

## Elements, Minerals, Glasses & Alloy Standards

STANDARD	SYMBOL FORM	PURITY									
Aluminum	Al	F	3N	Indium Arsenide	InAs	C	6N	Silicon Dioxide	SiO <sub>2</sub>	EM	3N
Aluminum Fluoride	AlF <sub>3</sub>	P	4N	Indium Phoshide	InP	C	3N	1000Å/Silicon	SiO <sub>2</sub>	TF	2N7
Aluminum Oxide	Al <sub>2</sub> O <sub>3</sub>	C	3N	Indium Antimonide	InSb	P	5N	Silicon Nitride	Si <sub>3</sub> N <sub>4</sub>	HP	1N8
Aluminum Nitride	AlN	P	2N5	Indium Tin Oxide	5% In	F	3N	468Å/Silicon	Si <sub>3</sub> N <sub>4</sub>	TF	
Antimony	Sb	B	4N	Iridium	Ir	F	3N	Silver	Ag	F	4N8
Barium Fluoride	BaF <sub>2</sub>	C	2N+	Iron	Fe	F	5N	Silver Chloride	AgCl	C	3N
Barium Sulfate	BaSO <sub>4</sub>	P	2N	Iron Fluoride	FeF <sub>2</sub>	P	3N	Silver Sulfide	Ag <sub>2</sub> S	C	3N
Barium Titanate	BaTi <sub>4</sub> O <sub>9</sub>	HP	2N	Iron Fluoride	FeF <sub>3</sub>	P	3N	Sodium Chloride	NaCl	C	Opt
Barium Titanate	BaTiO <sub>3</sub>	P	3N	Iron Nitride	Fe <sub>3</sub> N	P	3N	Sodium Fluoride	NaF	C	Opt
Beryllium	Be	F	2N5	Iron Oxide	FeO	P	3N	Strontium Fluoride	SrF <sub>2</sub>	P	2N5
Bismuth	Bi	B	5N	Iron Oxide	Fe <sub>2</sub> O <sub>3</sub>	EM	3N	Tantalum	Ta	F	3N5
Bismuth Oxide	Bi <sub>2</sub> O <sub>3</sub>	P	3N	Iron Oxide	Fe <sub>3</sub> O <sub>4</sub>	EM	3N	Tantalum Carbide	TaC	HP	2N
Boron	B	P	2N8	Iron Phosphide	Fe <sub>2</sub> P	P	2N5	Tantalum Nitride	TaN	P	2N5
Boron Carbide	B <sub>4</sub> C	P	2N	Iron Sulfide	FeS <sub>2</sub>	P	3N	Tantalum Oxide	Ta <sub>2</sub> O <sub>5</sub>	P	3N5
Boron Nitride	BN	B	2N5	Lead	Pb	F	5N	Tantalum Oxide	Ta <sub>2</sub> O <sub>5</sub>	TF	
Boron Phosphide	BP	P	1N75	Lead Oxide	PbO	P	5N	1000Å/Ta			
Cadmium	Cd	F	5N	Lead Sulfide	PbS	P	3N	Tantalum Silicide	TaSi <sub>2</sub>	P	2N5
Cadmium Sulfide	CdS	P	4N	Lanthanum Hexaborid	LaB <sub>6</sub>	C	3N	Tellurium	Te	B	5N
Calcium Carbonate	CaCO <sub>3</sub>	C	3N	Lithium Fluoride	LiF	C	Opt	Terbium	Tb	F	3N
Calcium Fluoride	CaF <sub>2</sub>	C	Opt	Magnesium	Mg	F	2N8	Thallium Chloride	TlCl	P	5N
Carbon (Pyrolytic)	C	CVD	3N	Magnesium Fluoride	MgF <sub>2</sub>	C	Opt	Thorium Oxide	ThO <sub>2</sub>	P	3N
Carbon (Diamond)	C	C	3N+	Magnesium Oxide	MgO	C	3N5	Thulium	Tm	F	3N
Cerium Oxide	CeO <sub>2</sub>	P	3N	Manganese	Mn	B	3N	Tin	Sn	F	4N8
Cesium Iodide	CsI	O	5N	Manganese Sulfide	MnS	P	3N	Tin Oxide	SnO <sub>2</sub>	EM	1N8
Chromium	Cr	P	4N7	Manganese Oxide	MnO <sub>2</sub>	TF	3N	Titanium	Ti	F	2N8
