



120 Valley Court
Oak Ridge, TN 37830
Ph: 865-482-5717
FAX: 865-482-1281
zypcoatings.com

Use Areas And Compatibility Guide

MATERIAL	USES	COMPATIBILITY	
		Reportedly Stable at High Temperatures (minimum interaction)	Reacts at High Temperatures (Unstable)
Y ₂ O ₃	Resistance to molten metals High-temperature lubrication Low Thermal Conductivity Low Electrical Conductivity Barrier/release layer Braze stop-off (for Ti)	U, Ti (reacts slightly), Be, V Cr, Zr, Hf, Ni, Specialty Steels Copper Alloys, Most Molten Metals, Glasses, Slags, and Salts	Acidic Materials, CuO C (>1500 C, vac)
ZrO ₂	Resistance to molten metals Very Low Thermal Conductivity Low Electrical Conductivity Precious Metal Processing	Al, Pt, Rh, Zr, Nb, Ta, Mo, W, U Cu, Fe, Pb, Cr, Mn, Zn, Bi, Be, Ni Co, Si, PbO, Pd, Ru, Steels, Ti or MoSi ₂ (reacts slightly), Acidic Slags, Titanates (below melting)	Basic steel slags, CuO C (>1400 C, vac), Na Ca, Sr, Ba, Li, K, Na ₂ CO ₃
Al ₂ O ₃	Resistance to molten metals Low Electrical Conductivity High Thermal Conductivity Reaction-barrier layer	Mo, Ni, Nb, Ta, Cu, Sn, Bi, Pr, Rh W, Pt, Au, Al, Pb, Zn, Ag, V, Co, Fe Cr, Mn, Steels, Acidic & Basic Slags Silicides, Phosphates, S, Se, Te, Sb As, P, Be-Mg-Ca (reacts slightly) Ga, Na ₂ CO ₃	Ti, U, Zr, Hf, Na, Li, B, Si BeO, MgO, CuO, PbO ZrO ₂ , Y ₂ O ₃ C (>1500 C, vac)
BN	Resistance to molten metals High-temperature lubrication Low Electrical Conductivity High Thermal Conductivity Molten salt resistance Molten glass resistance Release agent for hot-forming	Al, Mg, Zn, Na, B, Fe, Si, Cryolite KBF ₄ , Li ₂ B ₄ O ₇ , Ni (below melting) Molten Halide Salts, Steels, Ge, Sb In, Cu, Sn, Cd, Stainless Steels, W C, MoSi ₂ , Non-Lead Glasses ZrO ₂ & Y ₂ O ₃ (to BN dissociation)	Li, Ni (molten), Pt, U, Ce Be, Mo, Cl ₂ , MoO _x , PbO _x High-Lead Glasses, Cr ₂ O ₃ Sb ₂ O ₃ , AsO ₃ , CuO, Bi ₂ O ₃ Molten K ₂ CO ₃ /KOH
TiN	Stability with Graphite/C Electrical Conductivity Thermal Conductivity Resistance to molten metals Rare Earth Metals	Sn, Bi, Fe, Carbon Steel, Basic Slag Acid Slag, W, Mo, Nb, Al (wets) Ta (to 1800 C), U, Ce, Sm-Co	NaOH, Be, Cd, MgO, Na K, Pb (weak reaction) Cryolite, ZrO ₂ (>1300 C)

Note: This data is for pure materials: performance of coatings may differ. This information is given for general purposes only. Some interactions may occur at certain temperatures and environmental conditions; thus it is advised that investigators evaluate their specific systems based on a thorough search of the literature. Many materials may be compatible/stable but were not known to us: thus, this list should not be considered exhaustive.

BASIC MATERIAL PROPERTIES

(may differ from coatings ... data is for pure materials/fully-dense)

PROPERTY	<u>Y₂O₃</u>	<u>ZrO₂</u>	<u>Al₂O₃</u>	<u>BN</u>	<u>TiN</u>
Formula Wt. (g)	225.8	123.2	102.0	24.8	61.9
Density (g/cc)	5.0	5.6	4.0	2.3	5.4
Crystal Structure	b.c.c.	Cubic/Monocl.	Hex.	Hex.	f.c.c.
Thermal Expansion (25-1000 C; 10 ⁻⁶ /C)	8.2	10.5	8.5	0.8-7.5 directional	8.7
Melting point (C)	2415	2600	2050	>2400 Sublimes	2950
Specific Heat (@293K, cal/g-K)	0.109	0.109	0.184	0.117	0.179
Thermal Conductivity (cal/cm-sec-K) @100 C @1400 C	0.034 0.007	0.005 0.006	0.072 0.013	0.075 av. 0.050 av. directional	0.069 0.018 est.
Electrical Resistivity (@293K, ohm-cm)	10 ⁸	10 ⁷ -10 ⁸	10 ¹⁶	1.7 x 10 ¹³	22 x 10 ⁻⁶
Emissivity @1300 K	0.3	0.45	0.45	0.6	0.7
Chemical Resistance (molten metals/slugs)	Superior	Excellent	Good	Excellent	Good
Color	White	Cream	White	White	Golden Brown
Knoop Microhardness (kg/mm ² @ 100-g load)	700	1300	2100	200	1800
Dielectric Strength (volts/mil)	N.D.	230	400	800-1000	N.D.
Dielectric Constant	13-18	17-26	10	4	N.D.
Coefficient of Friction	N.D.	0.85	0.7	0.2 (to 350 C) 0.7 (at 600 C)	N.D.

Note: This data is for pure materials/fully-dense: properties of coatings may differ. This information is given for general purposes only.