.4	34.6	34.0	34.4	34.1	
65	35.5	35.3	35.5	35.8	35.9	35.5	35.7	35.2	35.5	35.2	
70	36.6	36.4	36.7	36.9	37.0	36.6	36.9	36.6	36.6	36.3	
75	37.8	37.6	37.8	38.0	38.1	37.8	38.0	37.4	37.8	37.5	
80	39.0	38.8	39.0	39.2	39.3	39.0	39.2	38.6	39.0	38.7	
85	40.2	40.1	40.2	40.6	40.5	40.2	40.4	40.0	40.3	40.1	
90	41.7	41.6	41.7	42.0	41.9	41.7	41.8	41.5	41.7	41.6	
95	43.5	43.4	43.4	43.6	43.7	43.6	43.6	43.4	43.5	43.4	

## Diameters (µm) Measured by Electric Sensing Zone Instrument

Cumulative Mass Fraction Finer (%)	Bottle Identification									
	1	2	3	4	5	6	7	8	9	10
	Diameter (µm)									
5	18.8	18.4	18.5	18.6	18.4	18.5	18.6	18.6	19.0	18.3
10	22.1	21.5	21.6	21.8	21.6	21.7	21.8	21.7	22.1	21.4
15	24.2	23.6	23.7	23.9	23.7	23.8	24.0	23.9	24.2	23.6
20	25.7	25.3	25.4	25.5	25.4	25.5	25.6	25.5	25.7	25.3
25	27.1	26.6	26.7	26.9	26.7	26.8	27.0	26.8	27.1	26.6
30	28.2	27.8	27.9	28.0	27.9	28.0	28.1	28.0	28.2	27.8
35	29.2	28.8	28.9	29.1	28.9	29.0	29.2	29.1	29.2	28.9
40	30.0	29.9	29.9	30.1	30.0	30.1	30.2	30.1	30.2	29.9
45	31.2	30.9	30.9	31.1	30.9	31.0	31.2	31.0	31.1	30.9
50	32.1	31.8	31.8	32.0	31.8	32.0	32.1	32.0	32.1	31.8
55	33.0	32.7	32.8	32.9	32.8	32.9	33.0	32.9	33.0	32.8
60	34.0	33.7	33.7	33.9	33.8	33.9	34.0	33.9	33.9	33.8
65	35.0	34.7	34.7	34.9	34.8	34.9	35.0	34.9	34.9	34.8
70	35.9	35.7	35.7	35.9	35.7	35.9	36.0	35.9	35.9	35.8
75	37.1	36.8	36.8	37.0	36.8	37.0	37.1	37.0	37.0	36.9
80	38.2	38.0	38.0	38.2	38.1	38.2	38.3	38.2	38.2	38.1
85	39.4	39.3	39.3	39.4	39.3	39.4	39.5	39.4	39.4	39.3
90	41.2	41.0	41.0	41.1	41.0	41.2	41.2	41.2	41.1	41.1
95	43.1	43.0	43.0	43.1	43.0	43.2	43.1	43.1	43.1	43.1

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1003c**      Glass Beads - Particle Size Distribution      70 g

It is intended primarily for use in evaluating and calibrating particle size measuring instruments covering the 100 µm to 400 µm range.

## Cumulative Size Distribution

Diameter (µm)	wB (%)	Uncertainty (%)	Diameter (µm)	wB (%)	Uncertainty (%)
100	2.6	0.3	252	72.8	1.0
104	3.5	0.3	256	73.8	1.2
108	4.8	0.3	260	74.8	0.9
112	6.4	0.3	264	75.8	0.9
116	8.7	0.3	268	76.7	0.9
120	10.8	0.4	272	77.7	0.7
124	13.4	0.3	276	78.6	0.9
128	16.1	0.8	280	79.5	1.0
132	18.7	0.9	284	80.4	1.0
136	21.4	0.9	288	81.3	0.7
140	23.8	0.9	292	82.2	0.5
144	26.1	0.7	296	83.2	0.8
148	28.7	0.6	300	84.2	0.6
152	31.6	0.9	304	85.1	0.8
156	34.3	1.0	308	86.0	0.9
160	36.8	0.9	312	86.6	1.1
164	39.1	0.9	316	87.1	1.1
168	41.3	0.9	320	87.7	1.2
172	43.4	0.9	324	88.3	1.2
176	45.1	0.8	328	88.9	1.4
180	47.0	0.9	332	89.4	1.4
184	48.7	0.8	336	90.1	1.4
188	50.6	0.7	340	90.8	1.3
192	52.3	0.8	344	91.4	1.3
196	54.1	0.7	348	92.0	1.3
200	55.6	0.7	352	92.5	1.4
204	57.2	0.7	356	93.1	1.4
208	58.7	0.8	360	93.8	1.4
212	60.2	0.6	364	94.3	1.3
216	61.6	0.4	368	94.9	1.2
220	62.9	0.6	372	95.5	0.9
224	64.4	0.7	376	96.1	1.2
228	65.7	0.7	380	96.6	1.2
232	66.8	0.7	384	97.1	1.2
236	68.1	0.9	388	97.6	1.2
240	69.4	0.9	392	98.0	1.2
244	70.7	0.9	396	98.4	1.0
248	71.8	0.9	400	98.7	1.0



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1019b**      Glass Beads - Particle Size Distribution      200 g

It is intended primarily for use in evaluating and calibrating particle size measuring instruments covering the 750  $\mu\text{m}$  to 2450  $\mu\text{m}$  range.

### Certified Bead Diameters ( $\mu\text{m}$ ) Versus Mass Fraction (%)

Mass (%)	Diameter ( $\mu\text{m}$ )	Uncertainty $\pm$ ( $\mu\text{m}$ )	Mass (%)	Diameter ( $\mu\text{m}$ )	Uncertainty $\pm$ ( $\mu\text{m}$ )	Mass (%)	Diameter ( $\mu\text{m}$ )	Uncertainty $\pm$ ( $\mu\text{m}$ )
2	746	15	35	1079	21	68	1496	36
3	753	14	36	1085	22	69	1517	39
4	758	14	37	1094	22	70	1547	39
5	763	14	38	1104	22	71	1579	40
6	767	14	39	1112	22	72	1609	40
7	773	14	40	1120	23	73	1640	36
8	778	15	41	1130	22	74	1659	34
9	784	15	42	1136	23	75	1676	33
10	797	18	43	1147	24	76	1692	33
11	824	24	44	1158	24	77	1704	33
12	861	22	45	1167	24	78	1717	33
13	878	18	46	1178	23	79	1729	33
14	889	17	47	1188	24	80	1743	34
15	899	18	48	1199	24	81	1765	38
16	908	18	49	1205	23	82	1804	47
17	918	18	50	1211	23	83	1865	58
18	927	18	51	1218	23	84	1950	57
19	934	19	52	1225	23	85	2009	48
20	942	19	53	1230	24	86	2059	44
21	950	19	54	1235	23	87	2090	43
22	959	19	55	1240	24	89	2115	43
23	967	19	56	1247	24	89	2140	44
24	976	19	57	1252	24	90	2166	47
25	984	20	58	1259	24	91	2195	52
26	996	20	59	1266	24	92	2228	53
27	1004	20	60	1272	25	93	2260	52
28	1012	20	61	1282	27	94	2290	52
29	1022	20	62	1301	33	95	2320	50
30	1031	20	63	1354	51	96	2358	51
31	1041	20	64	1416	40	97	2398	53
32	1050	20	65	1440	35	98	2449	59
33	1059	20	66	1459	35			
34	1069	21	67	1477	37			

### Certified Mass Fraction (%) Versus Bead Diameter ( $\mu\text{m}$ )

Diameter ( $\mu\text{m}$ )	Mass (%)	Uncertainty $\pm$ ( $\mu\text{m}$ )	Diameter ( $\mu\text{m}$ )	Mass (%)	Uncertainty $\pm$ ( $\mu\text{m}$ )	Diameter ( $\mu\text{m}$ )	Mass (%)	Uncertainty $\pm$ ( $\mu\text{m}$ )
760	4.5	2.5	1340	62.8	1.0	1920	83.7	1.0
780	8.4	2.2	1360	63.0	1.0	1940	83.9	1.1
800	10.3	1.5	1380	63.4	1.1	1960	84.1	1.1
820	10.9	1.0	1400	63.7	1.3	1980	84.4	1.3
840	11.4	1.0	1420	64.3	1.6	2000	84.7	1.4

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product							Unit
760	4.5	2.5	1340	62.8	1.0	1920	83.7	1.0
780	8.4	2.2	1360	63.0	1.0	1940	83.9	1.1
800	10.3	1.5	1380	63.4	1.1	1960	84.1	1.1
820	10.9	1.0	1400	63.7	1.3	1980	84.4	1.3
840	11.4	1.0	1420	64.3	1.6	2000	84.7	1.4
860	11.9	1.2	1440	65.0	1.8	2020	85.3	1.4
880	13.1	1.7	1460	66.2	2.0	2040	85.7	1.4
900	15.1	2.0	1480	67.3	2.0	2060	86.2	1.5
920	17.3	2.1	1500	68.1	2.0	2080	86.6	1.7
940	19.6	2.2	1520	68.9	1.8	2100	87.4	1.8
960	22.2	2.2	1540	69.7	1.7	2120	88.3	1.9
980	24.5	2.2	1560	70.5	1.7	2140	89.1	1.9
1000	26.5	2.2	1580	71.1	1.5	2160	90.0	1.9
1020	28.8	2.1	1600	71.6	1.6	2180	90.7	1.9
1040	30.9	2.1	1620	72.3	1.6	2200	91.2	1.8
1060	33.1	2.2	1640	73.1	1.7	2220	91.8	1.8
1080	35.3	2.3	1660	73.8	2.0	2240	92.4	1.8
1100	37.6	2.4	1680	75.2	2.2	2260	92.9	1.9
1120	39.9	2.4	1700	76.6	2.3	2280	93.5	1.9
1140	42.5	2.3	1720	78.1	2.4	2300	94.2	1.9
1160	44.3	2.2	1740	79.7	2.1	2320	94.9	1.8
1180	46.2	2.3	1760	80.9	1.8	2340	95.5	1.7
1200	48.3	2.6	1780	81.5	1.5	2360	96.1	1.7
1220	51.1	3.0	1800	82.0	1.4	2380	96.5	1.6
1240	54.8	3.0	1820	82.4	1.2	2400	97.0	1.5
1260	58.2	2.8	1840	82.7	1.1	2420	97.5	1.5
1280	61.0	2.3	1860	82.9	1.1	2440	97.8	1.4
1300	62.0	1.5	1880	83.1	1.1	2460	98.0	1.7
1320	62.5	1.2	1900	83.4	1.1			

## NIST-1021

### Glass Beads - Particle Size Distribution

4 g

It is intended for use in the evaluation and calibration of equipment used to measure particle size distributions (PSD) in the 2 µm to 12 µm diameter range.

#### Certified Diameter Values

Cumulative Volume Fraction Finer (%)	Certified Diameter (µm)	Standard Uncertainty Homogeneity (µm)	Standard Uncertainty Measurement (µm)	Type B Standard Uncertainty (µm)	Combined Standard Uncertainty (µm)	Expanded Uncertainty (µm)
5	2.1	0.01	0.07	0.25	0.26	0.52
10	2.6	0.00	0.09	0.25	0.27	0.53
15	3.0	0.00	0.10	0.25	0.27	0.54
20	3.3	0.00	0.11	0.25	0.27	0.55
25	3.7	0.00	0.12	0.25	0.28	0.55
30	4.1	0.00	0.13	0.25	0.28	0.56
35	4.5	0.00	0.13	0.25	0.28	0.56
40	4.9	0.00	0.12	0.25	0.28	0.56
45	5.3	0.00	0.12	0.25	0.28	0.55

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product						Unit
50	5.8	0.00	0.11	0.25	0.27	0.55	
55	6.3	0.00	0.11	0.25	0.27	0.54	
20	3.3	0.00	0.11	0.25	0.27	0.55	
25	3.7	0.00	0.12	0.25	0.28	0.55	
30	4.1	0.00	0.13	0.25	0.28	0.56	
35	4.5	0.00	0.13	0.25	0.28	0.56	
40	4.9	0.00	0.12	0.25	0.28	0.56	
45	5.3	0.00	0.12	0.25	0.28	0.55	
50	5.8	0.00	0.11	0.25	0.27	0.55	
55	6.3	0.00	0.11	0.25	0.27	0.54	
60	6.8	0.00	0.10	0.25	0.27	0.54	
65	7.4	0.00	0.12	0.25	0.28	0.56	
70	8.1	0.00	0.15	0.25	0.29	0.58	
75	8.9	0.00	0.20	0.25	0.32	0.63	
80	9.9	0.00	0.26	0.25	0.36	0.72	
85	11.1	0.00	0.35	0.25	0.43	0.86	
90	12.9	0.00	0.51	0.25	0.57	1.14	

## Information Diameter Values (Ten Bottle Averages) Measured by LLS and ESZ

Cumulative Volume Fraction		
Finer (%)	ESZ (µm)	LLS (µm)
5	2.11	2.05
10	2.62	2.50
15	3.04	2.89
20	3.43	3.26
25	3.82	3.63
30	4.21	4.00
35	4.60	4.39
40	5.00	4.80
45	5.41	5.23
50	5.85	5.69
55	6.32	6.20
60	6.83	6.75
65	7.39	7.38
70	8.04	8.09
75	8.81	8.93
80	9.75	9.95
85	10.97	11.26
90	12.77	13.11

Rocks, Metal, Ceramic  
Glass, Grass, and Minerals

**NIST-2689**

Coal Fly Ash

3 x 10 g

It is intended for use in the evaluation of analytical methods used for the classification of coal fly ash and for the determination of constituent elements in coal fly ash or materials of a similar matrix.

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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## Certified Mass Fraction Values

Constituent Element	Mass Fraction	Constituent Element	Mass Fraction
Al	12.94 ± 0.21 %	K	2.20 ± 0.03 %
Ca	2.18 ± 0.06 %	Si	24.06 ± 0.08 %
Fe	9.32 ± 0.06 %	Na	0.25 ± 0.03 %
Mg	0.61 ± 0.05 %	Ti	0.75 ± 0.01 %
P	0.10 ± 0.01 %		

## Reference Mass Fraction Value

Property	Mass Fraction
Residue on a 45 µm electroformed sieve (ASTM Standard Test Method C430-83)	12.8 ± 1.2 %

## Information Values

Constituent Element	Mass Fraction	Constituent Element	Mass Fraction
Sb	9 mg/kg	Mn	300 mg/kg
As	200 mg/kg	Hg	0.018 mg/kg
Ba	800 mg/kg	Ni	122 mg/kg
Be	21 mg/kg	Sc	32 mg/kg
Co	48 mg/kg	Se	7 mg/kg
Cr	170 mg/kg	Sr	700 mg/kg
Cs	11 mg/kg	Th	25 mg/kg
Eu	3 mg/kg	Zu	240 mg/kg
Hf	7 mg/kg	LOI 750 °C	1.76 mg/kg
Pb	52 mg/kg	Moisture (110 °C)	0.14 mg/kg

**NIST-2690**

Coal Fly Ash

3 x 10 g

It is intended for use in the evaluation of analytical methods used for the classification of coal fly ash and for the determination of constituent elements in coal fly ash or materials of a similar matrix.

## Certified Mass Fraction Values

Constituent Element	Mass Fraction	Constituent Element	Mass Fraction
Al	12.35 ± 0.28 %	K	1.04 ± 0.04 %
Ca	5.71 ± 0.13 %	Si	25.85 ± 0.17 %
Fe	3.57 ± 0.06 %	Na	0.24 ± 0.02 %
Mg	1.53 ± 0.05 %	S	0.15 ± 0.01 %
P	0.52 ± 0.01 %	Ti	0.52 ± 0.01 %

## Reference Mass Fraction Value

Property	Mass Fraction
Residue on a 45 µm electroformed sieve (ASTM Standard Test Method C430-83)	8.0 ± 0.7 %

## Information Values

Constituent Element	Mass Fraction	Constituent Element	Mass Fraction
Sb	6 mg/kg	Mn	300 mg/kg
As	26 mg/kg	Hg	0.0005 mg/kg
Ba	5800 mg/kg	Ni	46 mg/kg
Be	8 mg/kg	Sc	17 mg/kg
Co	19 mg/kg	Se	0.8 mg/kg
Cr	67 mg/kg	Sr	2000 mg/kg

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Cs ..... 8 mg/kg	Th ..... 25 mg/kg
	Eu ..... 2 mg/kg	Zu ..... 120 mg/kg
	Hf ..... 8 mg/kg	LOI 750 °C ..... 0.53 mg/kg
	Pb ..... 39 mg/kg	Moisture (110 °C) ..... 0.12 mg/kg
<b>NIST-1992</b>	<b>Zeta Potential – Colloidal Silica (Nominal Mass Fraction 0.15 %)</b>	4 x 5 mL
	It is intended to assess the performance of instruments and/or methods that are used for measuring zeta potential and electrophoretic mobility.	
	<b>Certified Values</b>	
	<b>Measurand</b>	<b>Value</b>
	Mean electrophoretic mobility [ $\times 10^{-8} \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ ]	-4.5 ± 0.4
	Mean zeta potential [mV]	-58 ± 5
<b>NIST-1993</b>	<b>Zeta Potential – Colloidal Silica (Nominal Mass Fraction 2.2 %)</b>	4 x 5 mL
	It is intended to assess the performance of instruments and/or methods that are used for measuring zeta potential and electrophoretic mobility.	
	<b>Certified Values</b>	
	<b>Measurand</b>	<b>Value</b>
	Mean electrophoretic mobility [ $\times 10^{-8} \text{ m}^2 \text{ V}^{-1} \text{ s}^{-1}$ ]	-4.3 ± 0.3
	Mean zeta potential [mV]	-56 ± 4
<b>NIST-2206</b>	<b>Controlled Pore Glass - BET Specific Surface Area (Nominal Pore Diameter 300 nm)</b>	4 x 5 mL
	It is intended for the calibration and performance testing of instruments used for the determination of the Brunauer-Emmett-Teller (BET) specific surface area (SSA) by the static volumetric gas sorption technique.	
	<b>Certified Values</b>	
	<b>Measurement Technique</b>	<b>Specific Surface Area Value</b>
	MP	10.99 ± 0.68 m <sup>2</sup> /g
	SP	10.73 ± 0.68 m <sup>2</sup> /g
<b>NIST-2207</b>	<b>Controlled Pore Glass - BET Specific Surface Area (Nominal Pore Diameter 18 nm)</b>	4 x 5 mL
	It is intended for the calibration and performance testing of instruments used for the determination of the Brunauer-Emmett-Teller (BET) specific surface area (SSA) by the static volumetric gas sorption technique.	
	<b>Certified Values</b>	
	<b>Measurement Technique</b>	<b>Specific Surface Area Value</b>
	MP	177.8 ± 1.3 m <sup>2</sup> /g
	SP	174.2 ± 1.3 m <sup>2</sup> /g
<b>NIST-2696</b>	<b>Silica Fume (powder form)</b>	70 g

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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It is intended primarily for use in evaluating chemical and instrumental methods of analysis of silica fume used in conjunction with product specifications [1,2].

### Certified Mass Fraction Values (Dry-Mass basis)

Constituent	Mass Fraction	Constituent Element	Mass Fraction
SiO <sub>2</sub>	12.94 ± 0.21 %	K <sub>2</sub> O	2.20 ± 0.03 %
Al <sub>2</sub> O <sub>3</sub>	2.18 ± 0.06 %	Mn <sub>2</sub> O <sub>3</sub>	24.06 ± 0.08 %
CaO	9.32 ± 0.06 %	ZnO	0.25 ± 0.03 %
MgO	0.61 ± 0.05 %		

### Reference Values (Dry-Mass Basis)

Constituent	Mass Fraction
Na <sub>2</sub> O	0.129 ± 0.019 %
P <sub>2</sub> O <sub>5</sub>	0.0863 ± 0.0057 %
Fe <sub>2</sub> O <sub>3</sub>	0.055 ± 0.011 %

### Reference Values (Dry-Mass Basis)

Constituent	Mass Fraction
Moisture Content	0.251 ± 0.034 %
Loss on Ignition at 750 °C	2.11 ± 0.10 %

Unit  
(m<sup>2</sup>/g)

Specific Surface Area (S) ..... 22.92 ± 0.36

## NIST-1893

### Copper Microhardness Test Block (Knoop)

1.5 mm

it consists of a square test block of electrodeposited bright copper on an AISI 1010 steel substrate.

The test block measures 1.35 cm on each side, is approximately 1.5 mm thick, and is mounted in a thermosetting epoxy.

### Certified Mean HK and Expanded Uncertainties

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
0.245	(0.025)	SAMPLE	(SAMPLE)
0.490	(0.050)	SAMPLE	(SAMPLE)
0.980	(0.100)	SAMPLE	(SAMPLE)

## NIST-1894a

### Vickers Microhardness of Nickel

1750 μm

It consists of a square test block of electrodeposited bright copper on an AISI 1010 steel substrate.

The test block measures 1.35 cm on each side, is approximately 1750 μm thick, and is mounted in a thermosetting epoxy.

### Certified Mean Vickers HV and Expanded Uncertainty

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
0.245	(0.025)	SAMPLE	(SAMPLE)
0.490	(0.050)	SAMPLE	(SAMPLE)
0.980	(0.100)	SAMPLE	(SAMPLE)



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1896b**      Vickers Microhardness of Nickel      1 mm

It consists of a square test block of electrodeposited bright nickel on an AISI 1010 steel substrate. The test block measures 1.35 cm on each side, is approximately 1 mm thick, and is mounted in a thermosetting epoxy.

**Certified Mean Vickers HV and Expanded Uncertainty**

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
0.49	(0.050)	SAMPLE ± SAMPLE	(SAMPLE ± SAMPLE)
0.98	(0.100)	SAMPLE ± SAMPLE	(SAMPLE ± SAMPLE)
1.96	(0.200)	SAMPLE ± SAMPLE	(SAMPLE ± SAMPLE)

**NIST-1908**      Vickers Microhardness of Nickel      750 μm

It consists of a square test block of electrodeposited bright nickel on an AISI 1010 steel substrate. The test block measures 1.35 cm on each side, is approximately 750 μm thick, and is mounted in a thermosetting epoxy.

**Certified Mean Vickers HV and Expanded Uncertainty, U**

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
2.943	(0.300)	SAMPLE	(SAMPLE)

**NIST-1909**      Vickers Microhardness of Nickel      750 μm

It consists of a square test block of electrodeposited bright nickel on an AISI 1010 steel substrate. The test block measures 1.35 cm on each side, is approximately 750 μm thick, and is mounted in a thermosetting epoxy.

**Certified Mean Vickers HV and Expanded Uncertainty, U**

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
9.81	(0.300)	SAMPLE	(SAMPLE)

**NIST-2798a**      Vickers Microhardness of Nickel      750 μm

It consists of a square test block of electrodeposited bright nickel on an AISI 1010 steel substrate. The test block measures 1.35 cm on each side, is approximately 750 μm thick, and is mounted in a thermosetting epoxy.

**Certified Mean Vickers HV and Expanded Uncertainty, U**

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
4.905	(0.500)	SAMPLE	(SAMPLE)

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-2828**      Knoop Microhardness of Steel      3.2 cm

It is intended for use as a primary standard in calibrating Knoop-type microhardness testers and is certified for mean Knoop hardness values at a load of 4.90 N (0.500 kgf). It consists of a steel block, approximately 3.2 cm in diameter and 1 cm in height.

**Certified Mean Knoop HK and Expanded Uncertainty**

Load		Mean HK	
N	(kgf)	GPa	(kgf/mm <sup>2</sup> )
4.90	(0.500)	SAMPLE	(SAMPLE)

**NIST-2831**      Vickers Hardness of Ceramics and Hardmetals      25 mm D × 9.5 mm disk

It consists of a 25 mm D × 9.5 mm disk that has a nominal hardness of approximately 15.0 GPa (1530 kgf/mm<sup>2</sup>) packaged in a wooden box.

**Certified Diagonal Lengths, Average Diagonal Lengths, and Vickers Hardness**

Disk Number	Size of NIST Reference Indentations					Average (V1-V5) Diagonal Size	Average HV1 (9.8N)	Average HV1
	V1	V1	V1	V1	V1			
W-	µm	µm	µm	µm	µm	µm	GPa	kgf/mm <sup>2</sup>
2	34.70	34.80	34.85	34.65	35.10	34.82	14.99	1530
3	34.50	34.75	34.95	34.70	34.65	34.71	15.09	1539
4	34.40	34.60	34.50	34.55	34.55	34.54	15.23	1554
5	34.40	34.55	34.90	34.45	34.65	34.59	15.19	1550
6	35.15	35.10	35.10	35.05	35.20	35.12	14.74	1503
7	34.40	34.70	34.55	34.75	34.75	34.66	15.16	1546
8	34.85	35.05	35.05	34.80	34.75	34.9	14.92	1523
9	34.70	34.70	34.75	35.20	35.05	34.88	14.94	1524
10	34.70	34.75	34.95	34.75	34.75	34.78	15.03	1533
11	34.30	34.50	34.50	34.60	34.50	34.48	15.29	1560
12	34.60	34.45	34.45	34.60	34.50	34.52	15.25	1556
13	34.80	34.55	34.55	34.40	34.50	34.56	15.22	1553
14	34.40	34.80	34.55	34.35	34.35	34.49	15.28	1559
15	34.55	34.75	34.75	34.60	34.70	34.67	15.12	1543
16	34.45	34.35	34.35	34.55	34.55	34.45	15.31	1563
17	34.85	35.25	35.00	35.05	35.05	35.04	14.80	1510
18	34.45	34.20	34.45	34.70	34.55	34.47	15.30	1561
19	34.55	34.30	34.75	34.60	34.85	34.61	15.17	1548
21	34.65	34.75	34.80	34.90	35.05	34.83	14.98	1529
22	34.90	34.60	34.75	34.70	34.70	34.73	15.07	1537
23	34.80	34.55	34.65	34.60	34.85	34.69	15.10	1541
24	34.55	34.55	34.65	34.70	34.55	34.6	15.18	1549
25	34.80	34.90	34.80	34.75	34.80	34.81	15.00	1530
26	34.90	34.60	34.90	34.65	34.90	34.79	15.02	1532
27	34.60	34.75	34.80	34.85	34.80	34.76	15.04	1535
28	34.65	34.70	34.90	34.90	34.70	34.77	15.03	1534
29	34.40	34.40	34.60	34.60	34.60	34.52	15.25	1556
30	34.80	34.80	34.55	34.95	34.65	34.75	15.05	1536
31	34.60	34.75	34.90	34.95	34.60	34.76	15.04	1535
32	34.70	34.80	34.70	34.70	34.70	34.72	15.08	1538
33	35.30	35.25	34.95	34.95	35.00	35.09	14.76	1506

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product					Unit		
Disk Number	Size of NIST Reference Indentations					Average (V1-V5)	Average	Average
	V1	V1	V1	V1	V1	Diagonal Size	HV1 (9.8N)	HV1
W-	µm	µm	µm	µm	µm	µm	GPa	kgf/mm <sup>2</sup>
34	34.55	34.70	34.50	34.55	34.65	34.59	15.19	1550
35	35.15	35.05	34.90	34.85	34.95	34.98	14.85	1516
36	34.45	34.65	34.40	34.25	34.65	34.48	15.29	1560
37	34.75	34.55	34.75	34.90	34.90	34.77	15.03	1534
38	34.80	34.65	34.90	34.85	35.05	34.85	14.97	1527
39	35.35	35.00	34.90	35.35	35.20	35.16	14.70	1500
40	34.75	35.00	34.85	34.85	35.10	34.91	14.91	1522
42	34.35	34.15	34.75	34.35	34.55	34.43	15.33	1564
43	34.65	34.55	34.45	34.70	34.45	34.56	15.22	1553
44	34.90	34.90	34.80	34.80	35.00	34.88	14.94	1524
45	34.45	34.60	34.60	34.55	34.70	34.58	15.20	1551
47	35.00	34.55	34.40	34.35	34.40	34.54	15.24	1555
48	34.65	34.60	34.95	34.80	34.80	34.76	15.04	1535
49	34.70	34.45	34.55	34.50	34.55	34.55	15.23	1554
50	35.15	34.70	34.90	35.20	35.05	35	14.84	1514
52	34.20	34.35	34.85	34.95	34.80	34.63	15.16	1547
53	34.70	34.75	34.65	34.75	34.60	34.69	15.10	1541
54	34.50	34.80	35.15	34.60	34.85	34.78	15.03	1533
55	34.45	34.70	34.45	34.55	34.70	34.57	15.21	1552
56	34.25	34.55	34.60	34.55	34.75	34.54	15.24	1554
57	34.80	34.90	34.95	34.95	34.95	34.91	14.91	1522
58	34.30	34.50	34.50	34.85	34.90	34.61	15.17	1548
60	34.65	34.97	34.56	34.46	34.52	34.632	15.15	1546
61	34.80	34.75	34.80	34.70	34.60	34.73	15.07	1537
62	34.53	34.77	34.70	34.85	34.73	34.716	15.08	1539
63	34.85	34.90	34.85	34.85	34.85	34.86	14.96	1526
64	34.20	34.10	34.20	34.65	34.55	34.34	15.41	1573
66	35.10	35.00	35.30	35.20	35.35	35.19	14.68	1498
67	34.75	34.50	34.70	34.55	34.60	34.62	15.16	1547
68	34.60	34.80	34.75	34.65	34.60	34.68	15.11	1542
69	34.45	34.40	34.65	34.50	34.65	34.53	15.24	1555
70	34.60	34.50	34.60	34.55	34.55	34.56	15.22	1553
71	34.60	34.80	34.80	34.75	34.85	34.76	15.04	1535
72	34.60	35.00	35.05	34.85	34.80	34.86	14.96	1526
73	34.45	34.60	34.95	34.65	34.75	34.68	15.11	1542
74	34.35	34.50	35.05	34.80	34.75	34.69	15.11	1541
75	34.40	34.35	34.60	34.50	34.85	34.54	15.24	1555
76	34.45	34.40	34.75	34.50	34.75	34.57	15.21	1552
77	34.45	34.40	34.75	34.50	34.75	34.57	15.21	1552
78	34.85	34.60	35.05	34.50	34.75	34.75	15.05	1536
80	34.80	34.70	34.95	34.75	34.70	34.78	15.03	1533
81	34.85	34.80	34.95	35.15	35.05	34.96	14.87	1517
82	34.95	35.25	35.15	34.95	34.95	35.05	14.79	1510
83	34.75	34.70	35.05	35.00	34.85	34.87	14.95	1525
84	34.50	34.95	34.65	34.80	35.05	34.79	15.02	1532
86	34.95	35.25	35.15	34.95	34.95	35.05	14.79	1510
88	34.15	34.60	34.40	34.90	34.70	34.55	15.23	1554
89	34.75	34.95	34.80	34.75	35.00	34.85	14.97	1527

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product								Unit
Disk Number	Size of NIST Reference Indentations					Average (V1-V5)	Average	Average	
	V1	V1	V1	V1	V1	Diagonal Size	HV1 (9.8N)	HV1	
W-	µm	µm	µm	µm	µm	µm	GPa	kgf/mm <sup>2</sup>	
34	34.55	34.70	34.50	34.55	34.65	34.59	15.19	1550	
90	34.35	34.60	34.55	34.65	34.75	34.58	15.20	1551	
91	34.40	34.70	34.65	34.85	34.80	34.68	15.11	1542	
92	34.60	34.75	34.80	34.70	34.75	34.72	15.08	1538	
93	34.75	35.15	34.70	35.10	34.85	34.91	14.91	1522	
94	34.50	34.80	34.55	34.95	34.65	34.69	15.10	1541	
95	34.50	34.65	34.75	35.05	34.80	34.75	15.05	1536	
96	34.60	34.60	34.75	34.50	34.75	34.64	15.15	1545	
97	35.20	34.90	35.10	34.95	34.95	35.02	14.82	1512	
98	35.25	35.20	35.30	34.90	35.40	35.21	14.66	1496	
99	34.35	34.80	34.55	34.75	34.80	34.65	15.14	1545	
100	34.80	34.60	34.80	34.45	34.90	34.71	15.09	1539	
101	34.30	34.70	34.75	34.55	34.65	34.59	15.19	1550	
102	34.50	34.80	34.55	34.70	34.95	34.7	15.10	1540	
103	34.65	34.85	34.80	34.45	34.65	34.68	15.11	1542	
106	35.25	35.10	35.20	34.85	35.00	35.08	14.77	1507	
107	34.85	34.90	35.10	34.95	35.15	34.99	14.85	1515	
108	35.10	35.40	35.55	35.25	35.85	35.43	14.48	1478	

**NIST-1857**      **Vickers Hardness of Ceramics and Hardmetals**      2 blocks

It is intended for use with the dry sand / rubber wheel abrasion wear method as described in ASTM Standard Practice G65-81, Procedure A.