Chromium carbide	Cr <sub>3</sub> C <sub>2</sub>	P	2N5	Mercury Sulfide	HgS	C	4N	Titanium Carbide	TiC	HP	2N5
Chromium Nitride	Cr <sub>2</sub> N	P	2N	Molybdenum	Mo	F	3N	Titanium Diboride	TiB <sub>2</sub>	HP	2N5
Chromium Oxide	Cr <sub>2</sub> O <sub>3</sub>	HP	2N7	Molybdenum Carbide	Mo <sub>2</sub> C	HP	2N5	Titanium Dioxide	TiO <sub>2</sub>	EM	2N
Cobalt	Co	F	4N6	Molybdenum Silicide	MoSi <sub>2</sub>	P	2N+	Titanium Nitride	TiN	P	2N5
Cobalt Oxide	Co <sub>3</sub> O <sub>4</sub>	P	2N5	Molybdenum Oxide	MoO <sub>3</sub>	P	2N5	Titanium Silicide	TiSi <sub>2</sub>	P	2N5
Cobalt Silicide	CoSi <sub>2</sub>	P	2N5	Osmium	Os	P	4N5	Tungsten	W	F	3N8
Copper	Cu	F	5N	Neodymium fluoride	NdF <sub>2</sub>	C	4N	Tungsten Carbide	WC	HP	2N5
Cupric Oxide	CuO	P	5N	Nickel	Ni	F	4N8	Tungsten Nitride	WN	P	2N5
Cuprous Oxide	Cu <sub>2</sub> O	EM	3N	Nickel oxide	NiO	P	3N	Tungsten Oxide	WO <sub>3</sub>	P	2N5
Copper Sulfide	CuS	M	2N	Nickel Phosphide	Ni <sub>2</sub> P	P	2N5	Tungsten Silicide	WSi <sub>2</sub>	P	2N5
Copper Sulfide	Cu <sub>2</sub> S	M	2N	Nickel Silicide	NiSi <sub>2</sub>	P	2N	Uranium 238	U	F	2N7
Dysprosium	Dy	F	3N	Niobium	Nb	F	2N8	Note: partially oxidized			
Erbium	Er	F	3N	Niobium Carbide	NbC	HP	2N5	Vanadium	V	F	2N5
Gadolinium	Gd	F	3N	Niobium Oxide	Nb <sub>2</sub> O <sub>5</sub>	P	3N5	Vanadium Carbide	VC	HP	2N5
Gallium Arsenide	GaAs	C	2N+	Palladium	Pd	F	3N	Vanadium Nitride	VN	HP	2N5
Gallium Nitride	GaN	P	4N	Platinum	Pt	F	3N	Vanadium Oxide	V <sub>2</sub> O <sub>5</sub>	P	4N5
Gallium Phosphide	GaP	P	5N	Potassium Bromide	KBr	C	Opt	Ytterbium	Yb	F	3N
Gallium Antimonide	GaSb	P	4N	Potassium Chloride	KCl	C	Opt	Yttrium	Y	F	3N
Germanium	Ge	B	5N	Potassium Iodide	KI	C	Opt	Yttrium Oxide	Y <sub>2</sub> O <sub>3</sub>	P	4N
Germanium Oxide	GeO	P	5N	Rhenium	Re	F	4N	Zinc	Zn	F	4N8
Gold	Au	F	3N	Rhenium Oxide	ReO <sub>3</sub>	P	3N	Zinc Oxide	ZnO	HP	3N
Hafnium	Hf	F	2N5	Rhodium	Rh	F	4N	Zinc Selenide	ZnSe	C	2N+
Hafnium Boride	HfB <sub>2</sub>	P	2N5	Rubidium Chloride	RbCl	F	4N	Zinc Sulfide	ZnS	C	Opt
Hafnium Carbide	HfC	B	2N	Ruthenium	Ru	P	3N5	Zirconium	Zr	F	4N
Hafnium Nitride	HfN	P	2N5	Samarium	Sm	F	3N	Zirconium Carbide	ZrC	HP	2N5
Hafnium Oxide	HfO <sub>2</sub>	P	3N	Scandium	Sc	F	3N8	Zirconium Nitride	ZrN	P	2N5
Holmium	Ho	B	3N	Selenium	Se	C	2N+	Zirconium Oxide	ZrO <sub>2</sub>	C	4N
Indium	In	F	4N7	Silicon	Si	C	3N	•			
				Silicon Carbide	SiC	CVD	3N				

