Directional Properties of PBN

Property	"a" Direction	"c" Direction
Termal conductivity	Good	Low
Electrical resistivity	High	Highest
Thermal expansion	Low	24X "a" Direction
Compressive strength	High (High tensile strength also)	High
Dielectric constant	Moderate	Low
Loss tangent	Low	Low

Chemical Properties Of Performance PBN

Performance PBN is non-toxic, non-wetting and inert to nearly all other compounds. It will not react with acids, alkalies, organic solvents, molten metals or graphite. Performance PBN is extremely pure. Bulk impurity levels are less than 100 parts per million with metallic impurities less than 10 parts per million.

Summary of Chemical Purity Data

Property	Value
Non toxic	
Non porous	
Non wetting	
Total impurities	<100 ppm
Metalic impurities typical elements	
Ca	<1 ppm
Al	<1 ppm
Mg	<1 ppm
Ti	<1 ppm
Cu	<1 ppm
Si	<5 ppm
Total metalic	<10 ppm
Total carbon (by LECO WR-12)	< 100 ppm
Oxidation rate standard air @700°C	1.8 x 10-5 mg/cm²•min
Oxidation rate standard air @900°C	3.8 x 10-4 mg/cm²•min
Oxidation rate standard air @1200°C	1.6 x 10-2 mg/cm²•min
Outgassing total system pressure 1300° C, system base pressure 1 x 10-10 torr	<1 x 10-10 Torr

Summary of Electrical Properties

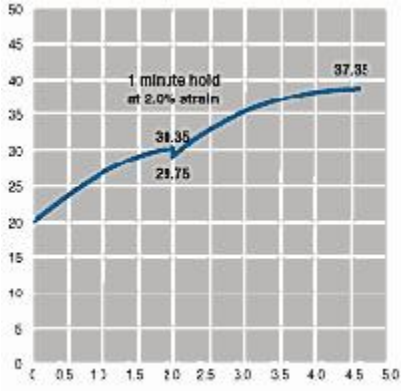
Property	Value
Resistivity "a" and "c"directions @25°C	1 x 1015 ohm•cm

Resistivity "a" direction @1000°C	3 x 107 ohm•cm
Resistivity "a" direction @1500°C	1 x 104 ohm•cm
Resistivity "c" direction @1000°C	5 x 109 ohm•cm
Resistivity "c" direction @1500°C	3 x 105 ohm•cm
Dielectric strength "c" direction @25°C	2 x 105 VDC/mm
Dielectric constant @ 8GHz "a" direction @25°C	4.97
Dielectric constant @ 8GHz "a" direction @1200°C	5.07
Dielectric constant @ 8GHz "c" direction @25°C	3.67
Dielectric constant @ 8GHz "c" direction @1200°C	3.75
Loss tangent "a" and "c" directions, @25°C to 600°C 1KHz to 12 GHz	< 9 x 10-4
Loss tangent "a" and "c" directions, @1200°C, 12 GHz	.001

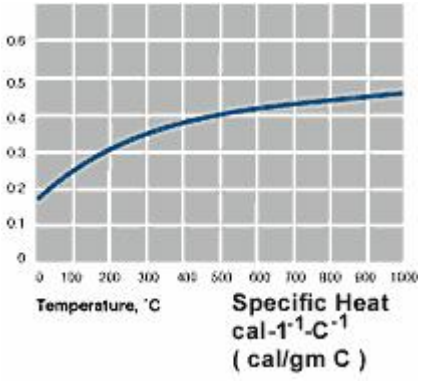
Summary of Mechanical Properties

Property	Value
Average density	2.185 g/cc
Gas permeability (Helium)	2 x 10-11 cm^2 / sec
Compression strength "a" direction @25°C	37, 000 PSI
Compression strength "a" direction @1200°C	35, 000 PSI
Compression strength "c" direction @25°C	48, 000 PSI
Compression "c" direction @1200°C	54, 000 PSI
Tensile strength "a" direction @25°C	21, 000 PSI
Flexural strength @25°C	28, 000 PSI
Flexural strength @1200°C	27, 000 PSI
Torsional shear strength @25°C	93, 000 PSI
Young's modulus "a" direction @25°C	3.4 x 106
Poisson's ratio "a" direction @25°C	.086
Flexural modulus @25°C	3.2 x 106 PSI
Flexural modulus @1200°C	3.2 x 106 PSI
Hardness taken on surface of "a" plane knoop hardness #	75

