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Z-MARC

ZYP Coatings' Machinable Advanced Refractory Ceramic

Z-MARC is a unique advanced oxide refractory ceramic that can be machined with conventional carbide-tipped machine tools to produce complex shapes as desired for a wide range of industrial areas-of-use. Z-MARC is unlike any other machinable ceramic – with composition that is very stable/inert at high temperature to 1200 C, while maintaining good hot strength, without creep or deformation. Additionally, Z-MARC is near-fully-dense with no outgassing. With outstanding electrical insulation and breakdown voltage, Z-MARC is excellent for electrical applications.

Key Attributes

- Stable/inert ceramic phases
- Readily machinable with conventional machine tools
- Usable in all atmospheres – air, vacuum, inert
- Good strength at temperatures up to 1200 C – well beyond any other machinable ceramic usable in air atmospheres
- Contains no Refractory Ceramic Fiber (RCF)
- Ready-to-use to high temperatures (no additional firing required)
- Low thermal conductivity
- Electrically insulating with high breakdown voltage
- Chemically resistant
- >99% theoretical density, with near-zero porosity
- No outgassing on heating
- Withstands thermal cycling

Ideal Uses

- Forming complex ceramic components
- Electrical insulation with high breakdown voltage
- Parts for thermal cycling
- Small specialty one-of-a-kind pieces

Safety Information

- Consult SDS before machining.
- For Industrial Use only.

Specifications

PROPERTY	METHOD	UNITS	VALUE
Visual	---	Color	White
Density (MIP) Mercury Intrusion Porosimeter		g/cm³	3.65*
Porosity	MIP	%	0.8*
Liquid/Vapor Chemical Resistance To acids/alkalis-bases	---	---	Superior
Use Atmospheres	---	---	All: Air, vacuum, Inert, nitrogen
Maximum Use Temperature	---	---	> 1200 C (> 2192 F)
Dynamic Young's Modulus	ASTM C1259	psi	1.50×10^7
Shear Modulus	ASTM C1259	psi	5.88×10^6
Poisson Ratio	ASTM C1259	---	0.276
Density per ASTM above	ASTM C1259	pcf (g/cm³)	213.9 (3.43)
Modulus of Rupture, MOR, r.t. (20 C)	ASTM C133	psi/MPa	2235/15.4
MOR, 800 C, 12-hr "soak"	ASTM C583	psi/MPa	2972/20.5
MOR, 1200 C, 12-hr "soak"	ASTM C583	psi/MPa	3125/21.5
Coefficient of Thermal Expansion	ASTM E228	10^{-6}/C	6.53 (20-1000 C)
Specific Heat Capacity+ [rt; 400 C; 800 C]	ASTM E1269	W-sec/gm- K	0.55; 0.77; 0.81
		Btu/lb-F	0.13; 0.18; 0.19
Thermal Diffusivity+ [rt; 400 C; 800 C]	ASTM E1461	cm²/sec	0.019; 0.011; 0.0096
		ft²/hr	0.074; 0.043; 0.037
Thermal Conductivity+ [rt; 400 C; 800 C]	ASTM E1461	W/cm-K	0.036; 0.030; 0.027
		Btu-in/hr-ft²-F	24.63; 20.89; 18.95
Electrical Resistivity (vol. - 20 C)	ASTM D257	Ω·cm	4.26×10^{10}
Dielectric Str., Breakdown Voltage	ASTM D149, Method A	AC: Volts/mil	293

*Z-MARC is "either non-porous, has pores that are not connected, or has pores that are below the lower limit of detection by MIP (below 3 nm)". +Density for these measurements = 3.39 g/cm³.

Sizes

Pucks of Z-MARC are standard size of 3" Diameter X 1" High cylinders generally. Larger sizes can be made as special order. The pucks may have slight discoloration or roughness that does not affect properties; can be easily cut, turned on a lathe, machined, milled, drilled, threaded, tapped, polished/surfaced to form the desired parts.