

Hot Pressed Boron Nitride Shapes

Hot pressed boron nitride (BN) is compacted at temperatures up to 2000°C and pressures up to 2000 psi to form a dense, strong engineering material that may be easily machined. It is available in standard and custom shapes and has several unique properties which make it an excellent candidate to consider for a wide range of challenging applications.

Four Material Grades

HBC & HBT

- High purity hot pressed boron nitride
- Diffusion bonded (no binder)
- Low dielectric constant & loss tangent
- Minimal moisture pick-up
- Chemically purified (HBC)
- Thermally purified (HBT)

HBN

- Boric oxide binder
- Highest density
- Highest strength

HBR

- Calcium borate binder
- High density
- Best moisture resistance

Thermal Management of Electronic Devices

The unique combination of electrical resistivity and thermal conductivity makes BN an ideal heat sink candidate to consider for use in high power electronic applications. Its properties generally compare favorably with beryllium oxide, aluminum oxide and other electronic packaging materials, and it is typically easier to form and finish.

High Temperature Applications

Temperature stability and excellent resistance to thermal shock make BN an excellent candidate to consider for the toughest high temperature applications such as plasma arc welding and semiconductor processing.

Molten Metal Handling

BN is inorganic, inert and is not wet by most molten metals and slags, nor does it react with halide salts or other reagents. These characteristics, combined with low thermal expansion, may make it an excellent candidate to consider for use in interface materials used in various molten metal processes.



Application Requirement	HBN	HBR	HBC	HBT
High Temperature Capability	•	••	•••	•••
Moisture Resistance	•	••	•••	•••
Thermal Shock Resistance	•	••	•••	•••
Thermal Conductivity	•••	•••	••	•
Electrical Resistance	•••	•••	•••	•••
Machinability	•••	•••	•••	•••
High Purity	••	••	•••	•••
Mechanical Properties	•••	•••	•	•

Key: • Good •• Better ••• Best

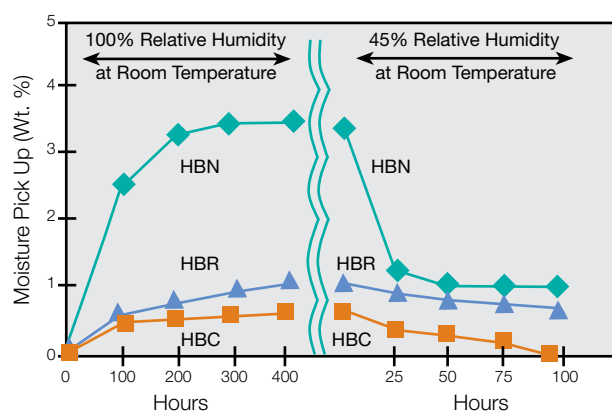
Typical Physical Properties⁽¹⁾

Physical Properties	HBN	HBR	HBC	HBT
BN, %	>95	>94	>99	>99
Binder	Boric Oxide	Calcium Borate	None	None
Binder Melting Point, °C	450	1150	—	—
Maximum Recommended Operating Temperature Oxidizing Atmosphere, °C Inert/Vacuum Atmosphere, °C	450 - 850 450 - 1600	850 1150 - 1600	850 2000 - 3000	850 2000 - 3000
Density, g/cm ³ Minimum Typical	2.00 2.10	1.90 2.00	1.90 1.95	1.70 1.75
Porosity, %	7	11	13	22
Hardness, Knoop (KHN, 100g)	19	20	16	11
Specific Heat, J/kg-K (Cal/g°C) @ 25°C @ 700°C	808 (0.193) 1846 (0.441)	808 (0.193) 1846 (0.441)	808 (0.193) 1846 (0.441)	808 (0.193) 1846 (0.441)
Pressing Direction	⊥	⊥	⊥	⊥
Thermal Conductivity, W/m-K @ 25°C @ 500°C	59 33 33 25	55 33 33 25	28 23 30 24	22 19 21 17
Coefficient of Thermal Expansion, ppm/°C 25°C to 1500°C	4 6	3 4	0.4 0.8	0.1 0.3
Flexural Strength, MPa (psi x 10 ³) @ 25°C @ 1500°C	89.6 75.8 (13) (11) 26.8 20.6 (3.9) (3)	51.7 41.3 (7.5) (6) 21.3 18.6 (3.1) (2.7)	20.6 17.2 (3) (2.5) 48.2 27.5 (7) (4)	19.3 17.2 (2.8) (2.5) 24.1 18.6 (3.5) (2.7)
Modulus of Elasticity, GPa (psi x 10 ⁶)	77.9 62.7 (11.3) (9.1)	62.0 48.2 (9) (7)	48.2 20.6 (7) (3)	41.3 20.6 (6) (3)
Compressive Strength, MPa (psi x 10 ³)	110.3 124.1 (16) (18)	68.9 62.0 (10) (9)	41.3 51.7 (6) (7.5)	33.1 38.6 (4.8) (5.6)
Electrical Properties	HBN	HBR	HBC	HBT
Dielectric Strength, V/mm x 10 ³	53	53	54	34
Dielectric Constant @ 1.0 MHz @ 1.0 GHz @ 9.3 GHz	4.2 4.3 4.4	4.1 4.2 4.3	4.1 4.1 4.3	3.8 3.9 3.9
Loss Tangent @ 1.0 MHz @ 1.0 GHz @ 9.3 GHz	<0.0002 0.0003 0.0002	<0.0002 0.0003 0.0002	<0.0002 0.0004 <0.0002	<0.0002 0.0003 <0.0002
Volume Resistivity, ohm-cm @ 25°C @ 700°C	>10 ¹⁵ 10 ⁸	>10 ¹⁵ 10 ⁸	>10 ¹⁵ 10 ¹⁰	>10 ¹⁵ 10 ¹⁰

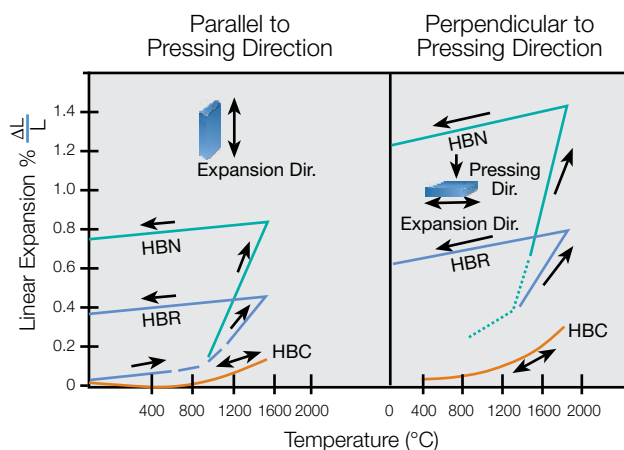
(1) Typical data are average and actual results may vary.
Typical data shall not be used as product specifications.

Vapor Pressure (Torr)		
Temperature (°C)	Boron Nitride (N ₂ g)	Boric Oxide (B ₂ O ₃ g) (Grade HBN)
200	3.1×10^{-25}	4.5×10^{-13}
500	3.1×10^{-17}	1.7×10^{-8}
800	6.8×10^{-12}	2.0×10^{-5}
1200	9.9×10^{-7}	1.8×10^{-2}
1600	8.1×10^{-3}	3.1
2000	11.5	2.0×10^2

Moisture Absorption of Various Grades of Hot Pressed Boron Nitride⁽¹⁾



Typical Thermal Expansion⁽¹⁾



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