Applied Normal Load	133 N
Sliding Distance	4309 m
Sliding Speed	2.39 ± 0.01 m/s
Wheel Rubber Hardness @ 22 °C	59 ± 1 Durometer A, 5 s dwell
Minimum Time Interval Between Tests with Same Whell	4 h
Ambient Temperature	22 ± 1 °C
Ambient Relative Humidity	25 to 40 %
Sand Flow Rate	298 ± 4 g/min
Sand Type (See caution statement)	A.F.S. 50-70 test sand

**NIST-2812**      **Vickers Hardness of Ceramics and Hardmetals**      Each

It is a transfer standard intended for use in the calibration and verification of the performance of Rockwell hardness equipment using the Rockwell C Hardness Scale (HRC). A unit of SRM 2812 is a steel test block, nominally 64 mm in diameter and 15 mm thick, having a polished test surface with a micro-engraved circle 52 mm in diameter.

**Sources of Uncertainty for the Certified Average Hardness Value**

Uncertainty Source	Standard Uncertainty (HRC)
σ1 - Material Uniformity and Measurement Repeatability	± SAMPLE
σ2 - Day-to-Day Reproducibility	± SAMPLE
σ3 - NIST Standardizing Hardness Tester	± SAMPLE
σ4 - NIST Standardizing Indenter	± SAMPLE
U <sub>c</sub> - Combined Standard Uncertainty	± SAMPLE
U - Expanded Uncertainty	± SAMPLE

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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## Individually Certified Hardness Values for Specific Test Block Locations

Location	x (mm)	y (mm)	Hardness (HRC)
A	0	23	SAMPLE ± SAMPLE
B	20	12	SAMPLE ± SAMPLE
C	20	-12	SAMPLE ± SAMPLE
D	0	-23	SAMPLE ± SAMPLE
E	-20	-12	SAMPLE ± SAMPLE
F	-20	12	SAMPLE ± SAMPLE
G	0	12	SAMPLE ± SAMPLE
H	10	6	SAMPLE ± SAMPLE
I	10	-6	SAMPLE ± SAMPLE
J	-10	-6	SAMPLE ± SAMPLE
K	-10	6	SAMPLE ± SAMPLE

## Sources of Uncertainty for Hardness Values at Each of the Individual Locations Given in Table 2

Uncertainty Source	Standard Uncertainty Locations A through F (HRC)	Standard Uncertainty Locations G through K (HRC)
$\sigma_1$ - Material Uniformity & Repeatability	± SAMPLE	± SAMPLE
$\sigma_2$ - Day-to-Day Reproducibility	± SAMPLE	± SAMPLE
$\sigma_3$ - NIST Standardizing Hardness Machine	± SAMPLE	± SAMPLE
$\sigma_4$ - NIST Standardizing Indenter	± SAMPLE	± SAMPLE
$U_c$ - Combined Standard Uncertainty	± SAMPLE	± SAMPLE
U - Expanded Uncertainty	± SAMPLE	± SAMPLE

## Semivariogram Coefficients that Describe Uniformity and Repeatability

Coefficients	Values
$C_o$ .....	SAMPLE
$C_e$ .....	SAMPLE
$1/a_e$ .....	SAMPLE

## NIST Hardness Measurements for Individual Test Block Locations

Location	x (mm)	y (mm)	Hardness (HRC)
1	-10	17	SAMPLE
2	20	0	SAMPLE
3	-10	-17	SAMPLE
4	0	0	SAMPLE
5	10	17	SAMPLE
6	10	-17	SAMPLE
7	-20	0	SAMPLE

NIST-2812

Vickers Hardness of Ceramics and Hardmetals

1 block

It 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 as shown in Figure 1.

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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## NIST Hardness Measurements for Individual Test Block Locations

Parameter	Value	NIST Tolerance
Preliminary Test Force Dwell Time	3 s	± 0.1 s
Total Force Dwell Time	5 s	± 0.1 s
Recovery Dwell Time	4 s	± 0.1 s
Average Indenter Velocity [during the final 25 % of total force application]	18 μm/s to 61 μm/s	

## Effect of Indent Spacing

Spacing distance in an indentation-filled test area (center to center)	Increase in measured hardness
2.0 mm	+ 0.05 HR15N
1.5 mm	+ 0.10 HR15N

## Sources of Uncertainty for the Certified Average Hardness Value

Type	Type	Standard Uncertainty
σ <sub>1</sub> A	Material Uniformity and Measurement Repeatability	± 0.012 HR15N
σ <sub>2</sub> A	Day-to-Day Reproducibility	± 0.032 HR15N
σ <sub>3</sub> B	NIST Standardizing Hardness Tester	± 0.019 HR15N
σ <sub>4</sub> B	NIST Standardizing Indenter	± 0.100 HR15N
U <sub>c</sub>	Combined Standard Uncertainty	± 0.107 HR15N
U	Expanded Uncertainty	± 0.21 HR15N

## NIST Hardness Measurements for Individual Test Block Locations

Location	x (mm)	y (mm)	Hardness (HRC)
1	-10	17	SAMPLE
2	20	0	SAMPLE
3	-10	-17	SAMPLE
4	0	0	SAMPLE
5	10	17	SAMPLE
6	10	-17	SAMPLE
7	-20	0	SAMPLE

<b>NIST-2812</b>	<b>Flooring Radiant Panel</b>	set (3)
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It consists of three sheets of kraft paperboard 104.1 cm long, by 25.4 cm wide, and 3.05 mm thick. It is intended primarily for use in checking the operation of flooring radiant panel test apparatus used to measure critical radiant flux.

### Certified value for average critical radiant flux

$$CRF = 0.36 \pm 0.04 \text{ W} \cdot \text{cm}^{-2}$$

<b>NIST-2100a</b>	<b>Fracture Toughness of Ceramics</b>	5 bars
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It is intended for verification of fracture toughness testing procedures. This SRM may be used with any fracture toughness test method, but is optimized for beam bending testing configurations.



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Certified value	
Billet	Fracture Toughness, $K_{Ic}$	Uncertainty, $U_1$ , in Fracture Toughness of a Single Specimen
		Uncertainty, $U_m$ , in the Mean Fracture Toughness For $n = 5$ Specimens
G	4.268 $\text{MPa} \cdot \text{m}^{1/2}$	0.307 $\text{MPa} \cdot \text{m}^{1/2}$ (7.2 %)
		0.145 $\text{MPa} \cdot \text{m}^{1/2}$ (3.4 %)

**NIST-2100b** Fracture Toughness of Ceramics 5 bars

It is intended for verification of fracture toughness testing procedures. This SRM may be used with any fracture toughness test method, but is optimized for beam bending testing configurations.

**Certified value**

Billet	Fracture Toughness, $K_{Ic}$	Uncertainty, $U_1$ , in Fracture Toughness of a Single Specimen	Uncertainty, $U_m$ , in the Mean Fracture Toughness For $n = 5$ Specimens
G	4.495 $\text{MPa} \cdot \text{m}^{1/2}$	0.477 $\text{MPa} \cdot \text{m}^{1/2}$ (10.6 %)	0.224 $\text{MPa} \cdot \text{m}^{1/2}$ (5.0 %)

**NIST-762** Magnetic Moment Standard - Nickel Disk 6 mm dia

It is intended for use in the calibration of magnetometers (such as vibrating sample magnetometers) used in the measurement of the magnetic properties of materials. SRM 762 consists of a nickel disk nominally 6 mm in diameter with a thickness of 0.127 mm and a mass of  $32 \text{ mg} \pm 1 \text{ mg}$ . The SRM 762 lot was produced from rolled nickel sheet with a purity of 99.999 %. Disks were punched from the sheet.

**Certified value**

$$\sigma = 54.78 \text{ A} \cdot \text{m}^2/\text{kg} \pm 0.15 \text{ A} \cdot \text{m}^2/\text{kg} (54.78 \text{ emu/g} \pm 0.15 \text{ emu/g})$$

**NIST-764a** Magnetic Moment Standard - Nickel Disk 3 mm dia. x 3.42 mm

It is intended for use in the calibration of magnetometers (such as vibrating sample magnetometers) used in the measurement of the magnetic properties of materials. SRM 764a consists of a platinum (Pt) cylinder with a nominal diameter of 3 mm, a nominal length of 3.42 mm, and a nominal mass of 620 mg.

**Certified value**

$$\chi = 1.268 \times 10^{-8} \text{ m}^3/\text{kg} \pm 0.004 \times 10^{-8} \text{ m}^3/\text{kg} (1.009 \times 10^{-6} \text{ emu/g} \cdot \text{Oe} \pm 0.003 \times 10^{-6} \text{ emu/g} \cdot \text{Oe})$$

**NIST-772a** Magnetic Moment Standard - Nickel Disk each

It is intended for use in the calibration of magnetometers (such as vibrating sample magnetometers) used in the measurement of the magnetic properties of materials. SRM 772a consists of a nickel sphere 2.383 mm in diameter with a mass of 63.16 mg. The SRM 772a lot was produced from annealed nickel wire with a purity of 99.999 %.

**Certified value**

$$m = 3.47 \text{ mA} \cdot \text{m}^2 \pm 0.01 \text{ mA} \cdot \text{m}^2 (3.47 \text{ emu} \pm 0.01 \text{ emu})$$

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit																						
<b>NIST-2812</b>	<b>Flooring Radiant Panel</b>	set (3)																						
	It is a bullet signature standard comprising bullet profile signatures of six Land Engraved Areas (LEAs) from fired bullets.																							
	<b>Certified Value CCFmax (a) and Ds (a) for each LEA</b>																							
	<table border="1"> <thead> <tr> <th>LEA #</th> <th>CCFmax (%)</th> <th>Ds (%)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>&gt; 96.0</td> <td>&lt; 8.2</td> </tr> <tr> <td>2</td> <td>&gt; 86.2</td> <td>&lt; 26.1</td> </tr> <tr> <td>3</td> <td>&gt; 96.8</td> <td>&lt; 6.3</td> </tr> <tr> <td>4</td> <td>&gt; 95.5</td> <td>&lt; 11.0</td> </tr> <tr> <td>5</td> <td>&gt; 95.0</td> <td>&lt; 10.8</td> </tr> <tr> <td>6</td> <td>&gt; 80.8</td> <td>&lt; 35.4</td> </tr> </tbody> </table>	LEA #	CCFmax (%)	Ds (%)	1	> 96.0	< 8.2	2	> 86.2	< 26.1	3	> 96.8	< 6.3	4	> 95.5	< 11.0	5	> 95.0	< 10.8	6	> 80.8	< 35.4		
LEA #	CCFmax (%)	Ds (%)																						
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3	> 96.8	< 6.3																						
4	> 95.5	< 11.0																						
5	> 95.0	< 10.8																						
6	> 80.8	< 35.4																						
<b>NIST-8K</b>	<b>Bessemer Steel (Simulated) 0.1 % Carbon</b>	150 g																						
	It is intended primarily for use in validation of chemical and instrumental methods of analysis. A unit of SRM 8k consists of a bottle containing approximately 150 g of fine millings sized between 0.50 mm (No. 35 sieve) and 1.18 mm (No. 16 sieve).																							
	<b>Certified Value</b>																							
	<table border="1"> <thead> <tr> <th>Constituent</th> <th>Mass Fraction (%)</th> <th>Expanded Uncertainty (%)</th> </tr> </thead> <tbody> <tr> <td>Manganese (Mn)</td> <td>0.5046</td> <td>0.0083</td> </tr> <tr> <td>Copper (Cu)</td> <td>0.0200</td> <td>0.0027</td> </tr> <tr> <td>Chromium (Cr)</td> <td>0.0467</td> <td>0.0027</td> </tr> <tr> <td>Vanadium (V)</td> <td>0.0145</td> <td>0.0011</td> </tr> </tbody> </table>	Constituent	Mass Fraction (%)	Expanded Uncertainty (%)	Manganese (Mn)	0.5046	0.0083	Copper (Cu)	0.0200	0.0027	Chromium (Cr)	0.0467	0.0027	Vanadium (V)	0.0145	0.0011								
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Chromium (Cr)	0.0467	0.0027																						
Vanadium (V)	0.0145	0.0011																						
<b>NIST-13g</b>	<b>0.6 % Carbon Steel (chip form)</b>	150 g																						
	It is the best estimate of the "true" value basrd on the result of the cooperative analytical program. The value is not expected to deviate from the "true" value by more than $\pm 1$ in the last significant figure reported.																							
	<b>Certified Value</b>																							
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Aluminum (Total) .....	0.04 <sub>8</sub>																							
<b>NIST-12h</b>	<b>Basic Open-Hearth Steel 0.4 % Carbon (chip form)</b>	150 g																						

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product					Unit
	<b>C</b> Direct combustion	<b>Mn</b> Persulfate-Arsenite	<b>P</b> Photometric	<b>S</b> Combustion Iodate titration	<b>Si</b> Perchloric acid dehydration	<b>Cu</b> Photometric
	0.411	0.839	0.018	0.027	0.238	0.027
	0.405	0.844	0.018	0.028	0.237	0.028
	0.406	0.840	0.017	0.028	0.237	0.028
	0.406	0.845	0.017	0.026	0.232	0.026
	0.409	0.840	0.018	0.027	{ 0.234 0.233 }	0.027
Average	0.407	0.842	0.018	0.027	0.235	0.073
	<b>Ni</b> Photometric	<b>Cr</b> FeSO <sub>4</sub> - KMnO <sub>4</sub> titration	<b>V</b>	<b>Mo</b> Photometric	<b>N</b> Distillation-Photometric	
	0.034	0.077	0.002	0.005	0.006	
	0.032	0.074	0.002	0.006	0.005	
	0.033	0.070	{ 0.004 0.003 }	0.005	0.006	
	0.031		<0.005	0.007	0.007	
	0.032	0.077	0.033	{ 0.005 0.006 }	0.006	
Average	0.032	0.074	0.003	0.006	0.006	

**NIST-14g** Carbon Steel - (AISI 1078) (chip form) 150 g

It is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh).

**Certified Value**

Element	Value, % by wt
Carbon .....	0.735
Manganese .....	0.456
Phosphorus .....	0.006
Sulfur .....	0.019
Silicon .....	0.232
Copper .....	0.047
Nickel .....	0.030
Chromium .....	0.081
Vanadium .....	0.0008
Aluminum .....	0.0.25

**NIST-16f** Basic Open-Hearth Steel, 1 % Carbon (chip form) 150 g

It is intended primarily for use in evaluating chemical and instrumental methods of analysis.

A unit of SRM 16f consists of a bottle containing approximately 150 g of chips sized between 0.50 mm and 1.18 mm sieve openings (35 mesh and 16 mesh).

**Certified Value**

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Element	Mass Fraction %
Carbon (C) .....	0.97
Chromium (Cr) .....	0.020
Cobalt (Co) .....	0.003
Copper (Cu) .....	0.006
Manganese (Mn) .....	0.404
Molybdenum (Mo) .....	0.003
Nickel (Ni) .....	0.008
Phosphorus (P) .....	0.014
Silicon (Si) .....	0.214
Sulfur (S) .....	0.026
Vanadium (V) .....	0.002

**NIST-19h**      **Basic Electric Steel, 0.2 % Carbon (chip form)**      150 g

It is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh).

**Certified Value**

Element	Value, % by wt
Carbon .....	0.215
Manganese .....	0.393
Phosphorus .....	0.016
Sulfur .....	0.022
Silicon .....	0.211
Copper .....	0.466
Nickel .....	0.173
Chromium .....	0.003
Vanadium .....	0.038
Aluminum .....	0.002

**NIST-368**      **Carbon Steel (AISI 1211)**      150 g

is intended primarily for use in the validation of chemical and instrumental methods of analysis. It can be used to validate value assignment of in-house reference materials. SRM 368 is in the form of chips sized to pass sieve openings between 0.5 mm and 1.18 mm (35 and 16 mesh) and is packaged in a glass bottle containing approximately 150 grams.

**Certified Value**

Element	Mass Fraction (%)
Chromium (Cr) .....	0.0295
Copper (Cu) .....	0.00984
Manganese (Mn) .....	0.8238
Molybdenum (Mo) .....	0.00311
Nickel (Ni) .....	0.00783
Nitrogen (N) .....	0.01030
Phosphorus (P) .....	0.0827
Silicon (Si) .....	0.0067

**NIST-20g**      **AISI 1045 Steel (chip form)**      150 g

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product					Unit
C	Mn	P	S	Si	Cu	
Direct combustion	Peroxydisulfate Arsenite	Molybdenum blue Photometric	Combustion iodate titration	Perchloric acid dehydration	Photometric	
0.457	0.662	0.011	0.028	0.308	{0.034 0.033}	
0.461	0.662	0.011	0.025	0.306	0.035	
0.463	0.666	0.012	0.028	0.306	0.036	
0.466	0.665	0.012	0.030	0.300	0.034	
Average	0.665	0.012	0.028	0.305	0.034	

Ni	Cr	V	Mo	Al
Photometric			Photometric	Total
0.034	0.035	0.002	0.007	0.040
0.034	0.036	0.03	0.06	0.040
0.034	0.037	0.01	0.08	0.042
0.033	0.037	0.01	0.010	0.040
Average	0.036	0.002	0.008	0.040

## NIST-152a AISI 1045 Steel (chip form) 150 g

C	Mn	P	S	Si	Cu
Direct combustion	Persulfate Arsenite	Photometric	Combustion iodate titration	Perchloric acid dehydration	Photometric
0.484	0.714	0.012	0.030	0.202	0.025
0.486	0.718	0.012	{0.030 0.030}	0.205	0.022
0.488	0.716	0.012	0.031	0.204	0.021
0.484	0.720	0.012	0.030	0.203	0.024
0.491	0.72	0.012	0.028	0.198	0.023
0.485	0.714	0.013	0.031	0.202	0.021
Average	0.717	0.012	0.030	0.202	0.023

Ni	Cr	V	Mo	Sn
Weighed as nikel dimethyl-glyoxime	FeSO <sub>4</sub> -KMnO <sub>4</sub> titration		Photometric	
0.057	0.047	0.001	0.035	0.035
0.055	0.046	<0.001	0.039	0.031
0.058	0.049	<0.001	0.037	0.031
0.052	0.041	0.001	0.036	0.033
0.054			0.037	
0.057	0.048	0.003	0.033	0.031
Average	0.046	0.001	0.036	0.032

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code Product Unit

NIST-19h 0.4C Basic Oxygen Furnace Steel (chip form) 150 g

	C Combustion Gravimetric	Mn Persulfate Arsenite	P Photometric	S Combustion titration	Si Perchloric acid dehydration	Cu Photometric
	0.398	{0.822 0.825}	0.011	0.014	0.163	{0.031 0.034}
	0.398	0.827	0.012	0.014	0.162	0.032
	0.394	0.817	0.011	0.012	0.163	0.033
	{0.396 0.392}	0.828	0.013	0.013	0.160	{0.030 0.033}
	0.394	0.826	0.011	0.015	0.167	0.033
Average	0.395	0.824	0.012	0.014	0.163	0.032

	Ni Photometric	Cr	V	Mo Photometric
	0.012	{0.018 0.015}	{0.001 0.001}	0.003
	0.010	0.015	0.001	0.003
	0.009	0.014	0.001	0.002
	{0.011 0.011}	{0.015 0.020}	0.002	0.002
	0.010	0.015	0.001	0.003
Average	0.010	0.016	0.001	0.003

NIST-100b Manganese Steel (chip form) 150 g

	C Direct Combustion	Mn Persulfate Arsenite	P Gravimetric Alkali Molybdatc		S Gravimetric Combustion Iodate titration Evolution with HCl		Si Perchloric acid dehydration	
	0.395	1.89	0.021	0.025	0.030	0.028	0.030	0.213
	0.394	1.91	0.021	0.021	0.028	0.028		0.209
	0.407	1.89		0.024	0.030	0.029	0.028	0.21
	0.401	1.90		0.023	0.027	0.027	0.028	0.207
	0.392	1.88	0.023	0.023	0.029		0.027	0.219
	0.392	1.88	0.023	0.022	0.030	0.030		0.217
	0.397	1.87		0.024			0.026	0.196
Average	0.397	1.89	0.022	0.023	0.029	0.028	0.028	0.210

	Cu	Ni Weighed as nickel dimethyl-glyoxime	Cr FeSO <sub>4</sub> -KMnO <sub>4</sub> titration	V	Mo Colorimetric	N Distillation titration
	0.064	0.029	0.063	0.003	0.238	0.004
	0.068	0.028	0.063	0.003	0.235	0.004
	0.063	0.030	0.062	0.003	0.239	0.005
	0.063	0.029	0.064	0.003	0.242	0.005
	0.060	0.030	0.061	0.003	0.233	
	0.058	0.029	0.058	0.003	0.229	
	0.076	0.034	0.068	0.001	0.243	
Average	0.064	0.030	0.063	0.003	0.237	0.004

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-30f</b>	Cr-V Steel (SAE 6150) (chip form)	150 g
	Certified value, % by wt	
C .....	0.490	Cu ..... 0.074
Mn .....	0.79	Ni ..... 0.070
P .....	0.011	Cr ..... 0.945
S .....	0.009	V ..... 0.182
Si .....	0.283	N ..... 0.010

<b>NIST-33e</b>	Nickel Steel (chip form)	150 g
	It is the form of chips sized between 0.50 and 1.18 mm sieve openings. (35 and 16 mesh)	
	Certified value, % by wt	
C .....	0.186	Cu ..... 0.070
Mn .....	0.525	Ni ..... 3.36
P .....	0.005	Cr ..... 0.068
S .....	0.009	Mo ..... 0.224
Si .....	0.262	Al ..... 0.030

### Analysts

	1	2	3	4	5
C	0.186	0.186	0.186	0.186	0.186
Mn	0.528	0.528	0.528	0.528	0.528
P	0.005	0.005	0.005	0.005	0.005
S	0.009	0.009	0.009	0.009	0.009
Si	0.262	0.262	0.262	0.262	0.262
Cu	0.070	0.070	0.070	0.070	0.070
Ni	3.34	3.34	3.34	3.34	3.34
Cr	0.068	0.068	0.068	0.068	0.068
Mo	0.222	0.222	0.222	0.222	0.222
Al	0.030	0.030	0.030	0.030	0.030

<b>NIST-125b</b>	Low-Alloy High-Silicon Steel (chip form)	100 g
	It is a low-alloy steel issued in the annealed condition and containing a high amount of silicon. SRM 125b is intended for use in the evaluation or calibration of chemical and instrumental methods of analysis.	
	A unit of SRM 125b consists of a bottle containing approximately 100 g of chips.	

### Certified value

Constituent	Mass Fraction (%)	Expansion Factor, k
C	0.0261 ± 0.0030	3.2
Cr	0.0198 ± 0.0017	2.0
Cu	0.0707 ± 0.0011	3.2
Mn	0.2751 ± 0.0037	2.0
Mo	0.0087 ± 0.0007	3.2
Ni	0.0375 ± 0.0011	2.0
P	0.0276 ± 0.0012	3.2
S	0.0095 ± 0.0022	2.0
Si	2.889 ± 0.018	3.2
Sn	0.0034 ± 0.0004	2.0



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-72g</b>	Low-Alloy Steel AISI 4130 (chip form)	150 g
	Certified value, % by wt	
	C ..... 0.278	Cu ..... 0.011
	Mn ..... 0.492	Ni ..... 0.016
	P ..... 0.009	Cr ..... 0.905
	S ..... 0.014	V ..... 0.003
	Si ..... 0.223	Mo ..... 0.170

<b>NIST-129c</b>	High-Sulfur Steel (chip form)	150 g
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It is available in chip form primarily for use in checking chemical methods of analysis.

	C Combustion Chromatographic	Mn Persulfate Arsenite Titration	P Photometric	S Combustion Titration	Si Gravimetric
	0.126	0.768	0.078	0.244	0.019
	0.125	0.771	0.076	0.248	0.023
	0.124	0.77	0.074	0.248	0.018
	0.126	0.766	0.075	0.241	0.020
Average	0.125	0.769	0.076	0.245	0.020

	Cu Photometric	Ni Gravimetric	Cr Titration	V Titration	Mo Photometric
	0.014	0.251	0.012	0.010	0.002
	0.014	0.251	0.011	0.010	0.001
		0.252	0.016	0.015	0.003
	0.012	0.250	0.016	0.012	0.001
Average	0.013	0.251	0.014	0.012	0.002

<b>NIST-139b</b>	High-Sulfur Steel (chip form)	150 g
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It is in the form of chips sized between 0.50 and 1.18 mm sieve openings.  
(35 and 16 mesh)

Certified value, % by wt

Carbon .....	0.403
Manganese .....	0.778
Phosphorus .....	0.013
Sulfur .....	0.019
Silicon .....	0.242
Copper .....	0.097
Nickel .....	0.510
Chromium .....	0.488
Vanadium .....	0.004
molybdenum .....	0.182
Nitrogen .....	0.007

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
NIST-155	Chromium-Tungsten Steel (chip form)	150 g

	C	Mn		P		S	
	Direct combustion	Bismuthate (FeSO <sub>4</sub> -KMnO <sub>4</sub> )	Persulfate Arsenite	Gravimetric	Alkali Molybdate	Gravimetric	Combustion
	0.901	1.23	1.25	0.015	0.013	0.010	0.008
	0.908		1.24	0.015	0.015	0.010	0.010
	0.906		1.23		0.015	0.010	0.011
	0.904		1.25		0.016		0.012
	0.905		1.24		0.016		0.011
	0.902	1.25	1.25		0.015	0.008	0.008
	0.906		1.24		0.018	0.012	0.012
	0.91		1.22	0.018	0.016		0.012
	0.904	1.26		0.014	0.013	0.009	0.012
Average	0.905	1.25	1.24	0.016	0.015	0.010	0.011

	Si	Copper	Nickel	Cr	Vanadium	molybdenum	W	
	Gravimetric			FeSO <sub>4</sub> -KMnO <sub>4</sub> Titration			Gravimetric	Colorimetric
	0.318	0.083	0.098	0.479	0.014	0.039	0.525	
	0.326	0.078	0.102	0.488	0.015	0.038	0.517	0.518
	0.325	0.082	0.101	0.490	0.013	0.039	0.521	
	0.323	0.087	0.099	0.489	0.011	0.043	0.514	
	0.323	0.091	0.098	0.48		0.040	0.526	0.52
	0.331	0.08	0.105	0.484	0.017	0.041	0.509	
	0.321	0.073	0.087	0.493	0.010	0.035	0.519	
	0.313	0.079	0.105	0.473	0.022	0.042	0.508	
	0.319	0.095	0.103	0.492	0.013	0.038	0.515	
Average	0.322	0.083	0.100	0.485	0.014	0.039	0.517	0.519

Code	Product	Unit
NIST-179	High-Silicon Steel (chip form)	150 g

It is in chip form for use in chemical analysis.

