



MOMENTIVE

performance materials

Hot-Pressed Boron Nitride Shapes

Hot-pressed BN is compacted at temperatures up to 2000°C and pressures up to 2000 psi to form a dense, strong engineering material that is easily machined. It is available in standard and custom shapes and has several unique properties which make it valuable in a wide range of challenging industrial applications.

Four Material Grades

Grades HBC and HBT are our highest purity hot-pressed boron nitrides. They are diffusion bonded and feature a low dielectric constant, minimal moisture pick-up and low loss tangent making them ideal for electronic applications. Grade HBT, although lower in strength and density than HBC, is available at lower cost and shorter lead times.

Grade HBN uses small amounts of boric oxide as a binder; it is used in applications where hydration and thermal shock are not a concern. Grade HBR uses calcium borate as a strengthening binder and is moisture insensitive.

For applications demanding even higher strength and durability, Momentive offers grade BIN77 composite material; see publication 81520 for more details.

Thermal Management of Electronic Devices

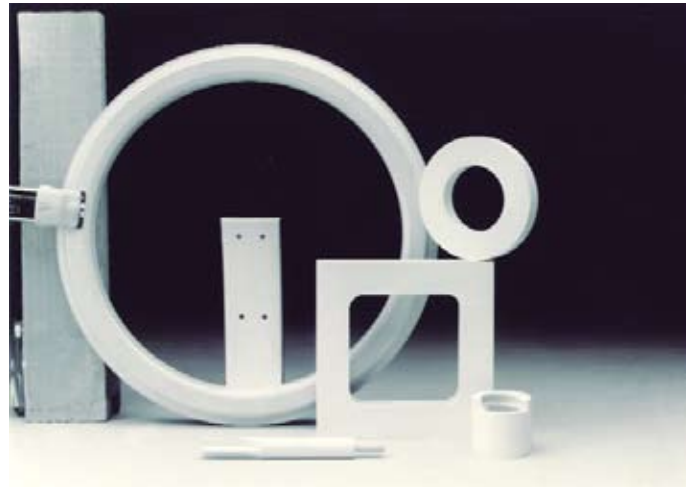
The unique combination of electrical resistivity and thermal conductivity makes BN an ideal heat sink in high power electronic applications. Its properties compare favorably with beryllium oxide, aluminum oxide and other electronic packaging materials, and it is easier to form and finish.

High Temperature Applications

Temperature stability and excellent resistance to thermal shock make BN the material of choice in 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, make it ideal for interface materials used in various molten metal processes.



Properties Selection Guide

Application Requirement	Grade			
	HBN	HBR	HBC	HBT
High Temperature Capability	Good	Better	Best	Best
Moisture Resistance	Good	Better	Best	Best
Thermal Shock Resistance	Good	Better	Best	Best
Thermal Conductivity	Best	Best	Better	Good
Electrical Resistance	Best	Best	Best	Best
Machinability	Best	Best	Best	Best
High Purity	Better	Better	Best	Best

Hot-Pressed Boron Nitride Shapes

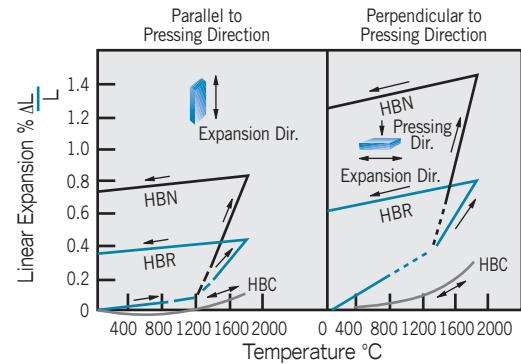
Typical Properties

	Grade							
	HBN		HBR		HBC		HBT	
B+N, %	>95		>94		>99		>99	
Binder	Boric Oxide		Calcium Borate		None		None	
Binder Melting Point, °C	550		1150		—		—	
Maximum Recommended Operating Temperature								
-Oxidizing Atmosphere, °C	550-850		850		850		850	
-Inert/Vacuum Atmosphere, °C	550-1600		1150-1600		2000-3000		2000-3000	
Density, g/cc								
-Minimum	2.00		1.90		1.90		1.70	
-Typical	2.10		2.00		1.95		1.75	
Porosity, %	7		11		13		22	
Hardness, Knoop (KHN, 100g)	19		26		16		11	
Specific Heat, J/kg-K (Cal/g°C)								
@ 25°C	808 (.193)		808 (.193)		808 (.193)		808 (.193)	
@ 700°C	1846 (.441)		1846 (.441)		1846 (.441)		1846 (.441)	
Pressing Direction		⊥		⊥		⊥		⊥
Thermal Conductivity, W/m-K								
@ 25°C	59	33	55	33	28	23	22	19
@ 500°C	33	25	33	25	30	24	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 10³)								
@ 25°C	89.6 (13)	75.8 (11)	51.7 (7.5)	41.3 (6)	20.6 (3)	17.2 (2.5)	19.3 (2.8)	17.2 (2.5)
@ 1500°C	26.8 (3.9)	20.6 (3)	21.3 (3.1)	18.6 (2.7)	48.2 (7)	27.5 (4)	24.1 (3.5)	18.6 (2.7)
Modulus of Elasticity, GPa (psi x 10⁶)	77.9 (11.3)	62.7 (9.1)	62.0 (9)	48.2 (7)	48.2 (7)	20.6 (3)	41.3 (6)	20.6 (3)
Compressive Strength, MPa (psi x 10³)	110.3 (16)	124.1 (18)	68.9 (10)	62.0 (9)	41.3 (6)	51.7 (7.5)	33.1 (4.8)	38.6 (5.6)
Electrical Properties	HBN		HBR		HBC		HBT	
Dielectric Strength, V/mm x 10³	53		53		54		34	
Dielectric Constant								
@ 1 GHz	4.3		4.2		4.1		3.9	
@ 9.3 GHz	4.4		4.3		4.3		3.9	
@ 1 MHz	4.2		4.1		4.1		3.8	
Loss Tangent								
@ 1 GHz	.0003		.0003		.0004		.0003	
@ 9.3 GHz	.0002		.0002		<.0002		<.0002	
@ 1 MHz	<.0002		<.0002		<.0002		<.0002	
Volume Resistivity, ohm-cm								
@ 25°C	>10 ¹⁵		>10 ¹⁵		>10 ¹⁵		>10 ¹⁵	
@ 700°C	10 ⁸		10 ⁹		10 ¹⁰		10 ¹⁰	

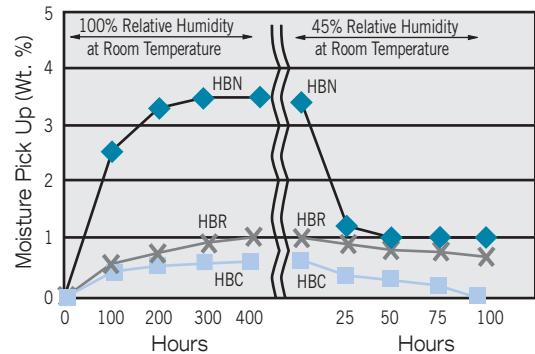
Vapor Pressure (Torr)

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

Typical Thermal Expansion



Moisture Absorption of Various Grades of Hot-Pressed Boron Nitride



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