**Abbreviations:**

M Natural mineral  
 Opt optical crystal  
 P powder: mixed with either Ag or Sn (for S containing materials)  
 TF Thin film

\*Purity: "N" is the # of "9"s. 5N would be 99.999% pure, 2N5 would be 99.5%

B Bulk material  
 C Crystalline  
 EM End member minral  
 F Foil  
 HP Hot pressed  
 "+" means higher purity.

**MINERAL FORMULA (Approximate formula)**

Acanthite	Ag <sub>2</sub> S
Albite	NaAlSi <sub>3</sub> O <sub>8</sub>
Almandine	Fe <sub>3</sub> +2Al <sub>2</sub> (SiO <sub>4</sub> ) <sub>3</sub>
Andradite	Ca <sub>3</sub> Fe <sub>2</sub> +3(SiO <sub>4</sub> ) <sub>3</sub>
Anorthite	CaAl <sub>2</sub> Si <sub>2</sub> O <sub>8</sub>
Barite	BaSO <sub>4</sub>
Benitoite	BaTiSi <sub>3</sub> O <sub>9</sub>
Biotite (black mica)	K(Mg,Fe <sup>+2</sup> ) <sub>3</sub> (Al,Fe <sup>+3</sup> )Si <sub>3</sub> O <sub>10</sub> (OH,F) <sub>2</sub>
Bytownite	(Na,Ca)Al(Al,Si)Si <sub>2</sub> O <sub>8</sub>
Calcium Carbonate	CaCO <sub>3</sub>
Cassiterite	SnO <sub>2</sub>
Chalcocite	Cu <sub>2</sub> S
Cinnabar	HgS
Chrysoberyl	BeAl <sub>2</sub> O <sub>4</sub>
Covellite	CuS
Cuprite	Cu <sub>2</sub> O
Diamond	C (cleaved ~1mm)

**MINERAL, continued**

Diopside	CaMgSi <sub>2</sub> O <sub>6</sub>
Dolomite	CaMg(CO <sub>3</sub> ) <sub>2</sub>
Fayalite	Fe <sub>2</sub> <sup>+2</sup> SiO <sub>4</sub>
Fluorapatite	Ca <sub>5</sub> (PO <sub>4</sub> ) <sub>3</sub> F
Forsterite	Mg <sub>2</sub> SiO <sub>4</sub>
Hematite	Fe <sub>2</sub> O <sub>3</sub>
Hornblende (Amphibole)	Ca <sub>2</sub> (Mg,Fe <sup>+2</sup> ) <sub>4</sub> Al(Si <sub>7</sub> Al)O <sub>22</sub> (OH,F) <sub>2</sub>
Kyanite	Al <sub>2</sub> O <sub>3</sub> •SiO <sub>2</sub>
Magnetite	Fe <sub>3</sub> O <sub>4</sub>
Orthoclase	K <sub>2</sub> O•Al <sub>2</sub> O <sub>3</sub> •6SiO <sub>2</sub>
Quartz	SiO <sub>2</sub>
Rutile	TiO <sub>2</sub>
Sodalite	Na <sub>4</sub> (AlCl)Al <sub>2</sub> (SiO <sub>4</sub> ) <sub>3</sub>
Spinel	MgAl <sub>2</sub> O <sub>4</sub>
Willemite (Troosite)	Zn <sub>2</sub> SiO <sub>4</sub>
Wollastonite	CaSiO <sub>3</sub>