It also is available in solid Form as SRM 1135 primarily for application in optical emission and X-ray spectrometric methods of analysis.

Certified value, % by wt

Carbon .....	0.027	Nickel .....	0.050
Manganese .....	0.094	Chromium .....	0.022
Phosphorus .....	0.006	Vanadium .....	< 0.01
Sulfur .....	0.026	Molybdenum .....	0.014
Silicon .....	3.19	Aluminum .....	0.0028
Copper .....	0.056	Tin .....	0.004

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
NIST-163	Chromium Steel (granular form)	100 g

C	Mn	P	S	Si	
Direct combustion gravimetric	Persulfate Arsenite	Alkali Molybdate	Combustion iodate titration	Perchloric acid dehydration	
0.934	{0.898 0.908}	0.007	0.027	0.487	
0.125	0.895	0.006	0.026	0.482	
0.124	0.904	0.009	0.026	0.489	
0.126	0.902	0.008	0.027	0.486	
0.126	0.895	0.007	0.029	0.487	
0.125	0.890	0.007	{0.028 0.027}	0.483	
0.124	0.898	0.006	0.030	0.492	
0.126	0.894	0.007	0.028	0.486	
0.126	0.892	0.007	0.026	0.493	
0.125	{0.900 0.905}	0.007	0.027	0.485	
0.124	0.889	0.007	0.027	0.490	
0.126	0.893	0.009	0.027	0.493	
0.126			0.028		
Average	0.933	0.897	0.007	0.027	0.488

Cu	Ni	Cr	Mo	N
	Weighed as nickel dimethylglyoxime	FeSO <sub>4</sub> -KMnO <sub>4</sub> titration	Thiocyanate Photometric	Distillation Photometric
0.092	0.083	0.982	0.030	0.030
0.087	0.078	0.980	0.029	0.029
0.085	0.078	0.986	0.027	0.027
0.086	0.080	0.980	0.030	0.030
0.088	0.079	0.980	0.027	0.027
0.092	0.086	0.974	0.028	0.028
0.092	0.081	0.988	0.029	0.029
0.085	0.079	0.988	0.032	0.032
0.089	0.084	0.984	0.030	
{0.088 0.088}	0.088	0.985	0.036	0.036
0.083	0.081	0.981	0.026	0.026
0.084	0.080	0.976	0.028	0.028
Average	0.087	0.982	0.029	0.007

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
NIST-291	Cr-Mo Steel (ASTM A-213) (chip form)	150 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of low alloy steel and materials of similar matrix. It can be used to validate value assignment of a laboratory's in-house reference materials.	
	Certified value	
	Constituent	Mass Fraction %
	Aluminum (Al total) .....	0.0041
	Carbon (C) .....	0.1769
	Chromium (Cr) .....	1.338
	Copper (Cu) .....	0.0474
	Manganese (Mn) .....	0.551
	Nickel (Ni) .....	0.538
	Phosphorus (P) .....	0.0654
	Copper (Cu) .....	0.0086
	Sulfur (S) .....	0.0198
NIST-293	Cr-Ni-Mo Steel (AISI 8620) (chip form)	150 g
	Certified value, % by wt	
	Carbon .....	0.222
	Manganese .....	0.960
	Phosphorus .....	0.018
	Sulfur .....	0.022
	Silicon .....	0.300
	Copper .....	0.032
	Nickel .....	0.480
	Chromium .....	0.510
	Vanadium .....	0.004
	Molybdenum .....	0.204
	Aluminum .....	0.039
NIST-2171	Low Alloy Steel (Ni-Cr-Cu-Mo) (HSLA 100) (chip form)	150 g
	It is a low alloy steel in the form of chips sized between 0.50 and 1.18 mm sieve openings. (35 and 16 mesh)	
	Certified value, % by wt	
	Carbon .....	0.066
	Manganese .....	0.73
	Phosphorus .....	0.006
	Sulfur .....	0.0012
	Silicon .....	0.338
	Copper .....	1.47
	Nickel .....	3.35
	Chromium .....	0.550
	Vanadium .....	0.003
	Molybdenum .....	0.546
Aluminum .....	0.019	
Niobium .....	0.024	
NIST-2171	Refined Cast Iron	100 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis. It can be used to validate value assignment of in-house reference materials and, if necessary, to calibrate carbon/sulfur analyzers.	
	Certified value, % by wt	
	Constituent	Mass Fraction (mg/kg)
	Sulfur (S) .....	7.4
	Carbon (C) .....	7.8

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-361**      **AISI 4340 Steel (chip form)**      150 g

It is intended primarily for use in chemical methods of analysis.  
 A unit of SRM 361 consists of a bottle containing approximately 150 g of chips sized between 0.5 mm and 1.18 mm sieve openings (35 mesh and 16 mesh).

Certified value, % by wt

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (total)	0.021 ± 0.005	Neodymium	0.00075 ± 0.00005
Antimony	0.0042 ± 0.0001	Nickel	2.00 ± 0.01
Arsenic	0.017 ± 0.001	Niobium	0.022 ± 0.001
Calcium	0.00010 ± 0.00005	Phosphorus	0.014 ± 0.001
Carbon	0.383 ± 0.001	Silicon	0.222 ± 0.001
Cerium	0.0040 ± 0.0001	Silver	0.0004 ± 0.0001
Chromium	0.694 ± 0.005	Sulfur	0.0143 ± 0.0003
Cobalt	0.032 ± 0.001	Tantalum	0.020 ± 0.001
Copper	0.042 ± 0.001	Tin	0.010 ± 0.001
Lead	0.000025 ± 0.000005	Titanium	0.020 ± 0.001
Magnesium	0.00026 ± 0.00005	Tungsten	0.017 ± 0.001
Manganese	0.66 ± 0.01	Vanadium	0.011 ± 0.001
Molybdenum	0.19 ± 0.01	Zirconium	0.009 ± 0.001
Boron	4.78 mg/kg ± 0.15 mg/kg		

**NIST-363**      **Chromium-Vanadium Steel (Modified) (chip form)**      150 g

It is intended primarily for use in chemical methods of analysis.  
 A unit of SRM 361 consists of a bottle containing approximately 150 g of chips sized between 0.5 mm and 1.18 mm sieve openings (35 mesh and 16 mesh).

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (total)	0.24 ± 0.01	Molybdenum	0.028 ± 0.001
Antimony	0.002 ± 0.001	Neodymium	0.0012 ± 0.0001
Arsenic	0.010 ± 0.001	Nickel	0.30 ± 0.01
Calcium	0.00022 ± 0.00005	Niobium	0.049 ± 0.001
Carbon	0.62 ± 0.01	Phosphorus	0.029 ± 0.005
Cerium	0.0030 ± 0.0001	Silicon	0.74 ± 0.01
Chromium	1.31 ± 0.01	Silver	0.0037 ± 0.0001
Cobalt	0.048 ± 0.001	Sulfur	0.0068 ± 0.0002
Copper	0.10 ± 0.01	Tin	0.104 ± 0.005
Gold	0.0005 ± 0.0001	Titanium	0.050 ± 0.001
Lead	0.00186 ± 0.00005	Tungsten	0.046 ± 0.001
Magnesium	0.00062 ± 0.00005	Vanadium	0.31 ± 0.01
Manganese	1.50 ± 0.01	Zirconium	0.049 ± 0.001
Boron	13.10 mg/kg ± 0.37 mg/kg		

**NIST-2160**      **Chromium-Vanadium Steel (Modified) (chip form)**      150 g

It is in the form of pins that are 4 mm in diameter, 12 mm long and weigh approximately 1g each.

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Certified value	
Element	Percent by Weight
Carbon .....	0.584
Sulfur .....	0.012

**NIST-2165**      **Low Alloy Steel (chip form)**      150 g

It is low alloy steel in the form of chips sized to pass through sieve openings between 0.50 mm and 1.18 mm (35 mesh to 16 mesh).

Certified value			
Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Antimony (Sb) .....	0.0010 ± 0.0005	Nickel (Ni) .....	0.155 ± 0.002
Arsenic (As) .....	0.0010 ± 0.0005	Niobium (Nb) .....	0.0004 ± 0.0001
Chromium (Cr) .....	0.050 ± 0.002	Phosphorus (P) .....	0.0052 ± 0.0002
Cobalt (Co) .....	0.0012 ± 0.0002	Silver (Ag) .....	0.0002 ± 0.0001
Copper (Cu) .....	0.0013 ± 0.0002	Sulfur (S) .....	0.003643 ± 0.000031
Lead (Pb) .....	0.0003 ± 0.0001	Tin (Sn) .....	0.002 ± 0.001
Manganese (Mn) .....	0.144 ± 0.003	Titanium (Ti) .....	0.0051 ± 0.0002
Molybdenum (Mo) .....	0.0055 ± 0.0005	Vanadium (V) .....	0.0040 ± 0.0002

**NIST-2166**      **Low Alloy Steel (chip form)**      150 g

It is low alloy steel intended primarily for use in evaluation of chemical and instrumental methods of analysis of steel and materials of similar matrix. It can be used to validate value assignment of in-house reference materials. A unit of SRM 2166 consists of one bottle containing approximately 150 g of chips sized to pass through sieve openings between 0.50 mm and 1.18 mm (35 mesh to 16 mesh).

Certified value			
Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Aluminum (Al) .....	0.012	Nickel (Ni) .....	0.022
Antimony (Sb) .....	0.0005	Niobium (Nb) .....	0.005
Arsenic (As) .....	0.0035	Phosphorus (P) .....	0.0012
Carbon (C) .....	0.015	Silicon (Si) .....	0.010
Chromium (Cr) .....	0.024	Silver (Ag) .....	0.0005
Cobalt (Co) .....	0.0022	Sulfur (S) .....	0.002164
Copper (Cu) .....	0.015	Tin (Sn) .....	0.0010
Lead (Pb) .....	0.003	Titanium (Ti) .....	0.0007
Manganese (Mn) .....	0.066	Vanadium (V) .....	0.009
Molybdenum (Mo) .....	0.0035	Sulfur (S) .....	0.002164

**NIST-2167**      **Low Alloy Steel (chip form)**      150 g

It is low alloy steel intended primarily for use in evaluation of chemical and instrumental methods of analysis of steel and materials of similar matrix. It can be used to validate value assignment of in-house reference materials. A unit of SRM 2167 consists of one bottle containing approximately 150 g of chips sized to pass through sieve openings between 0.50 mm and 1.18 mm (35 mesh to 16 mesh).

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Certified value			
Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Aluminum (Al)	0.0045	Niobium (Nb)	0.0095
Antimony (Sb)	0.0020	Phosphorus (P)	0.0031
Arsenic (As)	0.0005	Silicon (Si)	0.026
Carbon (C)	0.051	Silver (Ag)	0.0007
Chromium (Cr)	0.0015	Sulfur (S)	0.008731
Cobalt (Co)	0.0050	Tin (Sn)	0.006
Copper (Cu)	0.0014	Titanium (Ti)	0.010
Manganese (Mn)	0.022	Vanadium (V)	0.033
Molybdenum (Mo)	0.020	Sulfur (S)	0.008731
Nickel (Ni)	0.002		

**NIST-2168**      **High-Purity Iron (chip form)**      150 g

It is high-purity iron in the form of chips and is intended primarily for evaluation of methods for analysis of trace elements in iron and materials of similar matrix. It should not be used for calibration. A unit of SRM 2168 consists of one bottle containing approximately 150 g of chips.

Certified value	
Element	Mass Fraction (mg/kg)
Sulfur (S)	10.7 ± 2.8

**NIST-2168**      **Low Alloy Steel (chip form)**      150 g

It is a low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of a similar matrix. It can be used to validate value assignment of in-house reference materials.

Certified value			
Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Aluminum (Al)	0.0539	Niobium (Nb)	0.01978
Antimony (Sb)	0.00548	Phosphorus (P)	0.0407
Arsenic (As)	0.0131	Silicon (Si)	0.1816
Boron (B)	0.00215	Sulfur (S)	0.0347
Cobalt (Co)	0.0256	Tin (Sn)	0.0474
Chromium (Cr)	0.2195	Tantalum (Ta)	0.0522
Copper (Cu)	0.2973	Titanium (Ti)	0.180
Manganese (Mn)	0.680	Vanadium (V)	0.0540
Molybdenum (Mo)	0.1030	Zirconium (Zr)	0.0132

**NIST-2162**      **Chromium-Vanadium Steel (Modified) (chip form)**      150 g

It is a low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of a similar matrix. It can be used to validate value assignment of in-house reference materials.

Certified value			
Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Aluminum (Al)	0.0681	Phosphorus (P)	0.0336
Arsenic (As)	0.01804	Silicon (Si)	0.3532
Boron (B)	0.00470	Sulfur (S)	0.03267

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Cobalt (Co) .....	0.0589
	Chromium (Cr) .....	0.9252
	Copper (Cu) .....	0.1225
	Manganese (Mn) .....	2.095
	Molybdenum (Mo) .....	0.3545
	Niobium (Nb) .....	0.0721
	Nickel (Ni) .....	1.1537
	Tin (Sn) .....	0.0467
	Tantalum (Ta) .....	0.02153
	Titanium (Ti) .....	0.0988
	Tungsten (W) .....	0.00030
	Vanadium (V) .....	0.1996
	Zirconium (Zr) .....	0.02928

**NIST-2163**      **Low Alloy Steel (chip form)**      150 g

It is a low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of a similar matrix.

It can be used to validate value assignment of in-house reference materials.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Aluminum (Al) .....	0.0426	Nickel (Ni) .....	0.5095
Antimony (Sb) .....	0.01033	Phosphorus (P) .....	0.0126
Arsenic (As) .....	0.0520	Silicon (Si) .....	0.6168
Boron (B) .....	0.00541	Sulfur (S) .....	0.0225
Carbon (C) .....	0.1934	Tin (Sn) .....	0.0109
Cobalt (Co) .....	0.0938	Tantalum (Ta) .....	0.01187
Chromium (Cr) .....	0.5033	Titanium (Ti) .....	0.307
Copper (Cu) .....	0.0432	Tungsten (W) .....	0.00176
Manganese (Mn) .....	1.623	Vanadium (V) .....	0.3062
Molybdenum (Mo) .....	0.4956	Zirconium (Zr) .....	0.0374
Niobium (Nb) .....	0.0989		

**NIST-2164**      **Low Alloy Steel (chip form)**      150 g

It is a low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of a similar matrix.

It can be used to validate value assignment of in-house reference materials.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Aluminum (Al) .....	0.0098	Phosphorus (P) .....	0.02079
Arsenic (As) .....	0.0110	Silicon (Si) .....	0.0575
Chromium (Cr) .....	1.4700	Sulfur (S) .....	0.0127
Copper (Cu) .....	0.5156	Tin (Sn) .....	0.02087
Manganese (Mn) .....	1.219	Tantalum (Ta) .....	0.02919
Molybdenum (Mo) .....	0.1982	Titanium (Ti) .....	0.02820
Niobium (Nb) .....	0.0404	Vanadium (V) .....	0.1059
Nickel (Ni) .....	0.2029	Zirconium (Zr) .....	0.00171

**NIST-2164**      **High-Nickel Steel (Nominal Mass Fraction 36 % Ni) (chip form)**      150 g

It is a low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of a similar matrix.

It can be used to validate value assignment of in-house reference materials.



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit																																								
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<b>NIST-346a</b>	<p><b>Valve Steel (chip form)</b></p> <p>It is in the form of chips and is intended for use in chemical methods of analysis.</p> <p>Certified value</p> <table> <thead> <tr> <th>Constituent</th> <th>% by wt</th> <th>Constituent</th> <th>% by wt</th> </tr> </thead> <tbody> <tr> <td>Carbon .....</td> <td>0.502</td> <td>Copper .....</td> <td>0.375</td> </tr> <tr> <td>Manganese .....</td> <td>9.16</td> <td>Nickel .....</td> <td>3.43</td> </tr> <tr> <td>Phosphorus .....</td> <td>0.031</td> <td>Chromium .....</td> <td>21.08</td> </tr> <tr> <td>Sulfur .....</td> <td>0.002</td> <td>Vanadium .....</td> <td>0.096</td> </tr> <tr> <td>Silicon .....</td> <td>0.219</td> <td>Molybdenum .....</td> <td>0.237</td> </tr> <tr> <td></td> <td></td> <td>Nitrogen .....</td> <td>0.442</td> </tr> </tbody> </table>	Constituent	% by wt	Constituent	% by wt	Carbon .....	0.502	Copper .....	0.375	Manganese .....	9.16	Nickel .....	3.43	Phosphorus .....	0.031	Chromium .....	21.08	Sulfur .....	0.002	Vanadium .....	0.096	Silicon .....	0.219	Molybdenum .....	0.237			Nitrogen .....	0.442	150 g												
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<b>NIST-862</b>	<p><b>High-Temperature Alloy L 605 (chip form)</b></p> <p>It is in the form of chips sized between 0.35 and 0.85 mm sieve openings (46 and 20 mesh)</p> <p>Certified value</p> <table> <thead> <tr> <th>Element</th> <th>% by wt</th> <th>Element</th> <th>% by wt</th> </tr> </thead> <tbody> <tr> <td>Carbon .....</td> <td>0.120</td> <td>Chromium .....</td> <td>20.0</td> </tr> <tr> <td>Manganese .....</td> <td>1.59</td> <td>Vanadium .....</td> <td>0.005</td> </tr> <tr> <td>Phosphorus .....</td> <td>0.002</td> <td>Iron .....</td> <td>1.80</td> </tr> <tr> <td>Sulfur .....</td> <td>0.0008</td> <td>Tungsten .....</td> <td>15.1</td> </tr> <tr> <td>Silicon .....</td> <td>0.017</td> <td>Cobalt .....</td> <td>51.5</td> </tr> <tr> <td>Copper .....</td> <td>0.0010</td> <td>Nitrogen .....</td> <td>0.026</td> </tr> <tr> <td>Nickel .....</td> <td>9.74</td> <td></td> <td></td> </tr> </tbody> </table>	Element	% by wt	Element	% by wt	Carbon .....	0.120	Chromium .....	20.0	Manganese .....	1.59	Vanadium .....	0.005	Phosphorus .....	0.002	Iron .....	1.80	Sulfur .....	0.0008	Tungsten .....	15.1	Silicon .....	0.017	Cobalt .....	51.5	Copper .....	0.0010	Nitrogen .....	0.026	Nickel .....	9.74			100 g								
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<b>NIST-868</b>	<p><b>High Temperature Alloy (Fe-Ni-Co)</b></p> <p>It is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh)</p> <p>Certified value</p> <table> <thead> <tr> <th>Constituent</th> <th>% by wt</th> <th>Constituent</th> <th>% by wt</th> </tr> </thead> <tbody> <tr> <td>Aluminum .....</td> <td>0.99</td> <td>Nickel .....</td> <td>37.78</td> </tr> <tr> <td>Boron .....</td> <td>0.078</td> <td>Niobium .....</td> <td>2.99</td> </tr> <tr> <td>Carbon .....</td> <td>0.022</td> <td>Phosphorus .....</td> <td>&lt;0.003</td> </tr> <tr> <td>Chromium .....</td> <td>0.077</td> <td>Silicon .....</td> <td>0.097</td> </tr> <tr> <td>Cobalt .....</td> <td>16.1</td> <td>Sulfur .....</td> <td>0.0025</td> </tr> <tr> <td>Copper .....</td> <td>0.022</td> <td>Tantalum .....</td> <td>0.003</td> </tr> <tr> <td>Iron .....</td> <td>40.5</td> <td>Titanium .....</td> <td>1.48</td> </tr> <tr> <td>Manganese .....</td> <td>0.052</td> <td>Vanadium .....</td> <td>0.077</td> </tr> <tr> <td>Molybdenum .....</td> <td>0.014</td> <td></td> <td></td> </tr> </tbody> </table>	Constituent	% by wt	Constituent	% by wt	Aluminum .....	0.99	Nickel .....	37.78	Boron .....	0.078	Niobium .....	2.99	Carbon .....	0.022	Phosphorus .....	<0.003	Chromium .....	0.077	Silicon .....	0.097	Cobalt .....	16.1	Sulfur .....	0.0025	Copper .....	0.022	Tantalum .....	0.003	Iron .....	40.5	Titanium .....	1.48	Manganese .....	0.052	Vanadium .....	0.077	Molybdenum .....	0.014			100 g
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Cobalt .....	16.1	Sulfur .....	0.0025																																							
Copper .....	0.022	Tantalum .....	0.003																																							
Iron .....	40.5	Titanium .....	1.48																																							
Manganese .....	0.052	Vanadium .....	0.077																																							
Molybdenum .....	0.014																																									

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-345b</b>	Fe-Cr-Ni Alloy UNS J92180 (chip form)	150 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis for elements in high temperature alloys and materials of a similar matrix. It can be used to validate value assignment of in-house reference materials.	
	Certified value	
	Element	Mass Fraction (%)
	Chromium (Cr)	16.03
	Cobalt (Co)	0.0660
	Copper (Cu)	3.000
	Manganese (Mn)	0.4902
	Molybdenum (Mo)	0.1541
	Nickel (Ni)	4.054
	Constituent	Mass Fraction (%)
	Niobium (Nb)	0.2143
	Phosphorus (P)	0.0176
	Silicon (Si)	0.7821
	Tin (Sn)	0.00568
	Tungsten (W)	0.0394
	Vanadium (V)	0.0662
<b>NIST-1090</b>	Oxygen in Ingot Iron (rod form)	0.635 cm dia, 10.2 cm long
	It is intended for use in the evaluation of methods and the calibration of equipment used in the determination of oxygen in iron or ferrous materials.	
	Oxygen Content µg/g	
	Vacuum Fusion	14 MeV Neutron Activation
	Inert Gas Fusion	
	$\bar{X} = 484$	492
	$S^2 = 14$	28
	$n = 216$	6
		497
		13
		12
<b>NIST-1091a</b>	Oxygen in Stainless Steel (AISI 431) (rod form)	0.79 cm dia, 10.2 cm long
	It is intended for use in the evaluation of methods and the calibration of equipment used in the determination of oxygen in steels or ferrous materials.	
	Oxygen concentration ..... $132.2 \pm 3.1^a$ µg/g	
<b>NIST-1093</b>	Oxygen in Valve Steel (rod form)	0.79 cm dia, 10.2 cm long
	It is intended primarily for the determination of oxygen in ferrous materials. The high manganese content of the valve steel material (9 to 10%) makes the determination of oxygen by vacuum and inert gas fusion methods difficult because of the gettering action of the manganese.	
	Description	Oxygen, ppm
	Valve Steel	60 <sup>a</sup>
<b>NIST-1094</b>	Oxygen in Maraging Steel (rod form)	0.6 cm dia, 8.2 cm long
	It is intended primarily for use in vacuum and inert gas fusion methods for the determination of oxygen.	
	Description	Oxygen, ppm
	Maraging Steel	4.5 <sup>a</sup>

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1755</b>	Nitrogen in Low Alloy Steel (disk form) It is intended for use primarily in optical emission spectrometric methods of analysis. Certified value Nitrogen ..... 118.4 mg/kg ± 1.8 mg/kg	35 mm dia, 19 mm thick
<b>NIST-166c</b>	Low-Carbon Stainless Steel (AISI 316L) (chip form) It is intended primarily for use in validation of chemical and instrumental methods of analysis. A unit of SRM 166c consists of a bottle containing approximately 100 g of chips sized between 710 µm (25 mesh) and 75 µm (200 mesh). Certified value Constituent Carbon (C) ..... 0.00781	100 g
<b>NIST-101g</b>	18 Cr-10 Ni Steel (AISI 304L) (powder form) It is in the form of a powder and is intended for use in chemical methods of analysis. Certified value Constituent                      Percent, by wt      Constituent                      Percent, by wt Carbon ..... 0.136      Copper ..... 0.029 Manganese ..... 0.085      Nickel ..... 10.00 Phosphorus ..... 0.007      Chromium ..... 18.46 Sulfur ..... 0.0078      Vanadium ..... 0.041 Silicon ..... 1.08      Molybdenum ..... 0.004 Cobalt ..... 0.09	100 g
<b>NIST-160b</b>	Stainless Steel, Cr 18-Ni 12-Mo 2 (AISI 316) (chip form) It is intended for applications in chemical and instrumental methods of analysis. A unit of SRM 160b consists of a bottle containing approximately 150 g of chips. Certified value Constituent                      Mass Fraction (%)      Constituent                      Mass Fraction (%) C ..... 0.0445 ± 0.0014      Mo ..... 2.386 ± 0.024 Co ..... 0.1052 ± 0.0057      Ni ..... 12.35 ± 0.22 Cr ..... 18.37 ± 0.21      S ..... 0.0175 ± 0.0032 Cu ..... 0.1734 ± 0.0075      V ..... 0.0508 ± 0.0034 Mn ..... 1.619 ± 0.075	150 g
<b>NIST-123c</b>	Stainless Steel Cr 17-Ni 11-Nb 0.6 (AISI 348) (chip form) It is available in chip form primarily for use in checking chemical methods of analysis. A companion material, It is in solid form, also is available for application in optical emission and x-ray spectrometric methods of analysis. Certified value Element                      Percent by wt      Element                      Percent by wt Carbon ..... 0.056      Nickel ..... 11.3 <sub>4</sub> Mangaese ..... 1.7 <sub>5</sub> Chromium ..... 17.4 <sub>0</sub> Phosphorus ..... 0.024      Molybdenum ..... 0.22 Sulfur ..... 0.014      Niobium ..... 0.65	150 g

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Silicon .....	0.59	Tantalum .....	< 0.001
Copper .....	0.103	Cobalt .....	0.12

## NIST-133b Chromium-Molybdenum Steel 150 g

It is intended primarily for use in evaluating chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
C .....	0.128	Cu .....	0.080
Mn .....	1.07	Ni .....	0.230
P .....	0.018	Cr .....	12.63
S .....	0.328	V .....	0.071
Si .....	0.327	Mo .....	0.052

## NIST-339 17 Chromium-9 Nickel-0.2 Selenium Steel (granule form) 150 g

C	Mn	P	S	Si	Cu	
Direct combustion	Persulfate Arsenite	Photometric	Combustion Iodate titration	Perchloric acid dehydration	Photometric	
0.052	0.732	0.135	0.013	0.652	0.201	
{0.050 0.049}	0.737	0.130	0.014	0.646	0.197	
0.052	0.732		0.014	0.64	0.195	
{0.048 0.051}	0.739	0.133	0.014	0.665	0.198	
0.056	0.740	{0.128 0.125}	{0.011 0.013}	0.653	0.198	
0.057	0.745	0.121	0.015	0.665	0.204	
Average	0.052	0.738	0.129	0.013	0.654	0.199

Ni	Cr	V	Mo	Co	Se	
Weighed as nickel dimethyl-glyoxime	FeSO <sub>4</sub> -KMnO <sub>4</sub> titration		Photometric			
8.87	17.41	0.058	0.247	0.099	0.248	
8.92	17.43		0.24	0.091	0.250	
8.88	17.46		0.252	0.093	0.243	
8.93	17.43	0.063	0.247	0.100	0.246	
8.87	17.39	0.061	0.248	0.099	0.247	
	17.42	0.052	0.255			
Average	8.89	17.42	0.058	0.248	0.096	0.247

## NIST-893 Stainless Steel SAE 405 (chip form) 150 g

It is in the form of chips sized between 0.50 and 1.18 mm (Sieve Nos. 35 and 16).

Certified value

Element	Percent by wt	Element	Percent by wt
Carbon .....	0.027	Nickel .....	0.192
Manganese .....	0.378	Chromium .....	13.55
Phosphorus .....	0.022	Vanadium .....	0.080
Sulfur .....	0.0003	Molybdenum .....	0.023

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Silicon .....	0.326	Cobalt .....	0.020
Copper .....	0.261		

**NIST-895**      **Stainless Steel (SAE 201) (chip form)**      150 g

It is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh).

Certified value

Element	Percent by wt	Element	Percent by wt
Carbon .....	0.066	Nickel .....	5.34
Manganese .....	7.09	Chromium .....	16.72
Phosphorus .....	0.038	Vanadium .....	0.079
Sulfur .....	0.0033	Molybdenum .....	0.337
Silicon .....	0.399	Cobalt .....	0.126
Copper .....	0.439		

**NIST-50c**      **Tungsten-Chromium-Vanadium Steel (chip form)**      150 g

It is intended primarily for use in validation of chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Percent, by wt
As .....	0.0225	Ni .....	0.0686
Cr .....	4.128	P .....	0.0222
Cu .....	0.0792	S .....	0.006367
Mn .....	0.3417	Si .....	0.3102
Mo .....	0.0821	Sn .....	0.0183
N .....	0.0117	V .....	1.158
		W .....	18.445

**NIST-132b**      **Tool Steel (AISI M2) (chip form)**      150 g

It is in the form of chips and is intended for use in checking chemical methods of analysis.