"a" Directional Compressive Stress vs. Strain



Specific Heat vs.Temperature



Thermal Properties Of Performance PBN - Summary of Thermal Properties

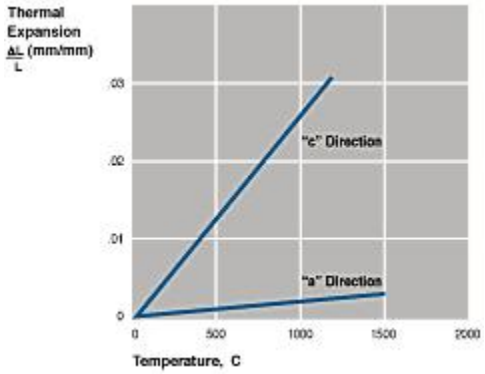
Property	Value
Thermal conductivity "a" direction @25°C	0.25 cal/cm•sec•°C
Thermal conductivity "a" direction @500°C	0.17 cal/cm•sec•°C
Thermal conductivity "a" direction @1000°C	0.15 cal/cm•sec•°C
Thermal conductivity "c" direction @25°C	0.004 cal/cm•sec•°C
Thermal conductivity "c" direction @500°C	0.005 cal/cm•sec•°C
Thermal conductivity "c" direction @1000°C	0.006 cal/cm•sec•°C
Thermal expansion "a" direction @500°C	0.001 mm/mm
Thermal expansion "a" direction @1000°C	0.0025 mm/mm
Thermal expansion "c" direction @500°C	0.013 mm/mm
Thermal expansion "c" direction @1000°C	0.027 mm/mm
Coefficient of thermal expansion "a" direction above @500°C	3 x 10-6 mm/mm•°C
Coefficient of thermal expansion "c" direction @500°C	30 x 10-6 mm/mm•°C
Resistance to thermal shock: 1200°C into liquid nitrogen	no damage
Specific heat @25°C	0.2 cal/gm•°C
Specific heat @500°C	0.4 cal/gm•°C
Specific heat @1000°C	0.47 cal/gm•°C

Performance PBN shows no melting point. It can withstand 1800° C in vacuum and 2000° C in nitrogen. This makes it an excellent choice for furnace components and melting vessels. Performance PBN is resistant to thermal shock. Crucibles heated to 1200° C can be plunged into liquid nitrogen without visible damage.

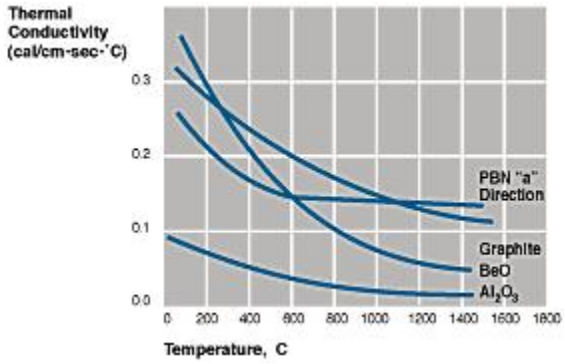
Performance PBN's thermal conductivity in the "a" direction is similar to that of cast iron, surpassing that of beryllia. For this reason, the compound can conduct heat while acting

as an electrical insulator. Thermal conductivity in the "a" direction is almost 66 times greater than thermal conductivity in the "c" direction. Conductivity in the "c" direction increases slightly with increasing temperatures.

Thermal expansion vs. temperature



Thermal condusctivity vs. temperature "a" direction



Thermal conductivity vs. temperature "c" direction