**Note:** electron probe compositions provided upon request or with standard.

*Please see next page (or backside) for Glasses & Alloys*

## Glasses & Alloys

**SRM# National Institute of Standards & Technology (formerly NBS) Please see note below regarding alloys.**

Glasses	B2O3	Na2O	MgO	Al2O3	SiO2	Cl	K2O	CaO	TiO2	V2O5	Cr2O3	MnO2	Fe2O3	ZrO2	PbO	Bi2O3	BaO	ZnO	CoO	CuO		
612		14.0		2.0	72.0			12.0														
93a	12.5	3.9		2.2	80.8	.06	.01	.01	.01													
K252					40.0							5.0	.028	.04				35.0	10.0	5.0	5.0	
K229					30.0										70.0							
K326	30.0	2.0	30.1		29.9			8.0														
K309				15.0	40.0			15.0					15.0					15.0				
Ti Alloys	Fe	C	Mn	P	S	Si	Cu	Zn	Pb	Sn	Ni	Cr	V	Mo	Ti	As	W	Zr	Nb	Ta	Al	Co
654b	.23					.045	.004			.023	.028	.025	4.31	.013	88.05			.008				6.34
1128	.134	.011								3.04		2.96	15.13		75.64							3.06
Miscellaneous NIST Standards																						
1104	.088			.005				61.33	35.31	2.77	.43	.07										
1108	.004		.0025					64.9	34.4	0.06	.39	.033										
1110	.033							84.5	15.2	0.03	.051	.053										
1230	Bal	.044	.64	.023	.0007	.43	.14				24.2	14.8	.23	1.18	2.12						.24	.15
1243	.79	.024	.019	.003	.0018	.018	.007				58.78	19.20	.12	4.25	3.06			.053			1.23	12.46
C2402	7.3	.01	.64	.007	.018	.85	.19				51.5	16.15	.22	17.1								1.5
SRM-482	5 wires in one 3mm • mount. Cu:Au (20:80, 40:60, 60:40, 80:20) + pure Cu.																					
Steels																						
461	Bal	.15	.36	.053	.019	.047	.34		.003	.022	1.73	.13	.024	.3	.01	.028	.01	<.005	.011	.002	.005	.26
462	Bal	.40	.94	.045	.019	.28	.20		.006	.066	.70	.74	.058	.08	.037	.046	.053	.063	.096	.036	.02	.10
464	Bal	.54	1.32	.017	.021	.48	.094		.02	.043	.13	.078	.29	.029	.004	.018	.022	.01	.037	.069	.005	.02
465	Bal	.037	.032	.008	.01	.029	.019		<.0005	.001	.026	.004	.002	.005	.20	.01	.001	.002	.001	.001	.19	.03
466	Bal	.065	.11	.012	.009	.025	.033		.001	.005	.051	.011	.007	.011	.057	.014	.006	<.005	.005	.002	.01	.04
467	Bal	.11	.23	.033	.009	.26	.067		.00	.1	.088	.036	.041	.021	.26	.14	.20	.094	.29	.23	.16	.07
468	Bal	.26	.47	.023	.02	.075	.26		<.0005	.009	1.03	.54	.17	.20	.011	.008	.077	<.005	.006	.005	.04	.16
661	Bal	.39	.66	.015	.015	.223	.042			.01	1.99	.69	.011	.19	.02	.017	.01	.009	.22	.02	.02	.03
663	Bal	.57	1.50	.02	.005	.74	.09		.0022		.32	1.31	.31	.30	.05	.01	.04	.05	.049		.24	.05
664	Bal	.87	.25	.01	.025	.066	.25		.024		.14	.06	.10	.49	.23	.05	.10	.069	.15	.11		.15
665	Bal	.008	.0057	.002	.0059	.008	.0058				.041	.007	.0006	.005	.0006	.002						.01
1761	Bal	1.03	.68	.043	.033	.19																
1762	Bal	.034	2.03	.036	.03	.36																
1763	Bal	.20	1.59	.012	.022	.65																
1764	Bal	.59	1.22	.023	.012	.06																
1765	Bal	.006	.14	.007	.004	.005																
1766	Bal	.015	.06	.004	.002	.01																
1767	Bal	.051	.02	.005	.009	.02																
1768	Bal	.001	.014	.0013	.0003		.0006				.0014										.002	.002

**Alloys- Certified by a group of laboratories, NIST traceable**

Analysis provided with each alloy purchased.

Stainless Steels + High Temp.	Low Alloy + Specialty	Nickel/Cobalt	Copper/Brass/Bronze
AISI 303	C-4140	Inco 600	CDA 360
AISI 304	C-4340	Inco 625	CDA 510
AISI 316	C-8620	Inco 718	CDA 655
AISI 321	Tool Steel A-6	Inco 800	CDA 857
AISI 410	Tool Steel D-2	Hastaloy C-22	
AISI 440C	Tool Steel H-13	Hastaloy C-276	
PH13-8MO	Tool Steel M-2	Hastaloy X	
15-5 PH	2-Cr-1Mo (36a)		
17-4PH	9Cr-1Mo (38a)		
CARP 20CB3			
Maraging 300			
HK-40			

**Miscellaneous Standards (some traceable):**

- BPSG (not a NIST standard), 4% P, 3.3% B.
- Al-Cu: NIST traceable standard for energy dispersive x-ray detector calibration.
- C-Cu-Ag: Standard for electron backscattering adjustment. Used for gun shot residue calibration
- GSR- Gun shot residue: mixture of Ba, Sb, Pb particles in epoxy and carbon coated.

**PLEASE READ CAREFULLY!**

The metal alloys on this list cannot be assumed to be homogenous at the micrometer scale. If you intend to use ZAF corrections electron beam excited x-ray analysis (wavelength or energy dispersive) the sample volume must be homogenous within the electron excited volume. It is a misuse to use these metal alloys for bulk quantitative analyses. Nevertheless, they are useful for comparison purposes (in a least square sense) to compare against unknown materials. Every effort is made to insure that cutting, grinding, and polishing of the materials do not alter their composition.

- If you do not see a standard on the list that you would like, please contact us for availability.
- We can custom prepare your materials for use in our mounting system.
- We will polish your Taylor or other standard mounts. Price on request.