Certified value

Element	Percent by wt	Constituent	Percent by wt
Carbon .....	0.0864 ± 0.005	Nickel .....	0.23 ± 0.01
Manganese .....	0.341 ± 0.005	Chromium .....	4.38 ± 0.01
Phosphorus .....	0.012 ± 0.01	Vanadium .....	1.83 ± 0.01
Sulfur .....	0.004 ± 0.001	Molybdenum .....	4.9 ± 0.1
Silicon .....	0.185 ± 0.005	Tungsten .....	6.28 ± 0.01
Copper .....	0.088 ± 0.001	Cobalt .....	0.029 ± 0.001

**NIST-1264a**      **High-Carbon Steel (Modified) (disk form)**      31 mm dia and 19 mm thick

It is a low alloy, high-carbon steel intended primarily for evaluation of methods for analysis of elements in steel alloys of similar composition.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Antimony (Sb) .....	0.034	Molybdenum (Mo) .....	0.49
Arsenic (As) .....	0.052	Neodymium (Nd) .....	0.00007
Carbon (C) .....	0.871	Nickel (Ni) .....	0.142
Calcium (Ca) .....	0.00004	Niobium (Nb) .....	0.157

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Cerium (Ce) .....	0.00022
	Chromium (Cr) .....	0.066
	Cobalt (Co) .....	0.15
	Copper (Cu) .....	0.250
	Lanthanum (La) .....	0.00007
	Lead (Pb) .....	0.024
	Magnesium (Mg) .....	0.00015
	Manganese (Mn) .....	0.258
	Phosphorus (P) .....	0.010
	Silicon (Si) .....	0.067
	Sulfur (S) .....	0.025
	Tantalum (Ta).....	0.11
	Tellurium (Te) .....	0.00018
	Titanium (Ti) .....	0.24
	Tungsten (W) .....	0.102
	Vanadium (V) .....	0.106
	Zirconium (Zr) .....	0.069

NIST-134a

Molybdenum-Tungsten-Chromium-Vanadium Steel (chip form)

150 g

	C	Mn	P	S		Si	Cu	Ni
	Direct combustion	Persulfate Arsenite	Alkali Molybdate	Gravimetric	Combution iodate titration	Persulfate acid dehydration	Colorimetric	Colorimetric
	0.804	0.218	0.019	0.006	0.005	0.329	0.099	0.089
	0.808	{ 0.213 } { 0.217 }	0.021		0.008	0.329	0.099	{ 0.091 } { 0.087 }
	0.811	0.221	0.020	0.006	0.008	0.330	0.099	0.086
	0.806	0.217	{ 0.017 } { 0.018 }	0.006	0.006	0.321	0.102	0.092
	0.807	0.223	0.016	0.008	0.007	0.327	0.098	0.086
	0.802	0.223	0.018		0.008	0.316	0.109	0.082
	0.812	{ 0.219 } { 0.215 }	0.020		0.007	0.320	0.101	0.090
	0.808	0.22	0.018		0.006	0.325	0.104	0.09
	0.813	0.209	0.018	0.008	0.008	0.313	0.095	0.090
Average	0.808	0.218	0.018	0.007	0.007	0.323	0.101	0.088

	Cr	V	Mo		W	
	Persulfate oxidation	HNO <sub>3</sub> oxidation, potentiometric titration in presence of tungsten	Gravimetric	Colorimetric	Gravimetric	Colorimetric
	3.65	1.24	8.32		2.03	2.05
	3.68	1.24	8.36	8.29	1.98	1.98
	3.68	1.23		8.36		2.05
	3.69	1.25		8.41		1.98
	3.67	1.25		8.38		1.97
	3.68	1.25		8.39	2.01	
	3.69	1.26	8.32	8.31	2.06	1.99
	3.69	1.25	8.34	8.37	1.97	1.98
	3.64	1.25	8.36		1.99	
Average	3.67	1.25	8.34	8.36	8.36	2.00

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit	
<b>NIST-1761a</b>	Low Alloy Steel	34 mm in dia and 19 mm thick	
It is intended for use in the evaluation of chemical and instrumental methods of analysis and in calibration of instrumental methods of analysis.			
Certified value			
Constituent	Mass Fraction (%)	Constituent                      Mass Fraction (%)	
B .....	0.0023 ± 0.0006	Cr .....	0.222 ± 0.006
Al .....	0.055 ± 0.005	Mn .....	0.679 ± 0.010
Si .....	0.182 ± 0.011	Ni .....	1.981 ± 0.019
P .....	0.042 ± 0.002	Cu .....	0.298 ± 0.006
S .....	0.037 ± 0.006	Zr .....	0.012 ± 0.002
Ti .....	0.173 ± 0.007	Nb .....	0.021 ± 0.002
V .....	0.054 ± 0.002	Mo .....	0.103 ± 0.002
<b>NIST-1764a</b>	Low Alloy Steel	34 mm in dia and 19 mm thick	
It is intended for use in the evaluation of chemical and instrumental methods of analysis and in calibration of instrumental methods of analysis.			
Certified value			
Constituent	Mass Fraction (%)	Constituent                      Mass Fraction (%)	
Al .....	0.0098 ± 0.0015	Nb .....	0.0416 ± 0.0024
As .....	0.0100 ± 0.0021	Ni .....	0.2006 ± 0.0045
C .....	0.592 ± 0.017	P .....	0.0210 ± 0.0016
Cr .....	1.468 ± 0.031	S .....	0.0118 ± 0.0030
Cu .....	0.5178 ± 0.0063	Si .....	0.0595 ± 0.0036
Mn .....	1.193 ± 0.058	Ta .....	0.0297 ± 0.0042
Mo .....	0.2007 ± 0.0051	Ti .....	0.0286 ± 0.0023
		V .....	0.1063 ± 0.0021
<b>NIST-663</b>	Chromium-Vanadium Steel (Modified)	3.2 mm in dia and 51 mm long	
It is intended primarily for use in chemical methods of analysis			
Certified value			
Constituent	Mass Fraction (%)	Constituent                      Mass Fraction (%)	
Aluminum (total) .....	0.24 ± 0.01	Molybdenum .....	0.030 ± 0.001
Antimony .....	0.002 ± 0.001	Nickel .....	0.32 ± 0.01
Arsenic .....	0.010 ± 0.001	Niobium .....	0.049 ± 0.001
Carbon .....	0.57 ± 0.01	Phosphorus .....	0.029 ± 0.005
Chromium .....	1.31 ± 0.01	Silicon .....	0.74 ± 0.01
Cobalt .....	0.048 ± 0.001	Sulfur .....	0.0055 ± 0.0001
Copper .....	0.098 ± 0.005	Titanium .....	0.050 ± 0.001
Gold .....	0.0005 ± 0.0001	Tungsten .....	0.046 ± 0.005
Lanthanum .....	0.0006 ± 0.0001	Vanadium .....	0.31 ± 0.01
Lead .....	0.0022 ± 0.0001	Zirconium .....	0.050 ± 0.001
Manganese .....	1.50 ± 0.01		

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1134** Molybdenum-Tungsten-Chromium-Vanadium Steel (chip form) 31 mm dia and 19 mm thick

It is a low-alloy steel issued in the annealed condition and containing a high amount of silicon.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
C .....	0.0261 ± 0.0030	Ni .....	0.0375 ± 0.0011
Cr .....	0.0198 ± 0.0017	P .....	0.0276 ± 0.0012
Cu .....	0.0707 ± 0.0011	S .....	0.0095 ± 0.0022
Mn .....	0.2751 ± 0.0037	Si .....	2.889 ± 0.018
Mo .....	0.0087 ± 0.0007	Sn .....	0.0034 ± 0.0004

**NIST-1135** High-Silicon Steel (disk form) 31.8 mm dia and 19.1 mm thick

C	Mn Peroxydisulfate Arsenite	P Photometric	S Combustion Iodate titration	Si Perchloric acid dehydration	Cu Photometric
0.025	0.096	0.005	0.026	3.18	0.054
0.028	0.095	0.008	0.028	3.18	0.056
0.028	0.093	0.006	0.026	3.21	0.057
0.026	0.092	0.006	0.026	3.18	0.056
Average 0.027	0.738	0.006	0.026	3.19	0.056

Ni Weighed as nickel dimethyl-glyoxime	Cr FeSO <sub>4</sub> -KMnO <sub>4</sub> titration	V	Mo Photometric	Al	Sn
0.051	0.024	< 0.01	0.013	{0.0027 0.0032}	0.005
0.049	0.023		0.014		0.004
0.047	0.022		0.015	0.0030	0.002
0.052	0.020	< 0.01	0.012	0.0027 0.0026	
Average 0.050	0.022	0.01	0.014	0.0028	0.004

**NIST-1218** Low Carbon and Sulfur Silicon Steel 32 mm dia and 19 mm thick

It is intended for use in optical emission and x-ray spectrometric methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Carbon .....	0.0029	Copper .....	0.003
Manganese .....	0.014	Chromium .....	0.006
Sulfur .....	0.0011	Aluminum .....	0.005



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1224** Carbon Steel (AISI 1078) 32 mm dia and 19 mm thick

It is intended primarily for use in the validation of chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Carbon (C) .....	0.7518 ± 0.0035	Molybdenum (Mo) .....	0.01320 ± 0.00027
Chromium (Cr) .....	0.0710 ± 0.0031	Nickel (Ni) .....	0.0537 ± 0.0014
Copper (Cu) .....	0.0711 ± 0.0016	Phosphorus (P) .....	0.00884 ± 0.00087
Manganese (Mn) .....	0.4098 ± 0.0021	Silicon (Si) .....	0.1725 ± 0.0020
		Sulfur (S) .....	0.0395 ± 0.0022

**NIST-1225** Low-Alloy Steel AISI 4130 (disk form) 32 mm dia and 19 mm thick

It is intended primarily for use in the validation of chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Carbon .....	0.274	Silicon .....	0.221
Manganese .....	0.48	Nickel .....	0.018
Phosphorus .....	0.007	Chromium .....	0.91
Sulfur .....	0.014	Vanadium .....	0.004
		Molybdenum (Mo) .....	0.166

**NIST-1226** Low Alloy Steel (HY 130) (disk form) 32 mm dia and 19 mm thick

It is intended primarily for use in the validation of chemical and instrumental methods of analysis.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (total) .....	0.054 ± 0.004	Nickel .....	5.42 ± 0.04
Carbon .....	0.085 ± 0.003	Phosphorus .....	0.0022± 0.0004
Chromium .....	0.467 ± 0.005	Silicon .....	0.231± 0.004
Cobalt .....	0.029 ± 0.003	Sulfur .....	0.0044± 0.0006
Copper .....	0.125 ± 0.005	Titanium .....	0.0021± 0.0003
Manganese .....	0.274 ± 0.005	Vanadium .....	0.0018± 0.0004
Molybdenum .....	0.446± 0.005		

**NIST-1227** Basic Open-Hearth Steel, 1 % Carbon (disk form) 32 mm dia and 19 mm thick

It is intended for use in optical emission and x-ray spectrometric methods of analysis.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Carbon .....	0.97	Copper .....	0.006
Manganese .....	0.402	Nickel .....	0.007
Phosphorus .....	0.014	Chromium .....	0.019
Sulfur .....	0.026	Vanadium .....	0.002
Silicon .....	0.215	Molybdenum .....	0.003
		Cobalt .....	0.003

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit	
<b>NIST-1228</b>	<b>Basic Open-Hearth Steel, 0.1 % Carbon (disk form)</b>	32 mm dia and 19 mm thick	
It is intended for use in optical emission and X-ray spectrometric methods of analysis.			
Certified value			
Constituent	Mass Fraction (%)	Constituent      Mass Fraction (%)	
Carbon .....	0.072	Copper .....	0.012
Manganese .....	0.365	Nickel .....	0.018
Phosphorus .....	0.004	Chromium .....	0.016
Sulfur .....	0.018	Vanadium .....	< 0.001
Silicon .....	0.007	Molybdenum .....	0.009
		Aluminum (total) .....	0.061
<b>NIST-1265a</b>	<b>Electrolytic Iron (disk form)</b>	31 mm dia and 19 mm thick	
It is high-purity, electrolytic iron intended primarily for evaluation of methods for analysis of elements in steel alloys of similar composition.			
Certified value			
Elements	Mass Fraction (%)	Elements      Mass Fraction (%)	
Boron (B) .....	0.00013	Manganese (Mn) .....	0.0057
Carbon (C) .....	0.0067	Molybdenum (Mo) .....	0.0050
Chromium (Cr) .....	0.0072	Nickel (Ni) .....	0.041
Cobalt (Co) .....	0.0070	Phosphorus (P) .....	0.0011
Copper (Cu) .....	0.0058	Silicon (Si) .....	0.0080
Lead (Pb) .....	0.000015	Sulfur (S) .....	0.0055
		Vanadium (V) .....	0.0006
<b>NIST-1269</b>	<b>Line Pipe Steel (disk form)</b>	32 mm dia and 19 mm thick	
It is intended for use in optical emission and X-ray spectrometric methods of analysis.			
Certified value			
Elements	Mass Fraction (%)	Elements      Mass Fraction (%)	
Carbon (C) .....	0.298	Nickel (Ni) .....	0.108
Manganese (Mn) .....	1.35	Chromium (Cr) .....	0.201
Phosphorus (P) .....	0.012	Vanadium (V) .....	0.004
Sulfur (S) .....	0.0061	Molybdenum (Mo) .....	0.036
Silicon (Si) .....	0.189	Lead (Pb) .....	0.005
Copper (Cu) .....	0.095	Aluminum (Al) .....	0.016
<b>NIST-1270</b>	<b>2 ¼ Cr - 1 Mo Low Alloy Steel, A 336 (F-22) (disk form)</b>	32 mm dia and 19 mm thick	
It is intended for use in optical emission and x-ray spectrometric methods of analysis.			
Certified value			
Elements	Mass Fraction (%)	Elements      Mass Fraction (%)	
Carbon .....	0.077	Nickel .....	0.174
Manganese .....	0.626	Chromium .....	2.34
Phosphorus .....	0.0065	Vanadium .....	0.013
Sulfur .....	0.0065	Molybdenum .....	0.956
Silicon .....	0.247	Cobalt .....	0.038
Copper .....	0.114		

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1271</b>	Low Alloy Steel (Ni-Cr-Cu-Mo) (HSLA 100) (disk form)	32 mm dia and 19 mm thick
	It is intended primarily for use in the validation of chemical and instrumental methods of analysis.	
	Certified value	
	Element	Mass Fraction (%)
	Carbon (C) .....	0.064
	Manganese (Mn) .....	0.73
	Phosphorus (P) .....	0.005
	Sulfur (S) .....	0.0013
	Silicon (Si) .....	0.334
	Copper (Cu) .....	1.48
	Element	Mass Fraction (%)
	Nickel (Ni) .....	3.34
	Chromium (Cr) .....	0.552
	Vanadium (V) .....	0.003
	Molybdenum (Mo) .....	0.543
	Aluminum (Al) .....	0.020
	Niobium (Nb) .....	0.025
<b>NIST-C1285</b>	Low Alloy Steel (A242 Mod.) (disk form)	32 mm dia and 19 mm thick
	It is intended for use in the X-ray spectrometric method of analysis.	
	Certified value	
	Element	Mass Fraction (%)
	Carbon (C) .....	0.058
	Manganese (Mn) .....	0.332
	Phosphorus (P) .....	0.072
	Sulfur (S) .....	0.020
	Silicon (Si) .....	0.36
	Copper (Cu) .....	0.37
	Element	Mass Fraction (%)
	Nickel (Ni) .....	1.17
	Chromium (Cr) .....	0.80
	Vanadium (V) .....	0.150
	Molybdenum (Mo) .....	0.164
	Cobalt (Co) .....	0.036
	Cerium (Ce) .....	0.021
	Tin (Sn) .....	0.035
<b>NIST-1286</b>	Low Alloy Steel (HY 80) (disk form)	32 mm dia and 19 mm thick
	It is intended for use in the X-ray spectrometric method of analysis.	
	Certified value	
	Element	Mass Fraction (%)
	Carbon (C) .....	0.196
	Manganese (Mn) .....	0.152
	Phosphorus (P) .....	0.008
	Sulfur (S) .....	0.017
	Silicon (Si) .....	0.130
	Copper (Cu) .....	0.043
	Nickel (Ni) .....	2.81
	Element	Mass Fraction (%)
	Chromium (Cr) .....	1.53
	Vanadium (V) .....	0.00057
	Molybdenum (Mo) .....	0.344
	Cobalt (Co) .....	0.116
	Aluminum (total) .....	0.109
	Titanium (Ti) .....	0.040
	Arsenic (As) .....	0.019
	Tin (Sn) .....	0.012
<b>NIST-1765</b>	Low Alloy Steel	34 mm dia and 19 mm thick
	It is intended for use in the X-ray spectrometric method of analysis.	
	Certified value	
	Element	Mass Fraction (%)
	Carbon .....	0.006
	Manganese .....	0.144
	Phosphorus .....	0.0052
	Sulfur .....	0.0038
	Copper .....	0.0013
	Nickel .....	0.154
	Chromium .....	0.051
	Vanadium .....	0.0040
	Molybdenum .....	0.005
	Element	Mass Fraction (%)
	Titanium .....	0.0055
	Cobalt .....	0.0012
	Tin .....	0.002
	Niobium .....	0.0004
	Arsenic .....	0.0010
	Lead .....	0.0003
	Antimony .....	0.0010
	Silver .....	0.0002
	Boron .....	0.0009
	Nitrogen .....	0.0010

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1763b</b>	Low Alloy Steel (disk form)	34 mm dia and 19 mm thick
	It is low alloy steel intended primarily for evaluation of methods for analysis of elements in low alloy steel and materials of similar matrix.	
	Certified value	
	Constituent	Mass Fraction (%)
	Aluminum (Al)	0.0422
	Antimony (Sb)	0.0110
	Arsenic (As)	0.0539
	Boron (B)	0.00535
	Carbon (C)	0.201
	Cobalt (Co)	0.09248
	Chromium (Cr)	0. k5039
	Copper (Cu)	0.04170
	Manganese (Mn)	1.605
	Molybdenum (Mo)	0.491
	Constituent	Mass Fraction (%)
	Niobium (Nb)	0.0998
	Nickel (Ni)	0.5075
	Phosphorus (P)	0.01233
	Silicon (Si)	0.6275
	Sulfur (S)	0.0229
	Tantalum (Ta)	0.0119
	Tin (Sn)	0.01098
	Titanium (Ti)	0.313
	Tungsten (W)	0.00216
	Vanadium (V)	0.3075
	Zirconium (Zr)	0.0445
<b>NIST-866</b>	Incoloy 800 (chip form)	100 g
	It is in the form of chips and is intended for use in chemical methods of analysis.	
	Certified value	
	Constituent	Percent by Wt
	Carbon (C)	0.082
	Manganese (Mn)	0.92
	Phosphorus (P)	0.017
	Sulfur (S)	0.001
	Silicon (Si)	0.17
	Copper (Cu)	0.49
	Nickel (Ni)	30.8
	Constituent	Percent by Wt
	Chromium (Cr)	20.1
	Aluminum (Al)	0.29
	Titanium (Ti)	0.31
	Cobalt (Co)	0.075
	Boron (B)	< 0.001
	Molybdenum (Mo)	0.36
	Iron (Fe)	46.1
<b>NIST-867</b>	Ni-Fe-Cr Alloy UNS N08825 (chip form)	100 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis.	
	Certified value	
	Constituent	Mass Fraction (%)
	Aluminum (Al)	0.0630 ± 0.0042
	Carbon (C)	0.0212 ± 0.0019
	Chromium (Cr)	23.375 ± 0.061
	Cobalt (Co)	0.092 ± 0.012
	Copper (Cu)	1.767 ± 0.032
	Iron (Fe)	26.564 ± 0.063
	Manganese (Mn)	0.3806 ± 0.0072
	Constituent	Mass Fraction (%)
	Molybdenum (Mo)	2.723 ± 0.028
	Nickel (Ni)	43.47 ± 0.27
	Niobium (Nb)	0.458 ± 0.030
	Phosphorus (P)	0.0203 ± 0.0025
	Silicon (Si)	0.3234 ± 0.0059
	Titanium (Ti)	0.755 ± 0.049
	Vanadium (V)	0.0478 ± 0.0035
	Constituent	Mass Fraction (mg/kg)
	Arsenic (As)	25.7 ± 8.1
	Boron (B)	19.8 ± 1.6
	Constituent	Mass Fraction (mg/kg)
	Lead (Pb)	0.340 ± 0.005
	Thallium (Tl)	0.00223 ± 0.00052

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1230** High-Temperature Alloy A286 (disk form) 32 mm dia and 19 mm thick

It is in the form of a disk and is intended primarily for use in optical emission and X-ray spectrometric methods.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	0.249	Manganese (Mn)	0.652
Boron (B)	0.00519	Molybdenum (Mo)	1.15
Carbon (C)	0.0428	Nickel (Ni)	24.08
Chromium (Cr)	14.65	Phosphorus (P)	0.0239
Cobalt (Co)	0.151	Silicon (Si)	0.411
Copper (Cu)	0.137	Sulfur (S)	0.00095
Iron (Fe)	55.6	Titanium (Ti)	2.18
		Vanadium (V)	0.229

**NIST-1246** Incoloy 800 (disk form) 35 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray methods of analysis.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Carbon (C)	0.082	Chromium (Cr)	20.1
Manganese (Mn)	0.91	Aluminum (Al)	0.30
Phosphorus (P)	0.018	Titanium (Ti)	0.32
Sulfur (S)	0.001	Cobalt (Co)	0.076
Silicon (Si)	0.18	Boron (B)	< 0.001
Copper (Cu)	0.49	Molybdenum (Mo)	0.36
Nickel (Ni)	30.8	Iron (Fe)	46.2

**NIST-1247** Ni-Fe-Cr Alloy UNS N08825 (disk form) 35 mm dia and 19 mm thick

It is intended primarily for use in validation of chemical and instrumental methods of analysis

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	0.0630 ± 0.0042	Molybdenum (Mo)	2.723 ± 0.028
Carbon (C)	0.0212 ± 0.0019	Nickel (Ni)	43.47 ± 0.27
Chromium (Cr)	23.375 ± 0.06	Niobium (Nb)	0.458 ± 0.030
Cobalt (Co)	0.092 ± 0.012	Phosphorus (P)	0.0203 ± 0.0025
Copper (Cu)	1.767 ± 0.032	Silicon (Si)	0.3234 ± 0.0059
Iron (Fe)	26.564 ± 0.063	Titanium (Ti)	0.755 ± 0.049
Manganese (Mn)	0.3806 ± 0.0072	Vanadium (V)	0.0478 ± 0.0035

Element	Mass Fraction (mg/kg)	Element	Mass Fraction (mg/kg)
Arsenic (As)	25.7 ± 8.1	Lead (Pb)	0.340 ± 0.005
Boron (B)	19.8 ± 1.6	Thallium (Tl)	0.00223 ± 0.00052

**NIST-1250** High-Temperature Alloy (Fe-Ni-Co) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray fluorescence spectrometric methods of analysis.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
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# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Aluminum (Al) .....	0.99
	Boron (B) .....	0.0078
	Carbon (C) .....	0.022
	Chromium (Cr) .....	0.077
	Cobalt (Co) .....	16.1
	Copper (Cu) .....	0.022
	Iron (Fe) .....	40.5
	Manganese (Mn) .....	0.052
	Molybdenum (Mo) .....	0.014
	Nickel (Ni) .....	37.78
	Niobium (Nb) .....	2.99
	Phosphorus (P) .....	< 0.003
	Silicon (Si) .....	0.097
	Sulfur (S) .....	0.0025
	Tantalum (Ta) .....	0.003
	Titanium (Ti) .....	1.48
	Vanadium (V) .....	0.077

**NIST-C2400** Fe-Cr-Ni Alloy UNS J92180 (disk form) 32 mm dia and 19 mm thick

It is intended primarily for use in validation of chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Carbon (C) .....	0.036	Nickel (Ni) .....	4.07
Chromium (Cr) .....	17.06	Niobium (Nb) .....	0.15
Cobalt (Co) .....	0.10	Phosphorus (P) .....	0.013
Copper (Cu) .....	2.63	Silicon (Si) .....	0.61
Manganese (Mn) .....	0.71	Sulfur (S) .....	0.003
Molybdenum (Mo) .....	0.23	Vanadium (V) .....	0.092

**NIST-C1151a** Stainless Steel 23 Cr-7 Ni (disk form) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon (C) .....	0.034	Nickel (Ni) .....	7.25
Manganese (Mn) .....	2.37	Chromium (Cr) .....	22.59
Phosphorus (P) .....	0.017	Vanadium (V) .....	0.040
Sulfur (S) .....	0.038	Molybdenum (Mo) .....	0.79
Silicon (Si) .....	0.29	Cobalt (Co) .....	0.033
Copper (Cu) .....	0.385	Lead (Pb) .....	0.0039

**NIST-C1152a** Stainless Steel 18 Cr-11 Ni (disk form) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon (C) .....	0.142	Nickel (Ni) .....	10.86
Manganese (Mn) .....	0.95	Chromium (Cr) .....	17.76
Phosphorus (P) .....	0.023	Vanadium (V) .....	0.033
Sulfur (S) .....	0.0064	Molybdenum (Mo) .....	0.44
Silicon (Si) .....	0.64	Cobalt (Co) .....	0.22
Copper (Cu) .....	0.097	Lead (Pb) .....	0.0047

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-C1153a**      **Stainless Steel 17 Cr-9 Ni (disk form)**      32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon (C) .....	0.225	Nickel (Ni) .....	8.76
Manganese (Mn) .....	0.544	Chromium (Cr) .....	16.70
Phosphorus (P) .....	0.030	Vanadium (V) .....	0.176
Sulfur (S) .....	0.019	Molybdenum (Mo) .....	0.24
Silicon (Si) .....	1.00	Cobalt (Co) .....	0.127
Copper (Cu) .....	0.226	Lead (Pb) .....	0.006

**NIST-C1154a**      **Stainless Steel 19 Cr-13 Ni (disk form)**      32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Carbon (C) .....	0.100	Nickel (Ni) .....	13.08
Manganese (Mn) .....	1.44	Chromium (Cr) .....	19.31
Phosphorus (P) .....	0.06	Vanadium (V) .....	0.135
Sulfur (S) .....	0.051	Molybdenum (Mo) .....	0.068
Silicon (Si) .....	0.53	Cobalt (Co) .....	0.38
Copper (Cu) .....	0.44	Lead (Pb) .....	0.017

**NIST-1171**      **Stainless Steel (Cr 17-Ni 11-Ti 0.3) (AISI 321) (disk form)**      31 mm dia and 19 mm thick

It is intended primarily for use in optical emission and X-ray fluorescence spectrometric methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
C .....	0.067	Mo .....	0.167
Cr .....	17.50	Ni .....	11.18
Cu .....	0.1205	Si .....	0.536
Mn .....	1.81	Ti .....	0.346

**NIST-1172**      **Stainless Steel 17 Cr-11 Ni-0.6 Nb (AISI 348) (disk form)**      32 mm dia and 19 mm thick

It is available in solid form primarily for application in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon (C) .....	0.056	Nickel (Ni) .....	0.10 <sub>5</sub>
Manganese (Mn) .....	1.7 <sub>6</sub>	Chromium (Cr) .....	11.3 <sub>5</sub>
Phosphorus (P) .....	0.025	Vanadium (V) .....	17.4 <sub>0</sub>
Sulfur (S) .....	0.051	Molybdenum (Mo) .....	0.22
Silicon (Si) .....	0.01 <sub>4</sub>	Niobium (Nb) .....	0.65
Copper (Cu) .....	0.59	Tantalum (Ta) .....	< 0.001
		Cobalt (Co) .....	0.12

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1219</b>	Stainless Steel Cr16 - Ni2 (AISI 431) (disk form)	34 mm dia and 19 mm thick
It is intended for use in calibrating optical emission and X-ray spectrometric methods of analysis.		
Certified value		
Constituent	Percent by Wt	Constituent Percent by Wt
Carbon (C) .....	0.149	Nickel (Ni) ..... 2.16
Manganese (Mn) .....	0.42	Chromium (Cr) ..... 15.64
Phosphorus (P) .....	0.026	Vanadium (V) ..... 0.056
Sulfur (S) .....	0.001	Molybdenum (Mo) ..... 0.164
Silicon (Si) .....	0.545	Nitrogen (N) ..... 0.078
Copper (Cu) .....	0.162	
<hr/>		
<b>NIST-1223</b>	Chromium Steel	32 mm dia and 19 mm thick
It is intended for use in calibrating optical emission and X-ray spectrometric methods of analysis.		
Certified value		
Element	Percent by Wt	Element Percent by Wt
Carbon (C) .....	0.127	Nickel (Ni) ..... 0.232
Copper (Cu) .....	0.081	Phosphorus (P) ..... 0.018
Chromium (Cr) .....	12.64	Silicon (Si) ..... 0.327
Manganese (Mn) .....	1.08	Sulfur (S) ..... 0.329
Molybdenum (Mo) .....	0.053	Vanadium (V) ..... 0.068
<hr/>		
<b>NIST-1295</b>	Stainless Steel SAE 405 (disk form)	32 mm dia and 19 mm thick
It is intended for use in optical emission and X-ray spectrometric methods of analysis.		
Certified value		
Element	Percent by Wt	Element Percent by Wt
Carbon (C) .....	0.027	Nickel (Ni) ..... 0.194
Manganese (Mn) .....	0.387	Chromium (Cr) ..... 13.52
Phosphorus (P) .....	0.022	Vanadium (V) ..... 0.082
Sulfur (S) .....	0.0003	Molybdenum (Mo) ..... 0.023
Silicon (Si) .....	0.321	Cobalt (Co) ..... 0.020
Copper (Cu) .....	0.260	
<hr/>		
<b>NIST-C1296</b>	Stainless Steel (disk form)	32 mm dia and 19 mm thick
It is intended for use in optical emission and X-ray spectrometric methods of analysis.		
Certified value		
Element	Percent by Wt	Element Percent by Wt
Carbon (C) .....	0.038	Chromium (Cr) ..... 27.90
Manganese (Mn) .....	0.256	Vanadium (V) ..... 0.134
Phosphorus (P) .....	0.024	Molybdenum (Mo) ..... 3.43
Sulfur (S) .....	0.013	Cobalt (Co) ..... 0.026
Silicon (Si) .....	0.66	Titanium (Ti) ..... 0.23
Copper (Cu) .....	0.056	Aluminum (Al) ..... 0.035
Nickel (Ni) .....	0.373	Niobium (Nb) ..... 0.20



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1297</b>	<b>Stainless Steel (SAE 201) (disk form)</b>	32 mm dia and 19 mm thick
	It is intended for use in optical emission and X-ray spectrometric methods of analysis.	
	Certified value	
	Element	Percent by Wt
	Element	Percent by Wt
	Carbon (C) .....	0.066
	Manganese (Mn) .....	7.11
	Phosphorus (P) .....	0.038
	Sulfur (S) .....	0.0033
	Silicon (Si) .....	0.397
	Copper (Cu) .....	0.442
	Nickel (Ni) .....	5.34
	Chromium (Cr) .....	16.69
	Vanadium (V) .....	0.080
	Molybdenum (Mo) .....	0.331
	Cobalt (Co) .....	0.127
<b>NIST-1155a</b>	<b>Stainless Steel, Cr 18-Ni 12-Mo 2 (AISI 316) (disk form)</b>	32 mm dia and 19 mm thick
	It is intended for use with test methods for elemental analysis based on both chemical processes and instrumental techniques.	
	Certified value	
	Element	Mass Fraction (%)
	Element	Mass Fraction (%)
	Carbon (C) .....	0.0260 ± 0.0036
	Cobalt (Co) .....	0.225 ± 0.018
	Chromium (Cr) .....	17.803 ± 0.099
	Copper (Cu) .....	0.2431 ± 0.0050
	Iron (Fe) .....	64.71 ± 0.12
	Manganese (Mn) .....	1.593 ± 0.060
	Molybdenum (Mo) .....	2.188 ± 0.015
	Niobium (Nb) .....	0.0082 ± 0.0014
	Nickel (Ni) .....	12.471 ± 0.056
	Phosphorus (P) .....	0.0271 ± 0.0012
	Silicon (Si) .....	0.521 ± 0.017
	Titanium (Ti) .....	0.0039 ± 0.0012
	Vanadium (V) .....	0.0725 ± 0.0046
	Tungsten (W) .....	0.0809 ± 0.0059
<b>NIST-1157</b>	<b>Tool Steel (AISI M2) (disk form)</b>	32 mm dia and 19 mm thick
	It is available in solid form primarily for application in optical emission and X-ray spectrometric methods of analysis.	
	Certified value	
	Element	Percent by Wt
	Element	Percent by Wt
	Carbon (C) .....	0.836
	Manganese (Mn) .....	0.34
	Phosphorus (P) .....	0.011
	Sulfur (S) .....	0.04
	Silicon (Si) .....	0.18
	Copper (Cu) .....	0.088
	Nickel (Ni) .....	0.228
	Chromium (Cr) .....	4.36
	Vanadium (V) .....	1.82
	Molybdenum (Mo) .....	4.86
	Tungsten (W) .....	6.28
	Cobalt (Co) .....	0.028
<b>NIST-1158</b>	<b>High-Nickel Steel (Nominal Mass Fraction 36 % Ni) (disk form)</b>	32 mm dia and 19 mm thick
	It is intended primarily for use in validation of chemical and instrumental methods of analysis used to determine elements in steel alloys.	
	Certified value	
	Constituent	Percent by Wt
	Constituent	Percent by Wt
	Carbon (C) .....	0.02540
	Manganese (Mn) .....	0.04684
	Nickel (Ni) .....	36.054
	Silicon (Si) .....	0.1936

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1772</b>	S-7 Tool Steel (disk form)	34 mm dia and 19 mm thick
It is intended primarily for use in optical emission and X-ray spectrometric methods of analysis.		
Certified value		
Element	Percent by Wt	Element Percent by Wt
Carbon (C) .....	0.477 ± 0.006	Nickel (Ni) ..... 0.105 ± 0.001
Chromium (Cr) .....	3.10 ± 0.08	Phosphorus (P) ..... 0.008 ± 0.002
Copper (Cu) .....	0.083± 0.004	Silicon (Si) ..... 0.264 ± 0.003
Manganese (Mn) .....	0.61± 0.01	Sulfur (S) ..... 0.0031 ± 0.0007
Molybdenum (Mo) .....	1.39 ± 0.04	Vanadium (V) ..... 0.236 ± 0.002
<b>NIST-57b</b>	Silicon Metal	40 g
It is intended primarily for use in evaluating chemical and instrumental methods of analysis.		
Certified value		
Element	Mass Fraction (mg/kg)	Element Mass Fraction (mg/kg)
Aluminum (Al) .....	1690	Manganese (Mn) ..... 78.2
Boron (B) .....	14.43	Iron (Fe) ..... 3400
Phosphorus (P) .....	16.3	Nickel (Ni) ..... 15.3
Titanium (Ti) .....	346	Zirconium (Zr) ..... 17.8
<b>NIST-58a</b>	Ferrosilicon (73 % Si - Regular Grade)	75 g
It is intended primarily for use in validation of chemical and instrumental methods of analysis.		
Certified value		
Element	Mass Fraction (%)	Element Mass Fraction (%)
Cu .....	0.0225	Mn ..... 0.1611
Cr .....	0.0193	Ni ..... 0.0124
Fe .....	25.239	Si ..... 73.13
<b>NIST-195</b>	Ferrosilicon (75 % Si - High-Purity Grade)	75 g
It is intended primarily for use in validation of chemical and instrumental methods of analysis.		
Certified value		
Element	Mass Fraction (%)	Element Mass Fraction (%)
B .....	0.00105	Fe ..... 23.62
Cr .....	0.0474	Mn ..... 0.1710
Cu .....	0.0468	Ni ..... 0.0318
		Si ..... 75.32
<b>NIST-59a</b>	Ferrosilicon Grade E1 (powder form)	50 g
It is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of ferrosilicon and materials of similar matrix.		
Certified value		
Element	Mass Fraction (%)	Element Mass Fraction (%)
Aluminum (Al) .....	0.354	Copper (Cu) ..... 0.0520
Boron (B) .....	0.0578	Iron (Fe) ..... 50.05
Calcium (Ca) .....	0.0418	Manganese (Mn) ..... 0.754
Carbon (C) .....	0.0458	Nickel (Ni) ..... 0.0328
Chromium (Cr) .....	0.0805	Phosphorus (P) ..... 0.0158
		Silicon (Si) ..... 48.10

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-64c</b>	<b>Ferrochromium High Carbon (powder form)</b>	100 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of ferrochromium and materials of similar matrix.	
	Certified value	
	Constituent	Mass Fraction (%)
	Carbon (C) .....	4.698
	Chromium (Cr) .....	68.00
	Cobalt (Co) .....	0.0515
	Copper (Cu) .....	0.0053
	Iron (Fe) .....	24.99
	Manganese (Mn) .....	0.1624
	Nickel (Ni) .....	0.429
	Nitrogen (N) .....	0.0449
	Phosphorus (P) .....	0.0193
	Silicon (Si) .....	1.216
	Sulfur (S) .....	0.0673
	Titanium (Ti) .....	0.0179
	Vanadium (V) .....	0.1528
<b>NIST-90</b>	<b>Ferrophosphorus (powder form)</b>	75 g
	It is intended for use in calibration and the evaluation of chemical and instrumental methods of analysis.	
	Certified value	
	Element	Mass Fraction (%)
	Phosphorus (P) .....	26.17 ± 0.04
<b>NIST-196</b>	<b>Ferrochromium Low Carbon (powder form)</b>	100 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of ferrochromium and materials of similar matrix.	
	Certified value	
	Constituent	Mass Fraction (%)
	Carbon (C) .....	0.0351
	Chromium (Cr) .....	70.81
	Phosphorus (P) .....	0.0195
	Silicon (Si) .....	0.373
<b>NIST-689</b>	<b>Ferrochromium Silicon</b>	100 g
	It is in the form of fine powder for use in checking chemical methods of analysis and in calibration with instrumental methods of analysis.	
	Certified value	
	Constituent	Percent by Wt
	Carbon .....	0.0.043
	Manganese .....	0.32
	Phosphorus .....	0.026
	Sulfur .....	0.002
	Silicon .....	39.5
	Copper .....	0.013
	Nickel .....	0.20
	Chromium .....	36.4
	Vanadium .....	0.09
	Aluminum .....	0.049
	Titanium .....	0.40
	Cobalt .....	0.034
	Iron .....	23.2
	Boron .....	0.0017

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-4l</b>	Cast Iron (chip form)	150 g
	It is intended for use in chemical methods of analysis.	
	Certified value	
	Element	Percent by Wt (%)
	Carbon (C)	2.59 ± 0.04
	Chromium (Cr)	0.080 ± 0.004
	Copper (Cu)	0.89 ± 0.03
	Manganese (Mn)	0.74 ± 0.30
	Molybdenum (Mo)	0.029 ± 0.003
	Nickel (Ni)	0.041 ± 0.002
	Element	Percent by Wt (%)
	Nitrogen (N)	0.006 ± 0.001
	Phosphorus (P)	0.32 ± 0.02
	Silicon (Si)	1.83 ± 0.04
	Sulfur (S)	0.133 ± 0.004
	Titanium (Ti)	0.097 ± 0.008
	Vanadium (V)	0.033 ± 0.001
<b>NIST-5m</b>	Cast Iron (chip form)	150 g
	It is intended primarily for use in evaluating chemical methods of analysis.	
	Certified value	
	Element	(%)
	Aluminum (Al)	1690
	Boron (B)	14.43
	Phosphorus (P)	16.3
	Titanium (Ti)	346
	Element	(%)
	Manganese (Mn)	78.2
	Iron (Fe)	3400
	Nickel (Ni)	15.3
	Zirconium (Zr)	17.8
<b>NIST-6g</b>	Cast Iron (chip form)	150 g
	Certified value	
	Analyst	Analyst
	C (Total)	2.85
	C (Graphite)	2.01
	Mn	1.05
	P	0.557
	S	0.124
	Si	1.05
	Cu	0.502
	Ni	0.135
	Cr	0.370
	V	0.056
	Mo	0.035
	Ti	0.059
	As	0.023
	N	0.05
<b>NIST-107c</b>	Ni-Cr-Mo Cast Iron	150 g
	It is intended for use in chemical methods of analysis.	
	Certified value	
	Element	Percent by Wt (%)
	Total carbon	2.99
	Graphitic carbon	1.98
	Manganese	0.480
	Phosphorus	0.079
	Sulfur	0.059
	Silicon	1.21
	Element	Percent by Wt (%)
	Copper	0.205
	Nickel	2.20
	Chromium	0.693
	Vanadium	0.015
	Molybdenum	0.83
	Titanium	0.019
<b>NIST-115a</b>	Cast Iron (Cu-Ni-Cr)	150 g
	Certified value	
	Analyst	Analyst
	C (Total)	2.62
	C (Graphite)	1.96
	Mn	1.00
	Si	2.13
	Cu	5.52
	Ni	14.49

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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P (Gravimetric) .....	0.086	Cr .....	1.98
P (Alkali-Molybdate) .....	0.086	V .....	0.014
S (Gravimetric) .....	0.064	Mo .....	0.050
S (Combustion Iodate titration) .....	0.064	Ti .....	0.020

**NIST-122i** Cast Iron (chip form) 150 g

It is intended for use in chemical methods of analysis.

Certified value			
Element	Percent by Wt	Element	Percent by Wt
Total carbon .....	3.47	Copper .....	0.033
Manganese .....	0.530	Nickel .....	0.047
Phosphorus .....	0.28	Chromium .....	0.151
Sulfur .....	0.087	Vanadium .....	0.012
Silicon .....	0.89	Molybdenum .....	0.008
		Titanium .....	0.024

**NIST-344** Gray Cast Iron (Carbon & Sulfur) 150 g

Certified value			
Constituent		Constituent	
C .....	0.069	Cu .....	0.106
Mn .....	0.57	Ni .....	7.28
P (Gravimetric) .....	0.18	Cr .....	14.95
P (Photometric) .....	0.18	V .....	0.040
S (Gravimetric) .....	0.19	Mo .....	2.40
S (Combustion Iodate titration) .....	0.19	Al .....	1.16
Si .....	0.395	Ti .....	0.076

**NIST-341** Ductile Cast Iron (chip form) 150 g

Certified value			
Constituent		Constituent	
C (Total) .....	1.81	Si .....	2.44
C (Graphite) .....	1.23	Cu .....	0.152
Mn .....	0.92	Ni .....	20.32
P (Gravimetric) .....	0.024	Cr .....	1.98
P (Alkali-Molybdate) .....	0.024	V .....	0.012
S (Gravimetric) .....	0.007	Mo .....	0.010
S (Combustion Iodate titration) .....	0.007	Ti .....	0.018
		Mg .....	0.068

**NIST-342a** Nodular Cast Iron (chip form) 150 g

It is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of cast iron and materials of similar matrix.

Certified value			
Element	Percent by Wt	Element	Percent by Wt
Carbon, Graphitic (C) .....	1.377	Molybdenum (Mo) .....	0.0057

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Carbon, Graphitic (C) .....	1.377	Molybdenum (Mo) .....	0.0057
Carbon, Total (C) .....	1.863	Nickel (Ni) .....	0.0583
Chromium (Cr) .....	0.0335	Phosphorus (P) .....	0.0187
Copper (Cu) .....	0.1347	Silicon (Si) .....	2.733
Magnesium (Mg) .....	0.0700	Sulfur (S) .....	0.002141
Manganese (Mn) .....	0.2740	Titanium (Ti) .....	0.0200

**NIST-892**      **High-Alloy White Cast Iron (Ni-Hard, Type IV) (chip form)**      150 g

It is in the form of small granules prepared by water atomization and is intended for use in chemical and instrumental methods of analysis.

Certified value			
Constituent	Percent by Wt (%)	Constituent	Percent by Wt (%)
Carbon .....	3.33	Copper .....	0.270
Manganese .....	0.76	Nickel .....	5.53
Phosphorus .....	0.054	Chromium .....	10.18
Sulfur .....	0.015	Vanadium .....	0.041
Silicon .....	1.83	Molybdenum .....	0.20
		Cobalt .....	0.31

**NIST-C1137a**      **White Cast Iron (disk form)**      32 mm dia and 19 mm thick.

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value			
Element	(In %)	Element	(In %)
Carbon .....	2.86 ± 0.02	Molybdenum .....	0.86 ± 0.01
Cerium .....	0.016 ± 0.001	Nickel .....	2.17 ± 0.02
Chromium .....	0.643 ± 0.003	Phosphorus .....	0.087 ± 0.002
Copper .....	0.192 ± 0.002	Silicon .....	1.15 ± 0.02
Magnesium .....	0.032 ± 0.002	Sulfur .....	0.017 ± 0.001
Manganese .....	0.52 ± 0.01	Vanadium .....	0.019 ± 0.002

**NIST-1145a**      **White Cast Iron (disk form)**      32 mm dia and 19 mm thick.

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value			
Element	(In %)	Element	(In %)
Carbon .....	2.92	Nickel .....	0.62
Manganese .....	0.187	Chromium .....	0.63
Phosphorus .....	0.215	Vanadium .....	0.112
Sulfur .....	0.191	Molybdenum .....	0.48
Silicon .....	0.271	Titanium .....	0.012
Copper .....	0.46	Cobalt .....	0.058
		Lead .....	0.0012

**NIST-1173**      **Ni-Cr-Mo-V Steel (disk form)**      32 mm dia and 19 mm thick.

Rocks, Metal, Ceramic  
Glass, Grass, and Minerals

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon .....	0.423	Copper .....	0.204
Manganese .....	0.19	Nickel .....	4.06
Phosphorus .....	0.033	Chromium .....	2.70
Sulfur .....	0.092	Vanadium .....	0.42
Silicon .....	1.28	Molybdenum .....	1.50

**NIST-C1173** Cast Steel 3 (disk form) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon .....	0.453	Copper .....	0.204
Manganese .....	0.174	Nickel .....	4.04
Phosphorus .....	0.031	Chromium .....	2.63
Sulfur .....	0.092	Vanadium .....	0.42
Silicon .....	1.38	Molybdenum .....	1.46
		Titanium .....	0.037

**NIST-C1290** High Alloy (HC-250 + V) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon .....	3.04	Copper .....	0.065
Manganese .....	0.66	Nickel .....	0.917
Phosphorus .....	0.030	Chromium .....	30.5
Sulfur .....	0.013	Vanadium .....	0.442
Silicon .....	0.971	Molybdenum .....	0.041

**NIST-C1291** High Alloy (Ni-Hard, Type I) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon .....	2.67	Copper .....	0.26
Manganese .....	1.14	Nickel .....	4.34
Phosphorus .....	0.028	Chromium .....	2.78
Sulfur .....	0.032	Vanadium .....	0.031
Silicon .....	1.34	Molybdenum .....	0.32

**NIST-C1292** High-Alloy White Cast Iron (Ni-Hard, Type IV) (disk form) 32 mm dia and 19 mm thick

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Element	Percent by Wt	Element	Percent by Wt
Carbon .....	3.47	Copper .....	0.36
Manganese .....	0.55	Nickel .....	5.04

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Phosphorus ..... 0.049	Chromium ..... 11.4
	Sulfur ..... 0.016	Vanadium ..... 0.041
	Silicon ..... 0.59	Molybdenum ..... 0.25
<b>NIST-C2424</b>	<b>Ductile Iron (disk form)</b>	32 mm dia and 19 mm thick.
	It is intended for use in optical emission and X-ray spectrometric methods of analysis.	
	Certified value	
	Constituent	Percent by Wt (%)
	Carbon ..... 2.68	Chromium ..... 0.13
	Manganese ..... 0.268	Vanadium ..... 0.083
	Phosphorus ..... 0.041	Molybdenum ..... 0.019
	Sulfur ..... 0.024	Magnesium ..... 0.06
	Silicon ..... 3.37	Cerium ..... 0.0046
	Copper ..... 0.125	Lanthanum ..... 0.0011
	Nickel ..... 0.061	Titanium ..... 0.050
<b>NIST-854a</b>	<b>Aluminum Alloy 5182 (chip form)</b>	25 g
	It is intended primarily for use in evaluating chemical and instrumental methods of analysis.	
	Certified value	
	Constituent	Mass fraction (%)
	Silicon (Si) ..... 0.1553	Nickle (Ni) ..... 0.0195
	Iron (Fe) ..... 0.1990	Zinc (Zn) ..... 0.0505
	Copper (Cu) ..... 0.0494	Titanium (Ti) ..... 0.0335
	Manganese (Mn) ..... 0.3753	Vanadium (V) ..... 0.0174
	Magnesium (Mg) ..... 4.474	Chromium (Cr) ..... 0.0340
<b>NIST-1241c</b>	<b>Aluminum Alloy 5182 (disk form)</b>	6.3 cm dia and 1.9 cm thick.
	It is intended primarily for use in evaluating instrumental methods of analysis including glow discharge optical emission spectrometry, spark source optical emission spectrometry, and X-ray fluorescence spectrometry.	
	Certified value	
	Constituent	Mass fraction (%)
	Silicon (Si)(b) ..... 0.1544	Nickel (Ni) ..... 0.0198
	Silicon (Si)(c) ..... 0.1601	Zinc (Zn) ..... 0.0506
	Iron (Fe) ..... 0.1997	Titanium (Ti)(b) ..... 0.0317
	Copper (Cu) ..... 0.0497	Titanium (Ti)(c) ..... 0.0334
	Manganese (Mn) ..... 0.3792	Vanadium (V) ..... 0.0174
	Magnesium (Mg) ..... 4.498	Chromium (Cr) ..... 0.0343
		Gallium (Ga) ..... 0.0184
<b>NIST-2426</b>	<b>55 % Aluminum–Zinc Alloy (chip form)</b>	40 g
	It is intended primarily for use in evaluating chemical and instrumental methods of analysis.	
	Certified value	
	Constituent	Mass fraction (%)
	Al ..... 58.18	Si ..... 1.925
	Zn ..... 38.92	Fe ..... 0.454



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1255b** Aluminum Alloy 356 (disk form) 6.3 cm in dia and 1.9 cm thick.

It is intended for use in optical emission and X-ray spectrometric methods of analysis.

Certified value

Constituent	(%)	Constituent	(%)
Si .....	7.298	Ti .....	0.1535
Fe .....	0.1170	V .....	0.0316
Cu .....	0.1161	V .....	0.0324
Mn .....	0.0527	Sr .....	0.0164
Mg .....	0.3822	Sr .....	0.0140
Ni .....	0.0179	Ga .....	0.0175
Zn .....	0.0842	Sn .....	0.1334
Ti(a) .....	0.1477	Pb .....	0.0182

**NIST-1255b** Aluminum Alloy 356 (disk form) 6.3 cm in dia and 1.9 cm thick.

It is intended primarily for use in evaluating instrumental methods of analysis including glow discharge optical emission spectrometry, spark source optical emission spectrometry, and X-ray fluorescence spectrometry.

Certified value

Constituent	Mass fraction (%)	Constituent	Mass fraction (%)
Si .....	9.362	Ti (b) .....	0.0859
Fe .....	0.865	Ti (c) .....	0.0859
Cu .....	3.478	V (b) .....	0.0212
Mn .....	0.3857	V (c) .....	0.0203
Mg .....	0.4135	Cr .....	0.0572
Ni .....	1.011	Sr (b) .....	0.0188
Zn .....	0.0877	Sr (c) .....	0.0173
		Pb .....	0.1075

**NIST-87a** Silicon-Aluminum Alloy (chip form) 75 g

It is in the form of chips sized between 1.0 and 3.35 mm sieve openings (18 and 6 mesh).

Certified value

Constituent	Percent by Wt	Constituent	Percent by Wt
Silicon .....	6.24	Titanium .....	0.18
Iron .....	0.61	Zinc .....	0.16
Nickel .....	0.57	Chromium .....	0.11
Magnesium .....	0.37	Lead .....	0.093
Copper .....	0.30	Tin .....	0.057
Manganese .....	0.26	Gallium .....	0.020
		Vanadium .....	< 0.01

**NIST-853a** Aluminum Alloy 3004 (chip form) 25 g

It is intended primarily for use in evaluating chemical and instrumental methods of analysis.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Silicon (Si) .....	0.1810	Nickel (Ni) .....	0.00429
Iron (Fe) .....	0.504	Zinc (Zn) .....	0.0514
Copper (Cu) .....	0.1504	Titanium (Ti) .....	0.0205

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Manganese (Mn) .....	1.251	Vanadium (V) .....	0.01842
Magnesium (Mg) .....	1.092	Gallium (Ga) .....	0.0176

**NIST-855a**      **Aluminum Casting Alloy 356 (chip form)**      30 g

It is in the form of fine millings, intended primarily for use in evaluating chemical methods of analysis.

Certified value

Constituent	Percent by Wt (%)	Constituent	Percent by Wt (%)
Silicon .....	7.07	Chromium .....	0.013
Iron .....	0.14	Nickel .....	0.016
Copper .....	0.13	Titanium .....	0.15
Zinc .....	0.085	Lead .....	0.019
Manganese .....	0.268	Tin .....	0.010
		Strontium .....	0.018

**NIST-856a**      **Aluminum Casting Alloy 380 (chip form)**      30 g

It is in the form of fine millings, intended primarily for use in evaluating chemical methods of analysis.

Certified value

Constituent	Percent by Wt (%)	Constituent	Percent by Wt (%)
Silicon .....	9.21	Chromium .....	0.060
Iron .....	0.85	Nickel .....	0.37
Copper .....	3.50	Titanium .....	0.065
Zinc .....	0.96	Lead .....	0.11
Manganese .....	0.35	Tin .....	0.10
Magnesium .....	0.063	Strontium .....	0.018

**NIST-858**      **Aluminum Alloy 6011 (Modified)**      35 g

It is in the form of fine millings, intended primarily for use in validating chemical methods of analysis.

Certified value

Constituent	Mass fraction (%)	Constituent	Mass fraction (%)
Silicon .....	0.79	Nickel .....	0.0006
Iron .....	0.078	Zinc .....	1.04
Copper .....	0.84	Magnesium .....	1.01
Manganese .....	0.48	Beryllium .....	< 0.0001
Chromium .....	0.0011	Titanium .....	0.042
		Vanadium .....	0.0030

**NIST-1240c**      **Aluminum Alloy 3004 (disk form)**      6.3 cm in dia and 1.9 cm thick

It is intended primarily for use in evaluating instrumental methods of analysis including glow discharge optical emission spectrometry, spark source optical emission spectrometry, and X-ray fluorescence spectrometry.

Certified value

Elements	Mass fraction (%)	Elements	Mass fraction (%)
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# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Silicon (Si) .....	0.1804
	Iron (Fe) .....	0.501
	Copper (Cu) .....	0.1484
	Manganese (Mn) .....	1.268
	Magnesium (Mg) .....	1.110
	Nickel (Ni) .....	0.00434
	Zinc (Zn) .....	0.0514
	Titanium (Ti)(b) .....	0.0218
	Ti(c) .....	0.0204
	Vanadium (V) .....	0.01850
	Gallium (Ga) .....	0.0181

**NIST-1258-I**      **Aluminum Alloy 6011 (Modified) (disk form)**      35 mm dia and 19 mm thick

It is an aluminum alloy intended primarily for evaluation of methods for analysis of elements in aluminum alloys of similar composition.

Certified value

Elements	Mass fraction (%)	Elements	Mass fraction (%)
Silicon (Si) .....	0.80	Manganese (Mn) .....	0.481
Iron (Fe) .....	0.080	Magnesium (Mg) .....	1.00
Copper (Cu) .....	0.848	Zinc (Zn) .....	1.03

**NIST-1259**      **Aluminum Alloy 7075 (disk form)**      35 mm dia and 19 mm thick

It is intended for use primarily in optical emission and X-ray spectrometric methods of analysis.

Certified value

Elements	Percent by Wt	Elements	Percent by Wt
Silicon (Si) .....	0.18	Chromium (Cr) .....	0.173
Iron (Fe) .....	0.205	Nickel (Ni) .....	0.063
Copper (Cu) .....	1.60	Zinc (Zn) .....	5.44
Manganese (Mn) .....	0.079	Magnesium (Mg) .....	2.48
		Beryllium (Be) .....	0.0025

**NIST-1242**      **High Temperature Alloy L 605 (disk form)**      35 mm dia and 19 mm thick

It is intended for use primarily in optical emission and X-ray spectrometric methods of analysis.

Certified value

Constituent	Percent by Wt	Constituent	Percent by Wt
Carbon .....	0.126	Nickel .....	9.78
Manganese .....	1.58	Chromium .....	20.0
Phosphorus .....	0.002	Vanadium .....	0.005
Sulfur .....	0.0007	Iron .....	1.80
Silicon .....	0.016	Tungsten .....	15.1
Copper .....	0.0010	Cobalt .....	51.5
		Nitrogen .....	0.026

**NIST-1775**      **Refractory Alloy MP-35-N**      35 mm dia and 12.7 mm thick

It is intended for use with optical emission and X-ray spectrometric methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Chromium (Cr) .....	20.472 ± 0.035	Molybdenum (Mo) .....	9.508 ± 0.012
Cobalt (Co) .....	33.352 ± 0.027	Nickel (Ni) .....	34.911 ± 0.029
Iron (Fe) .....	0.91 ± 0.10	Titanium (Ti) .....	0.730 ± 0.032

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit																												
	<table border="0"> <tr> <td>Constituent</td> <td>Mass Fraction (mg/kg)</td> <td>Constituent</td> <td>Mass Fraction (mg/kg)</td> </tr> <tr> <td>Boron (B) .....</td> <td>97 ± 24</td> <td>Sulfur (S) .....</td> <td>13 ± 1</td> </tr> <tr> <td>Manganese (Mn) .....</td> <td>121 ± 15</td> <td>Vanadium (V) .....</td> <td>95 ± 14</td> </tr> </table>	Constituent	Mass Fraction (mg/kg)	Constituent	Mass Fraction (mg/kg)	Boron (B) .....	97 ± 24	Sulfur (S) .....	13 ± 1	Manganese (Mn) .....	121 ± 15	Vanadium (V) .....	95 ± 14																	
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<b>NIST-2175</b>	<b>Refractory Alloy MP-35-N</b>	150 g																												
	It is in the form of chips sized between 0.50 mm and 1.18 mm sieve openings (35 mesh and 16 mesh) intended for use primarily in chemical methods of analysis.																													
	Certified value																													
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Cobalt (Co) .....	33.352 ± 0.027	Nickel (Ni) .....	34.911 ± 0.029																											
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	<table border="0"> <tr> <td>Constituent</td> <td>Mass Fraction (mg/kg)</td> <td>Constituent</td> <td>Mass Fraction (mg/kg)</td> </tr> <tr> <td>Boron (B) .....</td> <td>97 ± 23</td> <td>Sulfur (S) .....</td> <td>13 ± 1</td> </tr> <tr> <td>Manganese (Mn) .....</td> <td>120 ± 17</td> <td>Vanadium (V) .....</td> <td>100 ± 16</td> </tr> </table>	Constituent	Mass Fraction (mg/kg)	Constituent	Mass Fraction (mg/kg)	Boron (B) .....	97 ± 23	Sulfur (S) .....	13 ± 1	Manganese (Mn) .....	120 ± 17	Vanadium (V) .....	100 ± 16																	
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<b>NIST-158a</b>	<b>Silicon Bronze (chip form)</b>	150 g																												
	It is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of bronze alloys and materials of similar matrix.																													
	Certified value																													
	<table border="0"> <tr> <td>Constituent</td> <td>Mass fraction (%)</td> <td>Constituent</td> <td>Mass fraction (%)</td> </tr> <tr> <td>Aluminum (Al) .....</td> <td>0.4580</td> <td>Manganese (Mn) .....</td> <td>1.112</td> </tr> <tr> <td>Copper (Cu) .....</td> <td>90.93</td> <td>Phosphorus (P) .....</td> <td>0.0263</td> </tr> <tr> <td>Iron (Fe) .....</td> <td>1.228</td> <td>Silicon (Si) .....</td> <td>3.026</td> </tr> <tr> <td>Lead (Pb) .....</td> <td>0.0973</td> <td>Tin (Sn) .....</td> <td>0.960</td> </tr> <tr> <td></td> <td></td> <td>Zinc (Zn) .....</td> <td>2.076</td> </tr> </table>	Constituent	Mass fraction (%)	Constituent	Mass fraction (%)	Aluminum (Al) .....	0.4580	Manganese (Mn) .....	1.112	Copper (Cu) .....	90.93	Phosphorus (P) .....	0.0263	Iron (Fe) .....	1.228	Silicon (Si) .....	3.026	Lead (Pb) .....	0.0973	Tin (Sn) .....	0.960			Zinc (Zn) .....	2.076					
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<b>NIST-458</b>	<b>Beryllium-Copper Alloy (chip form)</b>	50 g																												
	It is in the form of chips sized between 0.50 and 1.18 mm sieve openings (35 and 16 mesh).																													
	Certified value																													
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<b>NIST-459</b>	<b>Beryllium-Copper Alloy (chip form)</b>	50 g																												
	It is intended primarily for use in chemical methods of analysis.																													
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Cobalt .....	0.221	Tin .....	0.005																											

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Nickel ..... 0.039	Zinc ..... 0.002
	Iron ..... 0.079	Chromium ..... 0.005
	Silicon ..... 0.077	Lead ..... 0.001
		Magnesium ..... 0.007
<b>NIST-460</b>	<b>Beryllium-Copper Alloy (chip form)</b>	50 g
	It is intended primarily for use in chemical methods of analysis.	
	Certified value	
	Elements	Percent by Wt
	Beryllium ..... 1.86	Aluminum ..... 0.048
	Cobalt ..... 0.217	Tin ..... 0.006
	Nickel ..... 0.031	Zinc (Zn) ..... 0.004
	Iron ..... 0.098	Chromium ..... 0.005
	Silicon ..... 0.077	Lead ..... 0.258
		Magnesium ..... 0.005
<b>NIST-871</b>	<b>Phosphor Bronze (CDA 521) (granule form)</b>	100 g
	It is in the form of small granules prepared by water atomization and is intended for use in chemical and instrumental methods of analysis.	
	Certified value	
	Constituent	Percent by Wt
	Cu ..... 91.68	Pb ..... 0.010
	Sn ..... 8.14	Zn ..... 0.025
	P ..... 0.082	Fe ..... < 0.001
<b>NIST-872</b>	<b>Phosphor Bronze (CDA 544) (granule form)</b>	100 g
	It is in the form of small granules prepared by water atomization and is intended for use in chemical and instrumental methods of analysis.	
	Certified value	
	Constituent	Percent by Wt
	Cu ..... 87.36	Pb ..... 4.13
	Sn ..... 4.16	Zn ..... 4.0
	P ..... 0.26	Fe ..... 0.003
<b>NIST-874</b>	<b>Cupro-Nickel, 10% (CDA 706) "High-Purity" (granule form)</b>	100 g
	It is in the form of small granules prepared by water atomization and is intended for use in chemical and instrumental methods of analysis.	
	Certified value	
	Constituent	Mass Fraction (%)
	Cu ..... 88.49	Sb ..... < 0.001
	Ni ..... 10.18	Sn ..... 0.007
	Fe ..... 1.22	P ..... 0.002
	Zn ..... 0.002	Bi ..... < 0.0002
	Pb ..... < 0.0005	Cd ..... < 0.0002
	Mn ..... 0.0020	Se ..... 0.00005

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-875** Cupro-Nickel, 10% (CDA 706) "Doped" (granule form) 100 g

It is in the form of small granules prepared by water atomization and is intended for use in chemical and instrumental methods of analysis.

Certified value

Constituent	Percent by Wt	Constituent	Percent by Wt
Cu .....	87.83	Sb .....	< 0.001
Ni .....	10.42	Sn .....	0.009
Fe .....	1.45	P .....	0.0020
Zn .....	0.11	Bi .....	0.003
Pb .....	0.0092	Cd .....	0.0022
Mn .....	< 0.0007	Se .....	0.0004

**NIST-880** Nickel Silver (CDA 770) (granular form) 100 g

It is in the form of small granules prepared by water atomization and is intended for use in chemical and instrumental methods of analysis.

Certified value

Constituent	Percent by Wt	Constituent	Percent by Wt
Cu .....	54.51	Fe .....	0.004
Ni .....	18.13	Mn .....	< 0.001
Zn .....	27.3	Pb .....	0.002

**NIST-1034** Unalloyed Copper (rod form) 31 mm dia and 19 mm thick.

It is intended for use in calibrating instruments used in the determination of sulfur in unalloyed copper and copper-base alloys.

Certified value

Elements	Percent by Wt	Elements	Percent by Wt
Cu .....	99.96	Te .....	0.5
Sb .....	0.2	Sn .....	< 0.2
As .....	0.2	Zn .....	< 11
Bi .....	0.2	Al .....	< 2
Fe .....	2.0	Cd .....	< 1
Pb .....	0.5	Cr .....	0.3
Mn .....	< 0.1	Co .....	0.2
Ni .....	0.6	Au .....	< 0.05
Se .....	3.3	Mg .....	< 1
Ag .....	8.1	O .....	363
		Si .....	< 2

**NIST-1035** Leaded-Tin Bronze Alloy (chip form) 50 g

It is in the form of chips and is intended for use in calibrating instruments used in the determination of sulfur in unalloyed copper and copper-base alloys.

Certified value

Elements	Percent by Wt	Elements	Percent by Wt
Copper .....	78.5	Zinc .....	0.25
Lead .....	13.5	Iron .....	0.001

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Tin .....	6.8	Phosphorus .....	0.004
Nickel .....	0.75	Oxygen .....	0.64

**NIST-1124**      **Free Cutting Brass (UNS C36000)**      39 mm in dia and 19 mm thick.

It is intended for use in the evaluation of chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (mg/kg)	Constituent	Mass Fraction (mg/kg)
Ag .....	131 ± 11	Cr .....	155 ± 22
Cd .....	65.1 ± 2.6	Sb .....	232.5 ± 1.1
Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Fe .....	0.2068 ± 0.0053	Pb .....	3.363 ± 0.086
Ni .....	0.0801 ± 0.0015	Sn .....	0.3112 ± 0.0038
		Zn .....	35.19 ± 0.30

**NIST-C1252a**      **Phosphorus Deoxidized Copper - Cu IX (block form)**      32 mm square and 19 mm thick.

It is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of copper and its alloys.

Certified value

Elements	Mass Fraction (mg/kg)	Elements	Mass Fraction (mg/kg)
Antimony (Sb) .....	42 ± 1	Chromium (Cr) .....	19 ± 2
Nickel (Ni) .....	128 ± 1	Tellurium (Te) .....	54.6 ± 2.5
Arsenic (As) .....	118 ± 2	Gold (Au) .....	33.9 ± 1.4
Phosphorus .....	(P)125 ± 21	Tin (Sn) .....	120 ± 12
Cadmium (Cd) .....	16.9 ± 1.3	Iron (Fe) .....	72 ± 9
Selenium (Se) .....	56 ± 8	Zinc (Zn) .....	69.4 ± 1.0
Cobalt (Co) .....	87 ± 4	Lead (Pb) .....	60 ± 1
Silver (Ag) .....	158 ± 10	Manganese (Mn) .....	43 ± 7

**NIST-1107**      **Naval Brass UNS 46400 (disk form)**      3.2 cm dia and 1.9 cm thick.

It is intended primarily for use in validation of chemical and instrumental methods of elemental analysis of brass alloys.

Certified value

Elements	Mass Fraction (%)	Elements	Mass Fraction (%)
Copper (Cu) .....	61.183 ± 0.074	Nickel (Ni) .....	0.0946 ± 0.0037
Iron (Fe) .....	0.0389 ± 0.0032	Tin (Sn) .....	1.066 ± 0.015
Lead (Pb) .....	0.1850 ± 0.0024	Zinc (Zn) .....	37.396 ± 0.084

**NIST-1110**      **Red Brass B (disk form)**      27 in dia and 3.5 in thick.

Certified value

Elements	(%)	Elements	(%)
Cu .....	84.59	Fe .....	0.033
Zn .....	15.20	Sn .....	0.051
Pb .....	0.033	Ni .....	0.053

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1111</b>	<b>Red Brass C (disk form)</b>	27 in dia and 3.5 in thick.
	Certified value	
	Elements (%)	Elements (%)
	Cu ..... 87.14	Fe ..... 0.010
	Zn ..... 12.81	Sn ..... 0.019
	Pb ..... 0.013	Ni ..... 0.022
<b>NIST-1112</b>	<b>Gilding Metal A (disk form)</b>	27 in dia and 3.5 in thick.
	Certified value	
	Elements (%)	Elements (%)
	Cu ..... 93.38	Ni ..... 0.100
	Zn ..... 6.30	Fe ..... 0.070
	Sn ..... 0.12	Pb ..... 0.057
		P ..... 0.009
<b>NIST-1113</b>	<b>Gilding Metal B (disk form)</b>	27 in dia and 3.5 in thick.
	Certified value	
	Elements (%)	Elements (%)
	Cu ..... 95.03	Ni ..... 0.057
	Zn ..... 4.80	Fe ..... 0.043
	Sn ..... 0.064	Pb ..... 0.026
		P ..... 0.008
<b>NIST-1114</b>	<b>Gilding Metal C (disk form)</b>	27 in dia and 3.5 in thick.
	Certified value	
	Elements (%)	Elements (%)
	Cu ..... 96.45	Ni ..... 0.021
	Zn ..... 3.47	Fe ..... 0.017
	Sn ..... 0.027	Pb ..... 0.012
		P ..... 0.09
<b>NIST-1115</b>	<b>Commercial Bronze A (disk form)</b>	27 in dia and 3.5 in thick.
	Certified value	
	Elements (%)	Elements (%)
	Cu ..... 87.96	Sn ..... 0.10
	Zn ..... 11.73	Ni ..... 0.074
	Fe ..... 0.13	Pb ..... 0.013
		P ..... 0.05
<b>NIST-C1115</b>	<b>Commercial Bronze A (disk form)</b>	27 in dia and 3.5 in thick.
	Certified value	
	Elements (%)	Elements (%)
	Cu ..... 87.96	Sn ..... 0.10
	Zn ..... 11.73	Ni ..... 0.074
	Fe ..... 0.13	Pb ..... 0.013
		P ..... 0.05



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit	
<b>NIST-1116</b>	Commercial Bronze B (disk form)	27 in dia and 3.5 in thick.	
Certified value			
Elements	(%)	Elements (%)	
Cu .....	87.96	Sn .....	0.10
Zn .....	11.73	Ni .....	0.074
Fe .....	0.13	Pb .....	0.013
		P .....	0.05
<b>NIST-C1117</b>	Commercial Bronze C (block form)	27 in dia and 3.5 in thick.	
Certified value			
Elements	(%)	Elements (%)	
Cu .....	93.01	Sn .....	0.021
Zn .....	6.87	Ni .....	0.020
Fe .....	0.014	Pb .....	0.069
		P .....	0.02
<b>NIST-C1251a</b>	Phosphorus Deoxidized Copper - Cu VIII (block form)	32 mm square and 19 mm thick.	
It is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of copper and its alloys.			
Certified value			
Elements	Mass Fraction (mg/kg)	Elements Mass Fraction (mg/kg)	
Antimony (Sb) .....	14.9 ± 0.4	Nickel (Ni) .....	23.6 ± 1.0
Arsenic (As) .....	16 ± 3	Phosphorus (P) .....	420 ± 29
Bismuth (Bi) .....	3.7 ± 1.0	Selenium (Se) .....	11 ± 2
Cobalt (Co) .....	13.2 ± 1.5	Silver (Ag) .....	80 ± 8
Gold (Au) .....	15.5 ± 0.9	Tellurium (Te) .....	16 ± 2
Iron (Fe) .....	285 ± 23	Tin (Sn) .....	16 ± 3
Lead (Pb) .....	23.5 ± 1.0	Zinc (Zn) .....	24 ± 3
Manganese (Mn) .....	4.6 ± 0.9		
<b>NIST-C1253a</b>	Phosphorus Deoxidized Copper - Cu X (block form)	32 mm square and 19 mm thick.	
It is intended primarily for use in evaluating chemical methods of analysis and in the calibration of instrumental methods for analysis of copper and its alloys.			
Certified value			
Elements	Mass Fraction (mg/kg)	Elements Mass Fraction (mg/kg)	
Aluminum (Al) .....	176 ± 16	Manganese (Mn) .....	357 ± 20
Antimony (Sb) .....	139 ± 12	Nickel (Ni) .....	491 ± 19
Arsenic (As) .....	436 ± 9	Phosphorus (P) .....	561 ± 19
Cadmium (Cd) .....	70 ± 2	Selenium (Se) .....	136 ± 13
Chromium (Cr) .....	260 ± 25	Silver (Ag) .....	494 ± 17
Cobalt (Co) .....	454 ± 69	Tellurium (Te) .....	168 ± 6
Gold (Au) .....	72 ± 3	Tin (Sn) .....	499 ± 22
Iron (Fe) .....	290 ± 33	Zinc (Zn) .....	329 ± 28
Lead (Pb) .....	243 ± 6		

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1276a</b>	Cupro-Nickel (CDA 715) (disk form)	32 mm in dia and 19 mm thick.
	It is intended for use in optical emission and X-ray spectrometric methods of analysis.	
	Certified value	
	Elements	Percent by Wt
	Copper .....	67.5
	Nickel .....	30.8
	Iron .....	0.56
	Zinc .....	0.038
	Lead .....	0.004
	Manganese .....	10.01
	Elements	Percent by Wt
	Antimony .....	0.0004
	Tin .....	0.023
	Phosphorus .....	0.006
	Cadmium .....	0.0002
	Selenium .....	0.0005
	Magnesium .....	0.12
	Cobalt .....	0.045
<b>NIST-457</b>	Unalloyed Copper - Cu IV (rod form)	27 in dia and 3.5 in thick.
	It is intended for use in the validation of chemical and instrumental methods of analysis for trace elemental analysis of copper materials.	
	Certified value	
	Elements	Mass Fraction (mg/kg)
	Antimony (Sb) .....	0.214 ± 0.059
	Lead (Pb) .....	0.512 ± 0.058
	Elements	Mass Fraction (mg/kg)
	Selenium (Se) .....	4.05 ± 0.15
	Silver (Ag) .....	8.086 ± 0.037
	Tellurium (Te) .....	0.296 ± 0.028
	Elements	Mass Fraction (%)
	Copper (Cu) .....	99.97 ± 0.18
<b>NIST-399</b>	Unalloyed Copper - Cu VI (chip form)	50 g
	It is intended for use in trace elemental analysis of copper materials.	
	Certified value	
	Elements	(mg/kg)
	Antimony .....	30
	Arsenic .....	47
	Bismuth .....	10.5
	Cobalt .....	0.5
	Iron .....	20.0
	Elements	(mg/kg)
	Lead .....	114
	Nickel .....	506
	Selenium .....	95
	Silver .....	117
	Tellurium .....	50
	Zinc .....	45
	Elements	(Wt %)
	Copper .....	99.79
<b>NIST-454</b>	Commercial Bronze A (disk form)	35 g
	It is intended for use in trace elemental analysis of copper materials.	
	Certified value	
	Elements	(µg/g)
	Antimony .....	24
	Arsenic .....	46
	Bismuth .....	19
	Gold .....	7.5
	Lead .....	66
	Elements	(µg/g)
	Selenium .....	479
	Silver .....	286
	Tellurium .....	27
	Tin .....	2.2
	Zinc .....	7
	Elements	(Wt %)
	Copper .....	99.84

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-494</b>	<b>Unalloyed Copper - Cu I (rod form)</b>	6.4 mm dia and 103 mm long.
	It is intended for use in trace elemental analysis of copper materials.	
	Certified value	
	Elements (µg/g)	Elements (µg/g)
	Antimony ..... 4.5	Nickel ..... 11.7
	Arsenic ..... 2.6	Selenium ..... 2.00
	Bismuth ..... 0.35	Silver ..... 50
	Chromium ..... 2.0	Sulfur ..... 15
	Cobalt ..... 0.5	Tellurium ..... 0.58
	Lead ..... 26.5	Tin ..... 70
	Manganese ..... 3.7	Zinc ..... 400
	Elements (Wt %)	
	Copper ..... 99.91	
<b>NIST-495</b>	<b>Unalloyed Copper - Cu II (rod form)</b>	6.4 mm dia and 103 mm long.
	It is intended for use in trace analysis of copper material.	
	Certified value	
	Elements (µg/g)	Elements (µg/g)
	Antimony ..... 8.0	Nickel ..... 5.4
	Arsenic ..... 1.6	Selenium ..... 0.63
	Bismuth ..... 0.50	Silver ..... 12.2
	Chromium ..... 6.0	Sulfur ..... 13
	Lead ..... 3.2	Tellurium ..... 0.32
	Manganese ..... 5.3	Tin ..... 1.5
		Zinc ..... 12
	Elements (Wt %)	
	Copper ..... 99.94	
<b>NIST-498</b>	<b>Unalloyed Copper - Cu V (rod form)</b>	6.4 mm dia and 103 mm long.
	It is intended for use in trace analysis of copper material.	
	Certified value	
	Elements (µg/g)	Elements (µg/g)
	Antimony ..... 7.4	Nickel ..... 7.0
	Arsenic ..... 25	Selenium ..... 17.5
	Bismuth ..... 2.0	Silver ..... 20.1
	Cobalt ..... 2.7	Tellurium ..... 10.1
	Iron ..... 11	Tin ..... 5
	Lead ..... 10	Zinc ..... 25
	Elements (Wt %)	
	Copper ..... 99.98	
<b>NIST-500</b>	<b>Unalloyed Copper - Cu VII (rod form)</b>	6.4 mm dia and 103 mm long.
	It is intended for use in trace analysis of copper material.	
	Certified value	
	Elements (µg/g)	Elements (µg/g)
	Antimony ..... 100	Lead ..... 128

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Arsenic .....	140
	Bismuth .....	25
	Cobalt .....	0.5
	Iron .....	42
	Nickel .....	603
	Selenium .....	214
	Silver .....	176
	Tellurium .....	153
	Zinc .....	111
	Elements	(Wt %)
	Copper .....	99.70

**NIST-53e**      **Lead-Base Bearing Metal (84 Pb-10 Sb-6 Sn) (powder form)**      150 g

It is primarily for application in optical emission and x-ray spectrometric methods of analysis.

Certified value		Elements	
Elements		Elements	
Sb .....	10.26	Bi .....	0.052
Sn .....	5.84	As .....	0.057
Cu .....	0.054	Ni .....	0.003
		Fe .....	< 0.001

**NIST-127b**      **Solder (40Sn-60Pb)**      150 g

Certified value		Elements	
Elements	Percent by Wt	Elements	Percent by Wt
Tin .....	39.3	Bismuth .....	0.5
Antimony .....	0.43	Copper .....	114
Arsenic .....	10.5	Nickel .....	506
		Silver .....	95

**NIST-1129**      **Commercial Bronze A (disk form)**      200 g

It is intended for use in chemical methods of analysis.

Certified value		Elements	
Elements	Percent by Wt	Elements	Percent by Wt
Tin .....	62.7	Copper .....	0.16
Antimony .....	0.13	Nickel .....	0.010
Arsenic .....	0.055	Silver .....	0.075
Bismuth .....	0.13	Gold .....	0.175
Cadmium .....	0.006		

**NIST-1131**      **Solder (40Sn-60Pb)**      32 mm dia and 19 mm thick.

It is intended primarily for application in optical emission and X-ray spectroscopic methods of analysis.

Certified value		Elements	
Elements	Percent by Wt	Elements	Percent by Wt
Tin .....	39.3	Copper .....	0.011
Antimony .....	0.43	Nickel .....	0.012
Arsenic .....	0.01	Silver .....	0.01
Bismuth .....	0.06		

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1132</b>	<b>Lead-Base Bearing Metal (84 Pb-10 Sb-6 Sn) (disk form)</b>	32 mm dia and 19 mm thick.
	It is intended primarily for use in optical emission and X-ray spectrometric methods of analysis.	
	Certified value	
	Elements	Percent by Wt
	Antimony .....	10.26
	Tin .....	5.84
	Copper .....	0.054
	Elements	Percent by Wt
	Bismuth .....	0.052
	Arsenic .....	0.057
	Nickel .....	0.003
	Iron .....	< 0.001
<b>NIST-C2416</b>	<b>Bullet Lead</b>	50 mm dia and 16 mm thick.
	It is intended for use in trace analysis of copper material.	
	Certified value	
	Elements	Percent by Wt
	Antimony .....	0.79
	Arsenic .....	0.056
	Bismuth .....	0.10
	Elements	Percent by Wt
	Copper .....	0.065
	Sulfur .....	0.0015
	Silver .....	0.0044
	Tin .....	0.09
<b>NIST-C2417</b>	<b>Lead-Base Alloy</b>	50 mm dia and 16 mm thick.
	It is intended for use in trace analysis of copper material.	
	Certified value	
	Elements	Percent by Wt
	Antimony .....	0.010
	Arsenic .....	0.011
	Elements	Percent by Wt
	Bismuth .....	0.010
	Copper .....	0.010
	Silver .....	0.010
<b>NIST-C2418</b>	<b>High-Purity Lead</b>	50 mm dia and 16 mm thick.
	It is intended for use as a composition standrd for optical emission spectrometric methods of analysis.	
	Certified value	
	Elements	Percent by Wt
	Cadmium .....	0.0003
	Elements	Percent by Wt
	Silver .....	0.0007
<b>NIST-C2415a</b>	<b>Battery Lead (UNS 52770)</b>	6.4 mm dia and 103 mm long.
	It is intended primarily for the evaluation of methods for analysis of constituent elements in lead alloys.	
	Certified value	
	Constituent	Mass Fraction %
	Antimony (Sb) .....	2.981
	Arsenic (As) .....	0.1865
	Constituent	Mass Fraction %
	Copper (Cu) .....	0.1022
	Tin (Sn) .....	0.3058
	Constituent	Mass Fraction mg/kg
	Bismuth (Bi) .....	507
	Cadmium (Cd) .....	49.7
	Nickel (Ni) .....	43.6
	Constituent	Mass Fraction mg/kg
	Selenium (Se) .....	100.5
	Silver (Ag) .....	76.2
	Tellurium (Te) .....	103.4

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-349a</b>	<b>Ni-Cr-Co Alloy UNS N07001 (chips)</b>	150 g
	It is intended primarily for use in chemical methods of analysis.	
	Certified value	
	Elements	%
	Aluminum	1.23 ± 0.05
	Boron	0.005 ± 0.001
	Carbon	0.035 ± 0.003
	Chromium	19.3 ± 0.1
	Cobalt	12.46 ± 0.08
	Copper	0.007 ± 0.001
	Iron	1.15 ± 0.04
	Manganese	0.019 ± 0.002
	Elements	%
	Molybdenum	4.25 ± 0.05
	Nickel	58.1 ± 0.1
	Phosphorus	0.003 ± 0.001
	Silicon	0.018 ± 0.002
	Sulfur	0.0024 ± 0.0006
	Titanium	3.06 ± 0.07
	Vanadium	0.12 ± 0.02
	Zirconium	0.053 ± 0.003
<b>NIST-861</b>	<b>Nickel-Base Superalloy PWA 1484 (chip form)</b>	50 g
	It is intended primarily for use in the evaluation of techniques employed in the determination of sulfur and phosphorus in nickel-based alloys.	
	Certified value	
	Elements	mg/kg
	Sulfur	0.561 ± 0.078
<b>NIST-864</b>	<b>Nickel Alloy UNS N06600 (chip form)</b>	100 g
	It is intended primarily for use in the evaluation of chemical and instrumental methods of analysis of nickel alloys and similar matrices.	
	Certified value	
	Elements	Mass Fraction (%)
	Aluminum (Al)	0.252
	Cobalt (Co)	0.0602
	Chromium (Cr)	15.74
	Copper (Cu)	0.255
	Elements	Mass Fraction (%)
	Iron (Fe)	9.63
	Manganese (Mn)	0.288
	Molybdenum (Mo)	0.204
	Nickel (Ni)	73.09
	Vanadium (V)	0.0327
<b>NIST-865</b>	<b>Inconel 625 (chip form)</b>	150 g
	It is in the form of chips and is intended for use in chemical methods of analysis.	
	Certified value	
	Elements	Percent by Wt
	Carbon	0.037
	Manganese	0.18
	Phosphorus	0.012
	Sulfur	0.001
	Silicon	0.41
	Copper	0.36
	Nickel	59.5
	Chromium	21.9
	Elements	Percent by Wt
	Aluminum	0.21
	Titanium	0.28
	Cobalt	0.072
	Boron	< 0.001
	Niobium	3.5
	Tantalum	< 0.01
	Molybdenum	8.6
	Iron	4.5

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit																								
<b>NIST-882</b>	<b>Nickel-Copper Alloy (65Ni-31Cu-3Al) (granule form)</b>	100 g																								
	is intended primarily for use in validation of chemical and instrumental methods of analysis for element contents of nickel and nickel-copper alloys and materials of similar matrix.																									
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<b>NIST-897</b>	<b>Nickel-Base High-Temperature Alloy (Tracealloy A) (chip form)</b>	35 g																								
	It is intended for use in the validation of chemical and instrumental methods used in trace elemental analysis of high-temperature alloys.																									
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<b>NIST-899</b>	<b>Nickel-Base High-Temperature Alloy (Tracealloy C) (chip form)</b>	35 g																								
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# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-1244**      Nickel Alloy UNS N06600 (disk form)      35 mm dia and 19 mm thick.

It is intended primarily for use in optical emission and X-ray fluorescence spectrometric methods of analysis of nickel alloys and similar matrices.

Certified value

Elements	Mass Fraction %	Elements	Mass Fraction %
Aluminum (Al) .....	0.252	Iron (Fe) .....	9.63
Cobalt (Co) .....	0.0602	Manganese (Mn) .....	0.288
Chromium (Cr) .....	15.74	Molybdenum (Mo) .....	0.204
Copper (Cu) .....	0.255	Nickel (Ni) .....	73.09
		Vanadium (V) .....	0.0327
Elements	Mass Fraction mg/kg	Elements	Mass Fraction mg/kg
Boron (B) .....	28.3	Lead (Pb) .....	2.27
Magnesium (Mg) .....	138.3	Thallium (Tl) .....	0.0029

**NIST-C1248**      Nickel-Copper Alloy (66Ni-30Cu)      32 mm dia and 19 mm thick.

It is intended for use in optical emission and X-ray fluorescence spectrometric methods of analysis.

Certified value

Elements	Percent by Wt	Elements	Percent by Wt
Carbon .....	0.266	Copper .....	29.80
Manganese .....	0.31	Nickel .....	65.75
Phosphorus .....	0.002	Chromium .....	0.095
Sulfur .....	0.0008	Molybdenum .....	0.006
Silicon .....	1.61	Iron .....	2.10
		Aluminum .....	0.009
Elements	µg/g	Elements	µg/g
Zinc .....	3	Lead .....	3.8
		Tin .....	1.1

**NIST-1249**      Ni-Cr-Fe-Nb-Mo Alloy UNS N07718 (disk form)      41 mm dia and 19 mm thick.

It is intended primarily for use in evaluating chemical and instrumental methods of analysis.

Certified value

Elements	Mass Fraction %	Elements	Mass Fraction %
Aluminum (Al) .....	0.5682 ± 0.0065	Cobalt (Co) .....	0.3371 ± 0.0078
Titanium (Ti) .....	0.959 ± 0.015	Nickel (Ni) .....	53.29 ± 0.26
Chromium (Cr) .....	18.472 ± 0.034	Copper (Cu) .....	0.1402 ± 0.0020
Iron (Fe) .....	17.693 ± 0.064	Niobium (Nb) .....	5.196 ± 0.021
		Molybdenum (Mo) .....	3.112 ± 0.028

**NIST-1728**      Tin Alloy (Sn-3Cu-0.5Ag)      39 mm in dia and 15 mm thick

It intended for use in the evaluation of chemical and instrumental methods of analysis and in calibration of analyses for bulk elemental composition.



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit																												
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<b>NIST-54d</b>	<b>Tin-Base Bearing Metal</b>	75 g																												
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<b>NIST-1727</b>	<b>Anode Tin (block form)</b>	30 mm × 30 mm × 30 mm.																												
	<p>It is intended primarily for use in evaluating chemical methods and instrumental methods of analysis of refined pig tin in anode form as specified by ASTM International B 339-00 Standard Specification for Pig Tin.</p> <p>Certified value</p> <table border="0"> <tr> <td>Constituent</td> <td>Mass Fraction (mg/kg)</td> </tr> <tr> <td>Pb .....</td> <td>33.26 ± 0.33</td> </tr> </table>		Constituent	Mass Fraction (mg/kg)	Pb .....	33.26 ± 0.33																								
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<b>NIST-1729</b>	<b>Tin Alloy (97Sn - 3Pb) (disk form)</b>	39 mm in dia and 15 mm thick.																												
	<p>It is intended for use in the evaluation of chemical and instrumental methods of analysis or in calibration of analyses for bulk elemental composition.</p> <p>Certified value</p> <table border="0"> <tr> <td>Constituent</td> <td>Mass Fraction %</td> </tr> <tr> <td>Pb .....</td> <td>3.11 ± 0.16</td> </tr> </table>		Constituent	Mass Fraction %	Pb .....	3.11 ± 0.16																								
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<b>NIST-2452</b>	<b>Hydrogen in Titanium Alloy (Nominal Mass Fraction 60 mg/kg H) (chip form)</b>	10 g																												
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# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-654b</b>	Titanium-Base Alloy (6Al-4V) (disk form) It is primarily intended for use in X-ray fluorescence and optical emission spectrometric methods of analysis.  Certified value Elements                      Mass Fraction (%)      Elements                      Mass Fraction (%) Aluminum (Al) ..... 6.34 ± 0.06      Nickel (Ni) ..... 0.028 ± 0.006 Chromium (Cr) ..... 0.025 ± 0.006      Silicon (Si) ..... 0.045 ± 0.003 Iron (Fe) ..... 0.23 ± 0.03      Vanadium (V) ..... 4.31 ± 0.06 Molybdenum (Mo) ..... 0.013 ± 0.003      Zirconium (Zr) ..... 0.008 ± 0.003	31 mm in dia and 19 mm thick.
<b>NIST-1128</b>	Titanium-Base Alloy (15V-3Al-3Cr-3Sn) (disk form) It is intended for use in optical emission and X-ray fluorescence spectrometric methods of analysis.  Certified value Element                      Percent by Wt      Element                      Percent by Wt Vanadium ..... 15.13      Chromium ..... 2.96 Aluminum ..... 3.06      Iron ..... 0.134 Tin ..... 3.04      Carbon ..... 0.011	35 mm in dia and 19 mm thick.
<b>NIST-2431</b>	Titanium-Base Alloy (6Al-2Sn-4Zr-6Mo) (chip form) It is intended for use primarily in chemical methods of analysis.  Certified value Element                      Percent by Wt      Element                      Percent by Wt Aluminum ..... 5.73      Molybdenum ..... 6.01 Tin ..... 1.98      Iron ..... 0.056 Zirconium ..... 4.06      Carbon ..... 0.006 Silicon ..... 0.088	50 g
<b>NIST-2432</b>	Titanium-Base Alloy (10V-2Fe-3Al) (chip form) It is intended for use primarily in chemical methods of analysis.  Certified value Element                      Percent by Wt      Element                      Percent by Wt Vanadium ..... 10.00      Iron ..... 1.77 Aluminum ..... 3.15      Silicon ..... 0.029 Carbon ..... 0.008	50 g
<b>NIST-2433</b>	Titanium-Base Alloy (8Al-1Mo-1V) (chip form) It is intended for use primarily in chemical methods of analysis.  Certified value Element                      Percent by Wt      Element                      Percent by Wt Aluminum ..... 7.63 ± 0.05      Molybdenum ..... 0.99 ± 0.02 Iron ..... 0.063 ± 0.003      Vanadium ..... 0.98 ± 0.02	50 g

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-173c</b>	Titanium Alloy UNS R56400 (chip form)	50 g
	It is intended primarily for use in evaluating chemical and instrumental methods of analysis of titanium and its alloys.	
	Certified value	
	Elements	Mass Fraction %
	Aluminum (Al) ..... 6.245 ± 0.036	Iron (Fe) ..... 0.2130 ± 0.0040
Chromium (Cr) ..... 0.0165 ± 0.0005	Nickel (Ni) ..... 0.0203 ± 0.0009	
Copper (Cu) ..... 0.0040 ± 0.0004	Vanadium (V) ..... 4.154 ± 0.016	
<hr/>		
<b>NIST-2453a</b>	Hydrogen in Titanium Alloy (Nominal Mass Fraction 125 mg/kg H) (pin form)	10 g
	It is intended primarily for use in evaluating chemical and instrumental methods for determination of hydrogen in titanium alloys.	
	Certified value	
	Elements	Mass Fraction (mg/kg)
	Hydrogen (H) ..... 126.8	
<hr/>		
<b>NIST-2453a</b>	Hydrogen in Titanium Alloy (Nominal Mass Fraction 125 mg/kg H) (pin form)	10 g
	It is intended primarily for use in evaluating chemical and instrumental methods for determination of hydrogen in titanium alloys.	
	Certified value	
	Elements	Mass Fraction (mg/kg)
	Hydrogen (H) ..... 126.8	
<hr/>		
<b>NIST-2454a</b>	Hydrogen in Titanium Alloy (Nominal Mass Fraction 215 mg/kg H) (pin form)	10 g
	It is intended primarily for use in evaluating chemical and instrumental methods for determination of hydrogen in titanium alloys.	
	Certified value	
	Elements	Mass Fraction (mg/kg)
	Hydrogen (H) ..... 216.0	
<hr/>		
<b>NIST-625</b>	Zinc-Base Die-Casting Alloy A (block form)	44 mm square and 19 mm thick.
	It is intended primarily for evaluating chemical and instrumental methods of analysis of zinc-base die-casting alloys.	
	Certified value	
	Elements	Mass Fraction (%)
	Aluminum 3.06 ± 0.04	Magnesium 0.070 ± 0.002
Cadmium 0.0007 ± 0.0001	Manganese 0.031 ± 0.002	
Chromium 0.0128 ± 0.0007	Nickel 0.0184 ± 0.0019	

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	Copper	0.034 ± 0.003
	Iron	0.036 ± 0.002
	Lead	0.0014 ± 0.0002
	Silicon	0.017 ± 0.002
	Tin	0.0006 ± 0.0001

**NIST-626**      Zinc-Base Die-Casting Alloy B (block form)      44 mm square and 19 mm thick.

It is intended primarily for evaluating chemical and instrumental methods of analysis of zinc-base die-casting alloys.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	3.56 ± 0.05	Magnesium (Mg)	0.020 ± 0.001
Cadmium (Cd)	0.0016 ± 0.0004	Manganese (Mn)	0.048 ± 0.001
Chromium (Cr)	0.0395 ± 0.0019	Nickel (Ni)	0.047 ± 0.002
Copper (Cu)	0.056 ± 0.003	Silicon (Si)	0.042 ± 0.003
Iron (Fe)	0.103 ± 0.006	Tin (Sn)	0.0012 ± 0.0002
Lead (Pb)	0.0022 ± 0.0004		

**NIST-627**      Zinc-Base Die-Casting Alloy B (block form)      44 mm square and 19 mm thick.

It is intended primarily for evaluating chemical and instrumental methods of analysis of zinc-base die-casting alloys.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	3.88 ± 0.04	Magnesium (Mg)	0.031 ± 0.001
Cadmium (Cd)	0.0051 ± 0.0007	Manganese (Mn)	0.014 ± 0.002
Chromium (Cr)	0.0038 ± 0.0007	Nickel (Ni)	0.0029 ± 0.0005
Copper (Cu)	0.132 ± 0.007	Silicon (Si)	0.021 ± 0.003
Iron (Fe)	0.023 ± 0.0006	Tin (Sn)	0.0042 ± 0.0003
Lead (Pb)	0.0082 ± 0.0004		

**NIST-628**      Zinc-Base Die-Casting Alloy D (block form)      44 mm square and 19 mm thick.

It is intended primarily for evaluating chemical and instrumental methods of analysis of zinc-base die-casting alloys.

Certified value

Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	4.59 ± 0.06	Magnesium (Mg)	0.0094 ± 0.0015
Cadmium (Cd)	0.0040 ± 0.0011	Manganese (Mn)	0.0091 ± 0.0009
Chromium (Cr)	0.0087 ± 0.0009	Nickel (Ni)	0.030 ± 0.002
Copper (Cu)	0.611 ± 0.017	Silicon (Si)	0.008 ± 0.002
Iron (Fe)	0.066 ± 0.002	Tin (Sn)	0.0017 ± 0.0002
Lead (Pb)	0.0045 ± 0.0004		

**NIST-629**      Zinc-Base Die-Casting Alloy E (block form)      44 mm square and 19 mm thick.

It is intended primarily for evaluating chemical and instrumental methods of analysis of zinc-base die-casting alloys.

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Certified value			
Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	5.15 ± 0.05	Magnesium (Mz)	0.094 ± 0.003
Cadmium (Cd)	0.0155 ± 0.0021	Manganese (Mn)	0.0017 ± 0.0002
Chromium (Cr)	0.0008 ± 0.0003	Nickel (Ni)	0.0075 ± 0.0004
Copper (Cu)	1.50 ± 0.01	Silicon (Si)	0.078 ± 0.003
Iron (Fe)	0.017 ± 0.004	Tin (Sn)	0.012 ± 0.001
Lead (Pb)	0.0135 ± 0.0014		

**NIST-630**      **Zinc-Base Die-Casting Alloy F (block form)**      44 mm square and 19 mm thick.

It is intended primarily for evaluating chemical and instrumental methods of analysis of zinc-base die-casting alloys.

Certified value			
Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum (Al)	4.30 ± 0.04	Magnesium (Mz)	0.030 ± 0.002
Cadmium (Cd)	0.0048 ± 0.0006	Manganese (Mn)	0.0106 ± 0.0008
Chromium (Cr)	0.0031 ± 0.0004	Nickel (Ni)	0.0027 ± 0.0003
Copper (Cu)	0.976 ± 0.016	Silicon (Si)	0.022 ± 0.003
Iron (Fe)	0.023 ± 0.001	Tin (Sn)	0.0040 ± 0.0003
Lead (Pb)	0.0083 ± 0.0007		

**NIST-631**      **Spectrographic Zinc Spelter (Modified) (block form)**      45 mm square and 19 mm thick.

It is intended primarily for use in optical emission and X-ray spectrometric methods of analysis.

Certified value			
Element	Mass Fraction (%)	Element	Mass Fraction (%)
Aluminum	0.50	Cadmium	0.0002
Manganese	0.00015	Iron	0.005
Indium	0.0023	Chromium	0.0001
Copper	0.0013	Tin	0.0001

**NIST-1738**      **Zinc-Aluminum Alloy**      44 mm square and 19 mm thick.

It is in the form of a disk, approximately 50.8 mm (2 in) in diameter and 12.7 mm (0.5 in) thick intended for use with optical emission and X-ray fluorescence spectrometric methods of analysis.

Certified value	
Elements	Mass Fraction (%)
Aluminum	0.1014 ± 0.0067
Lead	0.0101 ± 0.0005

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1740</b>	Zinc-Aluminum Alloy	50.8 mm dia and 12.7 mm thick.
	It is in the form of a disk, approximately 50.8 mm (2 in) in diameter and 12.7 mm (0.5 in) thick intended for use with optical emission and X-ray fluorescence spectrometric methods of analysis.	
	Certified value	
	Elements	Mass Fraction (%)
	Aluminum .....	0.4177 ± 0.0080
	Lead .....	0.0691 ± 0.0013
<b>NIST-1741</b>	Zinc-Base Die-Casting Alloy B (block form)	50.8 mm dia and 12.7 mm thick.
	It is in the form of a disk, approximately 50.8 mm (2 in) in diameter and 12.7 mm (0.5 in) thick intended for use with optical emission and X-ray fluorescence spectrometric methods of analysis.	
	Certified value	
	Elements	Mass Fraction (%)
	Aluminum .....	0.5242 ± 0.0137
	Lead .....	0.1571 ± 0.0035
<b>NIST-2139</b>	Zinc-Aluminum Alloy	44 mm square and 19 mm thick.
	It is in the form of milled chips intended for use with chemical methods of analysis.	
	Certified value	
	Elements	Mass Fraction (%)
	Aluminum .....	0.2042 ± 0.0105
	Lead .....	0.0302 ± 0.0010
<b>NIST-360b</b>	Zirconium (Sn-Fe-Cr) Alloy	100 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis.	
	Certified value	
	Element	Mass Fraction (mg/kg)
	Boron (B) .....	0.191
	Chromium (Cr) .....	1043
	Iron (Fe) .....	2138
	Nickel (Ni) .....	22.5
	Copper (Cu) .....	12.5
	Hafnium (Hf) .....	78.5
	Element	Mass Fraction (%)
	Tin (Sn) .....	1.555
<b>NIST-2066</b>	K-411 Glass Microspheres	50 mg
	It is intended for use as a standard for the quantitative microanalysis of particles and for the development of particle matrix correction procedures.	
	Certified value	
	Element	Concentration
	Element	Concentration

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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Silicon .....	0.256 ± 0.017	Magnesium .....	0.092 ± 0.014
Calcium .....	0.112 ± 0.023	Iron .....	0.112 ± 0.023
		Oxygen .....	0.429 ± 0.012

## NIST-481 Gold-Silver Wires for Microprobe Analysis 6 set

These standard reference materials are designed for use in quantitative elemental microprobe analysis.

Certified value Color-Code	Nominal Composition	Value	
		Au	Ag
Gold .....	Au100 .....	100	
Gray .....	Au80 - Ag20 .....	80.05	19.96
Yellow .....	Au60 - Ag40 .....	60.05	39.92
Blue .....	Au40 - Ag60 .....	40.03	59.93
Red .....	Au20 - Ag80 .....	22.43	77.58
Silver .....	Ag100 .....	100	

## NIST-482 Gold-Copper Wires for Microprobe Analysis 6 set

These standard reference materials are designed for use in quantitative elemental microprobe analysis.

Certified value Color-Code	Nominal Composition	Value	
		Au	Cu
Gold .....	Au100 .....	100	
Gray .....	Au80 - Cu20 .....	80.15	19.83
Yellow .....	Au60 - Cu40 .....	60.36	39.64
Blue .....	Au40 - Cu60 .....	40.10	59.92
Red .....	Au20 - Cu80 .....	20.12	79.85
Copper .....	Cu100 .....	100	

## NIST-682 High-Purity Zinc 57 mm dia and 25.4 mm deep and 19 mm long

It is intended primarily for the calibration of instruments and the evaluation of chemical methods used in zinc analysis.

Certified value Elements	Recommended Value ( ppm by wt)	Range of Values ( ppm by wt)
Copper .....	0.042 .....	[0.038 - 0.050]
Cadmium .....	(0.1) <sup>4</sup>	
Iron .....	(0.1)	
Silver .....	(0.02)	
Tin .....	(0.02)	



# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
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**NIST-683**      Zinc Metal      57 mm dia and 25.4 mm deep ,19 mm long.

It is intended for the calibration of instruments and the evaluation of chemical methods used in the analysis of zinc materials..

Certified value Elements	Recommended Value ( ppm by wt)	Range of Values ( ppm by wt)
Lead .....	11.1 .....	[9.6 - 11.3]
Copper .....	5.9 .....	[5.3 - 6.1]
Iron .....	2.2 .....	[1.7 - 3.1]
Silver .....	1.3 .....	[1.0 - 1.4]
Cadmium .....	1.1 .....	[1.0 - 1.2]
Thalium .....	(0.2) <sup>4</sup> .....	[0.17 - 0.18]
Tin .....	(0.02) .....	[0.013 - 0.023]

**NIST-728**      Intermediate-Purity Zinc      450 g

It is intended primarily for the calibration of instruments and the evaluation of chemical methods used in the analysis of zinc materials.

Certified value			
Element	Mass Fraction (mg/kg)	Element	Mass Fraction (mg/kg)
Cadmium .....	1.14 ± 0.04	Iron .....	1.84 ± 0.12
Copper .....	5.68 ± 0.34	Lead .....	11.13 ± 0.45
		Silver .....	1.08 ± 0.33

**NIST-885**      Refined Copper (pin form)      200 g

It is intended primarily for use in calibration and validation of instrumental methods of analysis used in determinations of sulfur and oxygen in copper and its alloys.

Certified value			
Element	Mass Fraction (%)	Element	Mass Fraction (%)
Oxygen (O) .....	0.031	Silver (Ag) .....	0.0005
Sulfur (S) .....	0.0018	Lead (Pb) .....	0.0002

**NIST-984**      Rubidium Chloride      0.25 g

This lot of rubidium chloride was prepared to ensure material of intermediate purity and high homogeneity.

Certified value	
Element	Percent by Wt
RbCl .....	99.90 ± 0.02

**NIST-997**      Thallium (Isotopic)      0.25 g

It is certified for use as an isotopic standard. SRM 997 consists of approximately 0.25 g of a commercial, high-purity thallium metal.

Certified value	
RbCl .....	99.90 ± 0.02

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit						
	Absolute Abundance Ratio ..... $^{205}\text{Tl}/^{203}\text{Tl}$ ..... 2.38714 ± 0.001 01 Thallium Atomic Weight ..... 204.38333 ± 0.000 18  Isotopic Composition: $^{203}\text{Tl}$ Atom Percent ..... 29.5235 ± 0.008 8 $^{205}\text{Tl}$ Atom Percent ..... 70.4765 ± 0.008 8							
<b>NIST-999b</b>	<b>Potassium Chloride</b>  It is intended for use as an analytical standard of known potassium (K) and chloride (Cl <sup>-</sup> ) content.  Certified value Element wKCl ..... 99.977% ± 0.014 % wCl ..... 47.5519% ± 0.0046 % wK ..... 52.4379% ± 0.0084 %	30 g						
<b>NIST-928</b>	<b>Lead Nitrate</b>  It is certified for use as an assay standard for lead and is intended primarily for use in the calibration and standardization of procedures employed in analysis and for routine critical evaluation of the daily working standards used in these procedures.  Certified value Lead Nitrate [Pb(NO <sub>3</sub> ) <sub>2</sub> ] ..... 100.00 % ± 0.03 %	30 g						
<b>NIST-937</b>	<b>Iron Metal</b>  It is a material of known purity intended for use as an assay standard for iron.  Certified value Iron (Mass Fraction) [1] ..... 99.90 % ± 0.02 %	50 g						
<b>NIST-2910b</b>	<b>Hydroxyapatite</b>  It is intended for use in evaluating the physical and chemical properties of apatites with biological, geological or synthetic origins.  Certified value <table border="0"> <tr> <td>Constituent</td> <td>Mass Fraction (%)</td> </tr> <tr> <td>Calcium (Ca) .....</td> <td>39.24</td> </tr> <tr> <td>Phosphorus (P) .....</td> <td>18.09</td> </tr> </table>	Constituent	Mass Fraction (%)	Calcium (Ca) .....	39.24	Phosphorus (P) .....	18.09	2 g
Constituent	Mass Fraction (%)							
Calcium (Ca) .....	39.24							
Phosphorus (P) .....	18.09							
<b>NIST-1877</b>	<b>Beryllium Oxide Powder</b>  It is intended for use in laboratory analysis and health research for the development and validation of analytical methods and instruments used to determine beryllium, as well as for proficiency testing of laboratories involved in beryllium determinations  Certified value Beryllium ..... 0.3576 g/g ± 0.0024 g/g	20 g						

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-1878b</b>	Respirable Alpha Quartz (Quantitative X-Ray Powder Diffraction Standard)	5 g
	It is intended for use in preparation of calibration standards for quantitative analyses of $\alpha$ -quartz by X-ray powder diffraction in accordance to National Institute for Occupational Safety and Health (NIOSH) Analytical Method 7500 or equivalent.	
	Certified value	
	Elements	Mass Fraction %
	Crystalline phase purity ..... ( $\alpha$ -quartz)	96.73 % $\pm$ 0.40 %
<b>NIST-1879b</b>	Respirable Cristobalite (Quantitative X-Ray Powder Diffraction Standard)	5 g
	It is intended for use in preparation of calibration standards for quantitative analyses of cristobalite by X-ray powder diffraction in accordance to National Institute for Occupational Safety and Health (NIOSH) Analytical Method 7500 or equivalent.	
	Certified value	
	Elements	Mass Fraction %
	Crystalline phase purity ..... (low cristobalite)	93.98 % $\pm$ 0.79 %
<b>NIST-2451</b>	Fine Carbon (Activated) – From Cyanide Ore Leaching	100 g
	It is intended primarily for use in calibration and validation of instrumental methods of analysis used in determinations of sulfur and oxygen in copper and its alloys.	
	Certified value	
	Element	Mass Fraction
	Mercury (Hg) .....	688 mg/kg $\pm$ 28 mg/kg
<b>NIST-2780a</b>	Rubidium Chloride	0.25 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis used to determine elements in hard rock mine waste and materials of a similar matrix.	
	Certified value	
	Element	Mass Fraction (%)
	Aluminum (Al) .....	8.43
	Barium (Ba) .....	0.093
	Calcium (Ca) .....	0.247
	Iron (Fe) .....	8.75
	Lead (Pb) .....	0.665
	Magnesium (Mg) .....	0.465
	Element	Mass Fraction (%)
	Potassium (K) .....	3.99
	Silicon (Si) .....	24.1
	Sodium (Na) .....	0.108
	Sulfur (S) .....	8.85
	Titanium (Ti) .....	0.643
	Zinc (Zn) .....	0.102
	Element	Mass Fraction (mg/kg)
	Antimony (Sb) .....	18.3
	Arsenic (As) .....	65.9
	Cerium (Ce) .....	67.7
	Cesium (Cs) .....	8.3
	Element	Mass Fraction (mg/kg)
	Neodymium (Nd) .....	28.3
	Nickel (Ni) .....	95
	Phosphorus (P) .....	286
	Rubidium (Rb) .....	s 220

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit	
Chromium (Cr) .....	205	Samarium (Sm) .....	4.7
Cobalt (Co) .....	16.5	Scandium (Sc) .....	15.6
Copper (Cu) .....	240	Silver (Ag) .....	72.5
Gold (Au) .....	6.6	Strontium (Sr) .....	121
Lanthanum (La) .....	34.4	Thorium (Th) .....	12.0
Manganese (Mn) .....	490	Uranium (U) .....	4.0
Molybdenum (Mo) .....	25.0	Vanadium (V) .....	152
		Zirconium (Zr) .....	206

**NIST-2445**      **Mercury in Iodized Activated Carbon**      25 g

It is intended for use in the evaluation of chemical methods of analysis for mercury in halogenated activated carbon sorbents.

Certified value

Mercury (Hg) ..... 0.690 mg/kg ± 0.047 mg/kg

**NIST-165a**      **Glass Sand**      75 g

It is intended for use in evaluating methods used to determine trace constituents in starting materials for the manufacture of glasses and similar products.

Certified value

Constituent	Wt %	Constituent	Wt %
Al <sub>2</sub> O <sub>3</sub> .....	0.059	TiO <sub>2</sub> .....	0.011
Fe <sub>2</sub> O <sub>3</sub> .....	0.012	ZrO <sub>2</sub> .....	0.006

**NIST-199**      **Silica Brick**      45 g

It is in the form of a powder and is intended for use in evaluating chemical and instrumental methods of analysis.

Certified value

Constituent	Mass Fraction (%)	Constituent	Mass Fraction (%)
Al <sub>2</sub> O <sub>3</sub> .....	0.48	CaO .....	2.41
Fe <sub>2</sub> O <sub>3</sub> .....	0.74	MgO .....	0.13
TiO <sub>2</sub> .....	0.06	Na <sub>2</sub> O .....	0.015
ZrO <sub>2</sub> .....		K <sub>2</sub> O .....	0.094
P <sub>2</sub> O <sub>5</sub> .....	0.015	Li <sub>2</sub> O .....	0.002
MnO .....	0.007	Loss on Ignition .....	0.17

**NIST-887**      **Cemented Carbide (W-83,Co-10)**      100 g

It is a sintered tungsten carbide base material in the form of a fine powder (150 μm) intended for use in checking chemical and instrumental methods of analysis.

Certified value

Constituent	Percent by Wt
Cobalt .....	10.35

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit	
<b>NIST-92</b>	<b>Soda-Lime Glass, Low Boron (Powder)</b>	45 g	
	It is intended primarily for use in validation of chemical and instrumental methods of analysis.		
Certified value			
Constituent	Mass Fraction %	Constituent                      Mass Fraction %	
Aluminum (Al) .....	0.706	Magnesium (Mg) .....	0.041
Arsenic (As) .....	0.031	Potassium (K) .....	0.478
Calcium (Ca) .....	5.81	Silicon (Si) .....	35.1
Iron (Fe) .....	0.0466	Sodium (Na) .....	9.6
Lead (Pb) .....	0.0030	Sulfur (S) .....	0.0164
		Boron oxide (B2O3) .....	0.70
<hr/>			
<b>NIST-80a</b>	<b>Soda-Lime Glass (Beads)</b>	45 g	
	It is intended primarily for use in validation of chemical and instrumental methods of analysis.		
Certified value			
Constituent	Mass Fraction %	Constituent                      Mass Fraction %	
Aluminum (Al) .....	0.921	Magnesium (Mg) .....	1.66
Antimony (Sb) .....	0.0063	Potassium (K) .....	0.552
Arsenic (As) .....	0.040	Silicon (Si) .....	33.6
Calcium (Ca) .....	5.80	Sodium (Na) .....	9.95
Iron (Fe) .....	0.108	Sulfur (S) .....	0.087
Lead (Pb) .....	0.0095	Tin (Sn) .....	0.0018
<hr/>			
<b>NIST-2686b</b>	<b>Portland Cement Clinker</b>	50 g	
	It is intended primarily for use in evaluating methods of phase abundance analysis of major phases in cement clinkers: the percentages of alite (C3S), belite (C2S), aluminat (C3A), ferrite (C4AF), and periclase.		
Certified value			
Phase	Mass Fraction (%)	Phase                              Mass Fraction (%)	
Alite .....	64.82 ± 2.57	Aluminat .....	3.76 ± 1.00
Belite .....	16.68 ± 3.35	Ferrite .....	10.42 ± 1.88
		Periclase .....	3.31 ± 0.70
<hr/>			
<b>NIST-2687a</b>	<b>Portland Cement Clinker</b>	5 vials x 8 g	
	It is intended for use in evaluating methods of phase abundance analysis of major phases in cement clinkers: the percentages of alite (C3S), belite (C2S), aluminat (C3A), and ferrite (C4AF).		
Certified value			
Phase	Mass Fraction (%)	Phase                              Mass Fraction (%)	
Alite .....	57.88	Aluminat .....	9.56
Belite .....	24.70	Ferrite .....	6.27

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
<b>NIST-635a</b>	<b>Portland Cement (Blended with Slag)</b>	25 g
	It is intended primarily for use in validation of chemical and instrumental methods of analysis of cements and materials of similar matrix for elemental contents.	
	Certified value	
	Constituent	Mass Fraction (%)
	Silicon Dioxide (SiO <sub>2</sub> )	23.13 ± 0.13
	Aluminum Trioxide (Al <sub>2</sub> O <sub>3</sub> )	7.867 ± 0.049
	Iron (III) Oxide (Fe <sub>2</sub> O <sub>3</sub> )	3.175 ± 0.025
	Calcium Oxide (CaO)	54.85 ± 0.36
	Magnesium Oxide (MgO)	3.817 ± 0.065
	Sulfur Trioxide (SO <sub>3</sub> )	3.222 ± 0.045
	Sodium Oxide (Na <sub>2</sub> O)	0.2477 ± 0.0037
	Potassium Oxide (K <sub>2</sub> O)	0.725 ± 0.019
	Titanium Dioxide (TiO <sub>2</sub> )	0.353 ± 0.010
	Phosphorus Pentoxide (P <sub>2</sub> O <sub>5</sub> )	0.0949 ± 0.0046
	Manganese Trioxide (Mn <sub>2</sub> O <sub>3</sub> )	0.1279 ± 0.0027
	Chromium Trioxide (Cr <sub>2</sub> O <sub>3</sub> )	0.01012 ± 0.00063
	Zinc Oxide (ZnO)	0.02619 ± 0.00087
Strontium Oxide (SrO)	0.1754 ± 0.0088	
Barium Oxide (BaO)	0.0315 ± 0.0043	
Chlorine (Cl)	0.0146 ± 0.0028	
<b>NIST-2497</b>	<b>Bingham Concrete Mixture for Rheological Measurements</b>	18.9 L
	It is intended for use in calibrating rheometers for measuring the rheological properties of concrete. A unit of SRM 2497 consists of two 18.9 L (5-gallons) containers labeled P and A. Container P includes Limestone (12 kg) and 4 L of corn syrup. Container A includes one plastic bag each of 1 mm beads (6 kg) and 10 mm beads (20 kg).	
	Certified value	
	Yield Stress	(Pa)
	Parallel Plate Measurement	12.5 ± 0.5
	Computational Model	22 ± 4
	Plastic Viscosity	(Pa*s)
	Parallel Plate Measurement	7.0 ± 0.2
	Computational Model	6.40 ± 0.06
	<b>NIST-1450e</b>	<b>Thermal Conductivity - Fibrous Glass Board</b>
It is intended primarily for use in the measurement of the thermal conductivity or thermal resistance of insulation materials.		
Certified value		
The certified values of $\rho$ (kg · m <sup>-3</sup> ) and $\lambda$ (W · m <sup>-1</sup> · K <sup>-1</sup> ), and their associated relative expanded uncertainties (k = 2) for this unit are		
$\rho = \text{SAMPLE} \pm 1.5 \% (k = 2)$		
$\lambda = -1.97313 \times 10^{-3} + 1.99227 \times 10^{-5} \rho + 1.07923 \times 10^{-4} T \pm 1.0 \% (k = 2)$		

# Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit	
<b>NIST-1984</b>	Thermal Spray Powder - Particle Size Distribution Tungsten Carbide/Cobalt (Acicular)	14 g	
	It is primarily intended for use in the calibration of equipment used to measure particle size distributions (PSD) in the 9 µm to 30 µm range.		
	Certified PSD Values by SEM		
	Cumulative Mass Fraction (%)	Certified Diameter (µm)	
	10 % .....	10.3	
	25 % .....	13.2	
	50 % .....	17.1	
	75 % .....	21.3	
	90 % .....	26.3	
<b>HIPB-1</b>	High Purity Lead Certified Reference Material for Lead Mass Fraction, Atomic Weight, Isotopic Composition, and Elemental Impurities	1 g	
	Certified Values		
	Quantity	Value	
	Mass fraction of lead, w(Pb)/(kg/kg) .....	0.999990	
	Atomic weight of lead, Ar(Pb) .....	207.1791	
	Isotopic abundance, x( <sup>204</sup> Pb)/(mol/mol) .....	0.012822	
	Isotopic abundance, x( <sup>206</sup> Pb)/(mol/mol) .....	0.27096	
	Isotopic abundance, x( <sup>207</sup> Pb)/(mol/mol) .....	0.203511	
	Isotopic abundance, x( <sup>208</sup> Pb)/(mol/mol) .....	0.51271	
<b>HICU-1</b>	High Purity Lead Certified Reference Material for Lead Mass Fraction, Atomic Weight, Isotopic Composition, and Elemental Impurities	0.9 g	
	Certified Values		
	Quantity	Value	
	Mass fraction of copper, w(Cu)/(kg/kg) .....	0.999993	
<b>PACS-3</b>	Marine Sediment Certified Reference Material for total and extractable metal content	50 g	
	Element/ Substance	Mass fraction, mg/kg	Type
	aluminium (c,d) .....	65800 ± 1200 .....	certified
	antimony (a,c) .....	14.7 ± 2.2 .....	certified
	arsenic (b,c) .....	30.3 ± 2.4 .....	certified
	beryllium (b) .....	1.06 ± 0.12 .....	certified
	cadmium (a) .....	2.23 ± 0.16 .....	certified
	calcium (c,d) .....	18900 ± 1200 .....	certified
	chromium (a,c) .....	90.6 ± 4.0 .....	certified
	cobalt (b) .....	12.1 .....	information
	copper (a,c) .....	326 ± 10 .....	certified
	iron (c,d) .....	41060 ± 640 .....	certified
	lead (a,c) .....	188.0 ± 7.4 .....	certified
	lithium (a,c) .....	31.9 ± 4.2 .....	certified

## Rocks, Metal, Ceramic, Glass, Grass, and Minerals

Code	Product	Unit
	magnesium (c,d) .....	14020 ± 580 ..... certified
	manganese (b,c) .....	432 ± 16 ..... certified
	mercury (a) .....	2.98 ± 0.36 ..... certified
	molybdenum (a) .....	5.9 ..... information
	nickel (a,c) .....	39.5 ± 2.2 ..... certified
	phosphorus (c,d) .....	937 ± 44 ..... certified
	potassium (c,d) .....	12530 ± 400 ..... certified
	silicon (d) .....	261000 ± 34000 ..... certified
	silver (a) .....	1.10 ± 0.08 ..... reference
	sodium (c) .....	35200 ± 3400 ..... certified
	strontium (a,c) .....	267 ± 10 ..... certified
	sulfur (d) .....	11700 ± 4400 ..... certified
	tin (a,c) .....	22.0 ± 2.2 ..... certified
	titanium (c,d) .....	4420 ± 180 ..... certified
	uranium (a) .....	2.6 ..... information
	vanadium (b,c) .....	129 ± 8 ..... certified
	zinc (a,c) .....	376 ± 12 ..... certified
	monobutyltin (as Sn) (e,f) .....	1.47 ± 0.22 ..... certified
	dibutyltin (as Sn) (e,f) .....	0.631 ± 0.038 ..... certified
	tributyltin (as Sn) (e,f) .....	0.43 ± 0.06 ..... certified



# Certified For Trace Element

본 자료는 시기에 따라 제품 단종 및 수치의 변경이  
있을 수 있으니 본사로 문의 부탁드립니다.

## Certified for trace element content

Code	Product	Unit
IRMM-524B	Fe (0.5 mm wire)	4.5 g
	<p>IRMM-524 consists of iron with a nominal purity of <math>\geq 99.996\%</math>.                      The isotopic abundances correspond to the natural composition.                      Manganese and cobalt, present as impurities and causing interference during application, are certified.</p>	
	Mass fraction	Certified value [mg/kg]
	Co .....	< 0.05
	Mn .....	< 0.1
IRMM-525A	Nb (0.02 mm foil)	0.3 g
	<p>IRMM-525 consists of niobium with a nominal purity of <math>&gt; 99.98\%</math>.                      Tantalum, present as impurity and causing spectral interference during application, is certified.</p>	
	Mass fraction	Certified value [mg/kg]
	Ta .....	19.6
IRMM-526A	Nb (0.02 mm foil)	0.3 g
IRMM-526B	Nb (0.1 mm foil)	1.7 g
IRMM-526C	Nb (0.5 mm wire)	1.7 g
	<p>IRMM-526 consists of niobium metal with a nominal purity of <math>&gt; 99.994\%</math>.                      Tantalum, present as impurity and causing spectral interference during application, is certified. The material is available as:</p> <p>IRMM-526A: 0.02 mm thick foil (20 cm<sup>2</sup> units).                      IRMM-526B: 0.1 mm thick foil (20 cm<sup>2</sup> units).                      IRMM-526C: 0.5 mm diameter wire (1 m units)</p>	
	Mass fraction	Certified value [g/g]
	Ta .....	0.30
IRMM-529	Rh (0.05 mm foil)	1.2 g
	<p>It has been prepared from rhodium metal powder of nominal purity of <math>&gt; 99.97\%</math> by crucible-less induction melting followed by hot and cold rolling.                      The material is available as 20 cm<sup>2</sup> foil (approximately 2 x 10 cm) of 0.05 mm thickness.</p>	
	Mass Fraction	Certified value [g/kg]
	Iridium .....	26.0
	Platinum .....	< 5
IRMM-531A	Ti (0.1 mm foil)	5.4 g
IRMM-531B	Ti (0.5 mm foil)	5.4 g
	<p>IRMM-531 consists of titanium metal with a nominal purity of <math>&gt; 99.94\%</math>. Scandium, present as impurity, is certified.</p> <p>The material is supplied in three different forms:</p>	

## Certified for trace element content

Code	Product	Unit
	IRMM-531A: 0.1 mm thick foil (100 cm <sup>2</sup> units) IRMM-531B: 0.5 mm thick foil (20 cm <sup>2</sup> units) IRMM-531C: 0.5 mm thick wire (1 m units)	
	Mass Fraction	Certified value [mg/kg]
	Sc .....	< 0.1
<b>IRMM-527RA</b>	Al-0.1 % Co (0.1 mm foil)	2.7 g
<b>IRMM-527RB</b>	Al-0.1 % Co (0.5 mm wire)	0.5 g
<b>IRMM-527RC</b>	Al-0.1 % Co (1.0 mm wire)	2.1 g
	The material is supplied as: IRMM-527RA: 0.1 mm foil (100 cm <sup>2</sup> unit) IRMM-527RB: 0.5 mm diameter wire (1 m unit) IRMM-527RC: 1 mm diameter wire (1 m unit)	
	Mass Fraction	Certified value [g/kg]
	Co .....	1.001
<b>IRMM-528RA</b>	Al-1.0 % Co (0.1 mm foil)	2.7 g
<b>IRMM-528RC</b>	Al-1.0 % Co (1.0 mm wire)	2.1 g
	The material is supplied as: IRMM-528RA: 0.1 mm foil (100 cm <sup>2</sup> unit) IRMM-528RC: 1 mm diameter wire (1 m unit)	
	Mass Fraction	Certified value [g/kg]
	Co .....	10.02
<b>ERM-EB530A</b>	Al-0.1 % Au (0.1 mm foil)	1.4 g
	It is an aluminium gold alloy material certified for the mass fraction of gold. The ERM-EB530A unit is a foil of 50 cm <sup>2</sup> thickness: 0.100 mm (relative tolerance ± 5 %).	
	Mass Fraction	Certified value [mg/kg]
	Au .....	1005
<b>ERM-EB530B</b>	Al-0.1 % Au (0.5 mm wire)	0.53 g
	It is an aluminium gold alloy material certified for the mass fraction of gold. The ERM-EB530B unit is a 1 meter length wire with diameter of 0.500 mm (relative tolerance ± 5 %).	
	Mass fraction	Certified value [mg/kg]
	Au .....	1005
<b>ERM-EB530C</b>	Al-0.1 % Au (1.0 mm wire)	2.12 g
	It is an aluminium gold alloy certified for the mass fraction of gold. The ERM-EB530C unit is a 1 meter length wire with diameter of 1.000 mm (relative tolerance ± 5 %).	

## Certified for trace element content

Code	Product	Unit
	Mass fraction	Certified value [mg/kg]
	Au .....	1005
<b>IRMM-532A</b>	Al-0.01 % Co (0.1 mm foil)	2.7 g
<b>IRMM-532B</b>	Al-0.01 % Co (0.5 mm wire)	0.5 g
<b>IRMM-532C</b>	Al-0.01 % Co (1.0 mm wire)	2.1 g
	The material is supplied in three different forms: IRMM-532A: 0.1 mm thick foil (100 cm <sup>2</sup> unit) IRMM-532B: 0.5 mm diameter wire (1 m unit) IRMM-532C: 1 mm diameter wire (1 m unit).	
	Mass fraction	Certified value [g/kg]
	Co .....	0.1
<b>IRMM-533A</b>	Al-0.1 % Ag (0.1 mm foil)	2.7 g
<b>IRMM-533B</b>	Al-0.1 % Ag (0.5 mm wire)	0.5 g
<b>IRMM-533C</b>	Al-0.1 % Ag (1.0 mm wire)	2.1 g
	The material is supplied as 0.1 mm foil (100 cm <sup>2</sup> unit), 0.5 mm diameter wire (1 m unit) or 1 mm diameter wire (1 m unit).	
	Mass fraction	Certified value [g/kg]
	Ag .....	0.996
<b>IRMM-534A</b>	Al-2.0 % Sc (0.1 mm foil)	2.7 g
<b>IRMM-534B</b>	Al-2.0 % Sc (0.5 mm wire)	0.5 g
<b>IRMM-534C</b>	Al-2.0 % Sc (1.0 mm wire)	2.1 g
	The material is supplied in three forms: IRMM-534A: 0.1 mm foil (100 cm <sup>2</sup> unit) IRMM-534B: 0.5 mm diameter wire (1 m unit) IRMM-534C: 1 mm diameter wire (1 m unit)	
	Mass Fraction	Certified value [g/kg]
	Sc .....	19.95
<b>BCR-017B</b>	<b>COPPER (S, P)</b>	50 g
	Chips in bottles containing approx. 50 g	
	Mass Fraction	Certified value [mg/kg]
	S .....	10.4
	P .....	6.85
<b>BCR-022A</b>	<b>ELECTROLYTIC TOUGH PITCH COPPER (O)</b>	42 g
<b>BCR-022B</b>	<b>ELECTROLYTIC TOUGH PITCH COPPER (O)</b>	28 g

## Certified for trace element content

Code	Product	Unit
	<p>The material is wrought copper according to ISO-RECOMMENDATION No. 1337. The samples are available as:</p> <ul style="list-style-type: none"> <li>- BCR-022A: discs of 26 mm in diameter and 9 mm thick</li> <li>- BCR-022B: rods of 9 mm in diameter and 50 mm long</li> </ul>	
	<p>Mass Fraction</p> <p>Oxygen ..... 138</p>	<p>Certified value [mg/kg]</p>
<b>BCR-054R</b>	<b>COPPER (O)</b>	18 g
	<p>The material is available in the form of rods with 7 mm diameter and 50 mm length, sealed under argon in cold welded aluminium tubes.</p>	
	<p>Mass Fraction</p> <p>Oxygen ..... 0.47</p>	<p>Certified value [mg/kg]</p>
<b>BCR-058</b>	<b>CONTINUOUS CAST COPPER (O)</b>	17 g
	<p>The samples are available as rods 7 mm in diameter and 50 mm long.</p>	
	<p>Mass Fraction</p> <p>Oxygen ..... 390</p>	<p>Certified value [µg/g]</p>
<b>BCR-024B</b> <b>BCR-024C</b>	<b>TITANIUM (O, N)</b> <b>TITANIUM (O, N)</b>	10 g 5 g
	<p>The samples are available as:</p> <ul style="list-style-type: none"> <li>- BCR-024B: 0.4 g samples (in bottles of 25 samples)</li> <li>- BCR-024C: 0.2 g samples (in bottles of 25 samples)</li> </ul>	
	<p>Mass Fraction</p> <p>Nitrogen ..... 117</p> <p>Oxygen ..... 608</p>	<p>Certified value [mg/kg]</p>
<b>BCR-275</b>	<b>ZIRCALOY (C, N, O)</b>	9 g
	<p>The material is available in bottles containing 10 disks of 13 mm diameter and 1 mm thickness (0.9 g each).</p>	
	<p>Mass fraction</p> <p>C ..... 0.113</p> <p>N ..... 0.0390</p> <p>O ..... 1.67</p>	<p>Certified value [g/kg]</p>
<b>BCR-276</b>	<b>ZIRCALOY (C, N, O)</b>	20 g
	<p>The material is available in glass bottles containing 100 cylinders of nominally 4.5 mm diameter and 2 mm thickness (about 0.2 g each).</p>	

## Certified for trace element content

Code	Product	Unit		
	Mass fraction	Certified value [g/kg]		
	C .....	0.108		
	N .....	0.041		
	O .....	1.54		
<b>BCR-102</b>	<b>TUNGSTEN CARBIDE POWDER (O)</b>	3 g		
	The material is available as 2-3 g portions of a powder (with a particle size of 5-8 µm) in bottles, each bottle sealed under argon in an aluminium container.			
	Mass fraction	Certified value [µg/g]		
	Oxygen .....	185		
<b>BCR-286A</b> <b>BCR-286B</b>	<b>ELECTROLYTICALLY REFINED LEAD (trace elements)</b> <b>ELECTROLYTICALLY REFINED LEAD (trace elements)</b>	60 mm x 60 mm x 12 mm 160 g		
	The material consists of electrolytically refined lead.			
	The material is available in two forms: BCR-286A: solid squares of about 60 mm x 60 mm x 12 mm BCR-286B: chips in glass bottles containing about 160 g			
	Mass fraction	Certified value [µg/g]	Mass fraction	Certified value [µg/g]
	Ag .....	15	Ni .....	41
	As .....	< 2	Se .....	< 50
	Cd .....	125	Sn .....	< 50
	Cu .....	1490	Te .....	< 100
<b>BCR-288B</b>	<b>LEAD WITH ADDED IMPURITIES (trace elements)</b>	160 g		
	Chips in glass bottles containing about 160 g			
	Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
	As .....	55.7	Se .....	< 0.2
	Bi .....	215.8	Te .....	32.8
	Cd .....	33.3	Tl .....	2.26
	Cu .....	19.3	Zn .....	8.2
<b>BCR-321</b>	<b>UNALLOYED ZINC (disc) (trace elements)</b>	80 mm diameter and 20 mm thickness		
	The samples are discs with 80 mm diameter and 20 mm thickness. Each sample has two different numbers:			
	- a five digit code, marked on the metal by the producer of the materials, defining the exact position of the sample in the original batch of rods;			
	- the "normal" individual identification (consecutive numbering of samples within a CRM), marked on the label of the samples.			

## Certified for trace element content

Code	Product	Unit
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Mass Fraction	Certified value [ $\mu\text{g/g}$ ]
Al .....	< 0.7
In .....	< 0.2
Pb .....	4.85
Sn .....	< 0.5
Tl .....	0.78

**ERM-EB322** UNALLOYED ZINC (trace elements) 60 mm diameter and 30 mm height

The CRM consists of one cylinder of about 60 mm diameter and 30 mm height.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Cd .....	15.08	Pb .....	15.0
Cu .....	5.89	Sn .....	5.6
Fe .....	19.1	Tl .....	5.28

**ERM-EB323** UNALLOYED ZINC (trace elements) 60 mm diameter and 30 mm height

The CRM consists of one cylinder of about 60 mm diameter and 30 mm height.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Cd .....	6.51	Pb .....	48.6
Cu .....	18.9	Sn .....	18.7
Fe .....	11.3	Tl .....	10.8

**ERM-EB324** UNALLOYED ZINC (trace elements) 60 mm diameter and 30 mm height

The CRM consists of one cylinder of about 60 mm diameter and 30 mm height.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Cd .....	48.6	Pb .....	26.1
Cu .....	9.87	Sn .....	9.8
Fe .....	58.5	Tl .....	19.9

**ERM-EB325** UNALLOYED ZINC (trace elements) 60 mm diameter and 30 mm height

The CRM consists of one cylinder of about 60 mm diameter and 30 mm height.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Cd .....	94.7	Pb .....	142
Cu .....	47.5	Sn .....	46.1
Fe .....	56.1	Tl .....	36.8

**BCR-326** UNALLOYED ZINC (disc) (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.

Each sample has two different numbers:

- a five digit code, marked on the metal by the producer of the materials, defining the exact position of the sample in the original batch of rods;

## Certified for trace element content

Code	Product	Unit
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- the "normal" individual identification (consecutive numbering of samples within a CRM), marked on the label of the samples.

Mass fraction	Certified value [ $\mu\text{g/g}$ ]	Mass fraction	Certified value [ $\mu\text{g/g}$ ]
Cd .....	203.0	Fe .....	264.8
Cu .....	104.8	Pb .....	307.0

**BCR-327** UNALLOYED ZINC (disc) (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.

Each sample has two different numbers:

- a five digit code, marked on the metal by the producer of the materials, defining the exact position of the sample in the original batch of rods;
- the "normal" individual identification (consecutive numbering of samples within a CRM), marked on the label of the samples.

Mass fraction	Certified value [ $\mu\text{g/g}$ ]
Cd .....	301.4
Fe .....	144.0
Pb .....	409.4

**BCR-351** ZnAl4 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.

For the numbering of the samples see Annex I.

Mass fraction	Certified value	Mass fraction	Certified value
Al .....	43.55 g/kg	Mg .....	131.0 mg/kg
Cu .....	12.13 mg/kg	Pb .....	4.50 mg/kg
In .....	< 0.2 mg/kg	Sn .....	< 1 mg/kg
		Tl .....	0.74 mg/kg

**BCR-352** ZnAl4 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.

For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	41.50 g/kg	Mg .....	283.0 mg/kg
Cd .....	2.88 mg/kg	Ni .....	6.74 mg/kg
Cu .....	31.26 mg/kg	Sn .....	3.0 mg/kg
In .....	3.02 mg/kg	Tl .....	3.2 mg/kg

**BCR-353** ZnAl4 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.

For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	39.5 g/kg	Mg .....	452.5 mg/kg



## Certified for trace element content

Code	Product	Unit
	Cd .....	10.44 mg/kg
	Cu .....	100.0 mg/kg
	In .....	2.5 mg/kg
	Ni .....	24.4 mg/kg
	Sn .....	5.6 mg/kg
	Tl .....	3.95 mg/kg

**BCR-354** ZnAl4 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	37.27 g/kg	Mg .....	602 mg/kg
Cd .....	29.7 mg/kg	Ni .....	83.1 mg/kg
Cu .....	312.3 mg/kg	Pb .....	30.8 mg/kg
In .....	9.8 mg/kg	Sn .....	14.1 mg/kg
		Tl .....	11.01 mg/kg

**BCR-355** ZnAl4 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	34.43 g/kg	Mg .....	786 mg/kg
Cd .....	58.1 mg/kg	Ni .....	268 mg/kg
Cu .....	1035 mg/kg	Pb .....	56.9 mg/kg
In .....	24.6 mg/kg	Sn .....	29.1 mg/kg
		Tl .....	23.25 mg/kg

**BCR-356** ZnAl4Cu1 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	44.34 g/kg	In .....	< 0.2 mg/kg
Cd .....	0.73 mg/kg	Mg .....	132.3 mg/kg
Cu .....	3.944 g/kg	Ni .....	3.43 mg/kg
Fe .....	31.5 mg/kg	Pb .....	9.87 mg/kg
		Tl .....	0.79 mg/kg

**BCR-357** ZnAl4Cu1 (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	42.27 g/kg	Mg .....	273 mg/kg
Cd .....	2.83 mg/kg	Ni .....	9.82 mg/kg
Cu .....	5.849 g/kg	Pb .....	13.8 mg/kg

## Certified for trace element content

Code	Product	Unit
	Fe .....	25.7 mg/kg
	In .....	3.30 mg/kg
	Sn .....	3.51 mg/kg
	Tl .....	2.76 mg/kg

**BCR-360** ZnAl<sub>4</sub>Cu<sub>1</sub> (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	34.27 g/kg	Mg .....	705 mg/kg
Cd .....	59.5 mg/kg	Ni .....	267 mg/kg
Cu .....	12.34 g/kg	Pb .....	73.9 mg/kg
In .....	29.8 mg/kg	Sn .....	33.0 mg/kg
		Tl .....	25.9 mg/kg

**BCR-361** ZnAl<sub>4</sub>Cu<sub>1</sub> (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	40.68 g/kg	Pb .....	5.31 mg/kg
Cu .....	7.98 g/kg	Sn .....	46.3 mg/kg
Fe .....	10.34 mg/kg	Tl .....	37.4 mg/kg

**BCR-089** Ti 6Al 4V (Al, V) 40 mm diameter and 20 mm height.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	59.7 g/kg	N .....	212 mg/kg
C .....	38 mg/kg	Ni .....	106 mg/kg
Cr .....	122 mg/kg	O .....	1660 mg/kg
Cu .....	10.3 mg/kg	Sb .....	1.94 mg/kg
Fe .....	515 mg/kg	Sn .....	10.4 mg/kg
H .....	31 mg/kg	Ta .....	0.30 mg/kg
Hf .....	0.126 mg/kg	V .....	39.76 g/kg
Mn .....	4.2 mg/kg	W .....	1.6 mg/kg
Mo .....	15.2 mg/kg	Zr .....	2.8 mg/kg

**BCR-354** ZnAl<sub>4</sub> (trace elements) 80 mm diameter and 20 mm thickness.

The samples are discs with 80 mm diameter and 20 mm thickness.  
For the numbering of the samples see Annex I.

Mass Fraction	Certified value	Mass Fraction	Certified value
Al .....	37.27 g/kg	Mg .....	602 mg/kg
Cd .....	29.7 mg/kg	Ni .....	83.1 mg/kg

## Certified for trace element content

Code	Product	Unit
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Cu .....	312.3 mg/kg	Pb .....	30.8 mg/kg
In .....	9.8 mg/kg	Sn .....	14.1 mg/kg
		Tl .....	11.01 mg/kg

**BCR-090A**      TITANIUM (impurities)      80 mm diameter and 20 mm thickness.

The material is available in 2 forms:  
BCR-090A: cylinders with 40 mm diameter and 20 mm height

Mass Fraction	Certified value [g/kg]	Mass Fraction	Certified value [g/kg]
B .....	0.0282	Fe .....	0.563
Co .....	0.501	Mn .....	0.314
Cr .....	0.533	Mo .....	0.488
Cu .....	0.513	Ni .....	0.667

**BCR-098**      ZIRCALOY-4 (trace element impurities)      10 g

The material is available in the form of chips (1 bottle contains approximately 10 g).

Mass Fraction	Certified value
Cr .....	906 µg/g
Fe .....	2.143 mg/g
Hf .....	77.6 µg/g
Sn .....	14.60 mg/g

**BCR-074A**      ELECTROLYTIC COPPER (trace elements)      40 mm diameter and 30 mm height

The material is available in two forms:  
BCR-074A: cylinders with 40 mm diameter and 30 mm height

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Ag .....	12.8	Mn .....	1.27
As .....	0.78	Ni .....	1.04
Cd .....	< 0.02	Pb .....	0.97
Co .....	< 0.05	Sb .....	0.576
Cr .....	< 0.1	Se .....	0.37
Fe .....	1.14	Sn .....	< 0.07
		Zn .....	0.46

**ERM-EB074B**      ELECTROLYTIC COPPER, rod, (trace elements)      8 mm diameter; 100 mm length

It is a material composed of pure copper with added impurities.  
ERM-EB074B is a cylinder of 8 mm diameter; 100 mm length;  
sealed in plastic sachet under vacuum.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Ag .....	1.03	Mg .....	2.03
As .....	1.23	Mn .....	0.93
Au .....	0.52	Ni .....	0.61

## Certified for trace element content

Code	Product	Unit
	Be .....	0.31
	Bi .....	0.51
	Cd .....	0.40
	Co .....	0.83
	Cr .....	0.37
	Fe .....	5.8
	In .....	0.49
	P .....	1.53
	Pb .....	2.7
	Sb .....	0.57
	Se .....	0.55
	Te .....	0.50
	Ti .....	0.97
	Zn .....	2.2

**ERM-EB074C** ELECTROLYTIC COPPER, chips (trace elements) 80 mm diameter and 20 mm thickness.

It is a material composed of pure copper with added impurities.  
ERM-EB074C is composed of chips of approximately 250 mg.  
Fifty grams of chips are packed into an amber glass bottle flushed with inert gas (Ar).

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Ag .....	1.03	Mg .....	2.03
As .....	1.23	Mn .....	0.93
Au .....	0.52	Ni .....	0.61
Be .....	0.31	P .....	1.53
Bi .....	0.51	Pb .....	2.7
Cd .....	0.40	Sb .....	0.57
Co .....	0.83	Se .....	0.55
Cr .....	0.37	Te .....	0.50
Fe .....	5.8	Ti .....	0.97
In .....	0.49	Zn .....	2.2

**ERM-EB075A** ELECTROLYTIC COPPER WITH ADDED IMPURITIES, disc 39 mm diameter; 30 mm thick (trace elements)

ERM-EB075A is a material composed of pure copper with added impurities.  
ERM-EB075A is a disc of 39 mm diameter; 30 mm thick; packed in a box.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Ag .....	10.8	Cd .....	2.69
Al .....	2.3	Co .....	2.64
As .....	3.18	Cr .....	1.40
Au .....	1.46	Fe .....	9.3
Be .....	1.08	In .....	1.83
Bi .....	1.79	Mg .....	7.0

**ERM-EB075B** ELECTROLYTIC COPPER WITH ADDED IMPURITIES, rod 8 mm diameter; 100 mm length (trace elements)

ERM-EB075B is a material composed of pure copper with added impurities.  
ERM-EB075B is a cylinder of 8 mm diameter; 100 mm length;  
sealed in a plastic sachet under vacuum.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Ag .....	10.8	Cd .....	2.69

## Certified for trace element content

Code	Product	Unit
	Al .....	2.3
	As .....	3.18
	Au .....	1.46
	Be .....	1.08
	Bi .....	1.79
	Co .....	2.64
	Cr .....	1.40
	Fe .....	9.3
	In .....	1.83
	Mg .....	7.0

**ERM-EB075C** ELECTROLYTIC COPPER WITH ADDED IMPURITIES, chips (trace elements) 50 g

ERM-EB075C is a material composed of pure copper with added impurities.  
ERM-EB075C is composed of chips of approximately 250 mg.  
Fifty grams of chips are packed into a bottle.

Mass Fraction	Certified value [mg/kg]	Mass Fraction	Certified value [mg/kg]
Ag .....	10.8	Cd .....	2.69
Al .....	2.3	Co .....	2.64
As .....	3.18	Cr .....	1.40
Au .....	1.46	Fe .....	9.3
Be .....	1.08	In .....	1.83
Bi .....	1.79	Mg .....	7.0

**BCR-691** COPPER ALLOYS (As, Pb, Sn and Zn) 35 mm diameter and 2 mm thickness,

A set comprises five discs (one of each composition) of 35 mm diameter and 2 mm thickness, packed in a plastic box.

A Quaternary bronze    B Brass    C Arsenic-Copper    D Lead-bronze    E Tin-bronze

Certified value [g/kg]

As	1.94	0.99	46.0	2.85	1.94
Pb	79	3.9	1.75	92	2.04
Sn	71.6	20.6	2.02	101	70
Zn	60.2	148	0.55	1.48	1.57

**BCR-331** LOW VOLATILE STEAM COAL (S) 20 g

The sample is a ground low volatile steam coal (sieve fraction of particles up to 125 µm).  
It is provided in units of approx. 20 g in sealed, hard-glass ampoules with an argon atmosphere. Additional information on the material is given in the report.

Mass Fraction	Certified value [g/kg]
sulfur .....	4.99

**BCR-332** HIGH VOLATILE INDUSTRIAL COAL (S) 20 g

The sample is a ground high volatile industrial coal (sieve fraction of particles up to 125 µm).  
It is provided in units of approx. 20 g in sealed, hard-glass ampoules with an argon atmosphere. Additional information on the material is given in the report.

## Certified for trace element content

Code	Product	Unit
	Mass Fraction sulfur ..... 9.61	Certified value [g/kg]
<b>BCR-336</b>	<b>HIGH VOLATILE STEAM COAL (S)</b>  The sample is a ground high volatile industrial coal (sieve fraction of particles up to 125 µm). It is provided in units of approx. 20 g in sealed, hard-glass ampoules with an argon atmosphere. Additional information on the material is given in the report.	20 g
	Mass Fraction sulfur ..... 32.90	Certified value [g/kg]
<b>BCR-460</b>	<b>COAL (F)</b>  The material consists of 40 g South African Rietspruit coal powder in a glass bottle. Additional information on the preparation of the material and the certified value is given in the certification report.	40 g
	Mass Fraction F ..... 255	Certified value [mg/kg]
<b>BCR-461</b>	<b>CLAY (F)</b>  The material consists of a clay powder in a glass bottle. The bottle contains about 30 g of powder. Additional information on the preparation and the certified value of F is given in the certification report.	30 g
	Mass Fraction F ..... 568	Certified value [mg/kg]
<b>ERM-EF672</b>	<b>GAS OIL (0.0203 % S)</b>  The CRM is supplied in amber glass ampoules containing approximately 8 mL gas oil under an atmosphere of 90 % argon and 10 % helium.	8 g
	Mass Fraction Sulfur ..... 0.203	Certified value [g/kg]
<b>ERM-EF671</b>	<b>GAS OIL (0.0452 % S)</b>  The CRM is supplied in amber glass ampoules containing approximately 8 mL gas oil under an atmosphere of 90 % argon and 10 % helium.	8 g
	Mass Fraction Sulfur ..... 0.452	Certified value [g/kg]



## Certified for trace element content

Code	Product	Unit
ERM-EG001	ANTIMONY IMPLANTED IN SILICON (areal density of Sb atoms, isotope amount ratio)	10 mm × 10 mm
The material consists of 40 g South African Rietspruit coal powder in a glass bottle. Additional information on the preparation of the material and the certified value is given in the certification report.		
Mass Fraction		Certified value [mg/kg]
Areal density of Sb		
atoms / $10^{16} \text{ cm}^{-2}$ .....		4.81
Isotope amount ratio		
$n(^{121}\text{Sb})/n(^{123}\text{Sb})$ .....		1.435

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