

BN COMPONENTS

Boron Nitride Ceramic Components

TECHNICAL DATA

Boron nitride is a high temperature ceramic that has a structure similar to graphite. Our portfolio of hot-pressed solid materials includes pure hexagonal boron nitride as well as composites suitable for applications requiring excellent thermal properties combined with electrical isolation. Easy machinability and fast availability make boron nitride an outstanding choice for prototypes to large quantities requiring its unique properties.

GENERAL PROPERTIES

- High thermal conductivity/thermal shock resistance
- Electrical isolation/high electrical resistivity
- Non-wetting to glass and metals/corrosion resistant

APPLICATIONS

- Furnace insulators/muffles/crucibles
- Molten metal
- Hall effect thrusters
- Semi-conductor/plasma
- Powder metal atomization
- Sintering setters

| Material Type | Boron Nitride | | | | | | Boron Nitride Composites | | | |
|-------------------------------------|---|---|------------------------|------------------------|------------------------|------------------------|--------------------------|--|---|-------------------------------------|
| | BN4000 | BN5000 | BN6000 | BN7000 | BN8000 | BN9000 | BNP-2 | BNP-3 | BNP-6 | PBN |
| Grade | BN4000 | BN5000 | BN6000 | BN7000 | BN8000 | BN9000 | BNP-2 | BNP-3 | BNP-6 | PBN |
| Composition | hBN (B ₂ O ₃ binder) | hBN (CaO + B ₂ O ₃ binder) | hBN | hBN | hBN | hBN | AlN+BN | BN 45% ZrO ₂ 45% SiO ₂ 10% | BN 43% ZrO ₂ 4% SiO ₂ 53% | — |
| Maximum Service Temperature, °C | 850 Air, 1200 Inert | 850 Air, 1150 Inert | 850 Air, 2000 Inert | 850 Air, 2000 Inert | 850 Air, 1700 Inert | 850 Air, 1900 Inert | 1020 Air, 1900 Inert | 850 Air, 1600 Inert | 1000+ | 850 Air, 2000 Inert |
| Density, g/cm ³ | 2.0 | 2.0 | 1.9 | 1.9 | 1.3 | 1.6 | 2.9 | 2.9 | 2.1 | 1.9–2.1 |
| Flexural Strength(RT), MPa | 94 /65 ± | 59 /45 ± | 14 /30 ± | 22 /21 ± | 42 /40 ± | 22 /21 ± | 300 | 144 /07 ± | >50 | 115 |
| Compressive Strength, MPa | 143 /186 ± | 97 /97 ± | 40 /40 ± | 25 /25 ± | 20 /20 ± | 18 /18 ± | <1070 /<1070 ± | 218 /253 ± | 312 /312 ± | — |
| C.T.E 20°C–1000°C x10 ⁻⁶ | 1.9 /1.8 ± | 1.5 /0.10 ± | 5.5 /1.0 ± | 1.6 /0.4 ± | 1.6 /1.2 ± | 0.2 /0.3 ± | 0.57 /0.46 ± | 0.51 /4.2 ± | >2.5 />2.0 ± | 15.5 “c”, 3.0 “a” (-40–150°C) |
| Thermal Conductivity, W/m*K | 30 /34 ± | 27 /29 ± | 21 /21± | 78 /130 ± | 30 /30 ± | 36 /36 ± | 92.6 /92.6 ± | 24-34 /24-34 ± | — | 1.6 “c” |
| Dielectric Strength, KV/mm | 88 | >10 | >70 | 79 | — | — | — | — | — | 230 “c” |
| Volume Resistivity, ohms*cm | >10 ¹³ | >10 ¹³ | 10 ¹⁴ | >10 ¹⁴ | >10 ¹⁵ | >10 ¹⁵ | — | — | — | 10 ¹⁵ |

NOTES:

- The values indicated above are for reference and subject to change.
- Compressive Strength listed is Typical Value.

Boron Nitride Materials Applications

| Grade | General Properties | Applications |
|---------------|--|--|
| BN4000 | With the boric oxide binder, BN4000 has the highest mechanical properties of all the pure hBN products. BN4000 can be used in a variety of electrical insulator and general-purpose applications. The hygroscopic nature of boric oxide makes this material susceptible to moisture pick-up. | High-temperature electrical insulators, Crucibles, Ion implantation systems, Powdered metal spray nozzles, Setter plates |
| BN5000 | The calcium borate binder in BN5000 makes this the most versatile of all the hBN grades due to the reduced susceptibility to moisture pick-up. BN5000 can be used in a variety of higher temperature applications where lower thermal expansion and higher thermal shock resistance are required. | Thermocouple protection tubes, Crucibles, Electrical insulators, Glass manufacturing rolls and support plates |
| BN6000 | Having one of the lowest binder contents of all the hBN materials, BN6000 offers an economical alternative to the high purity grades. BN6000 is an excellent general-purpose grade for use in higher temperature applications requiring vacuum or inert environments in sizes up to ø300mm x 400mm long. | Electrical insulators, Thermocouple protection tubes, Crucibles and rollers for molten glass and metals, Casting Nozzles for non-ferrous metals, Channel and pump components for molten metals |
| BN7000 | When high purity, binder-less and the highest temperature capability are required, BN7000 offers the best of all hBN grades. With a use temperature up to 2000° C in inert atmospheres or high vacuum, BN7000 can be used in the most extreme conditions. | Insulators for high temperature vacuum furnaces, Crucibles for high purity metals and Refractories, High-temperature electrical insulators |
| BN8000 | This low density hBN grade incorporates unique near-net shape forming and pressure-less sintering technology, allowing sizes up to ø350mm x 200mm long or 490mm x 300mm x 50mm. BN8000 offers all the expected properties of thermal shock resistance, electrical resistivity, and chemical inertness. | High-temperature and high-voltage electrical insulators, Thyristors electrical insulators |
| BN9000 | A medium density version of hBN, BN9000 utilizes unique near-net shape forming and pressure-less sintering technology, allowing sizes up to 490mm x 310mm x 50mm. The large size capability makes it an excellent choice for furnace setters requiring all the benefits of hBN. | Insulators, Semiconductor equipment, Jigs for molding glass, Nozzles and crucibles, Paving plates |
| BNP-2 | For applications requiring high thermal conductivity, BNP-2 offers the benefits of an aluminum nitride in a composite with boron nitride. BNP-2 offers excellent mechanical strength while still maintaining ease of machinability and is useful for a broad range of applications. | Vacuum furnace seals, Nuclear, Casting nozzles, High-temperature bearings |
| BNP-3 | Combining boron nitride with zirconia and silicon carbide gives BNP-3 outstanding performance in molten metal applications. The non-wetting, wear-resistant, and high strength properties of BNP-3 make it ideal for break rings and atomizer nozzles. | Molten metal side dams, Continuous casting break rings, Refractories, Crucibles, Atomizing nozzles |
| BNP-6 | Excellent electrical properties combined with resistance to moisture and thermal shock are primary benefits of the BNP-6 composite of boron nitride and silica. BNP-6 has superior mechanical strength and is easily machinable for applications including Hall effect thrusters and refractory applications requiring corrosion resistance. | Aerospace / Satellite Thrusters, Plasma, Extreme environments, PVD: constraint of Plasma arcs, Extreme corrosion and wear resistance |
| PBN | Unique in its structure and ultra-high purity, Pyrolytic BN (PBN) is a grade of boron nitride grown by Chemical Vapor Deposition. PBN can be machined from flat plate stock up to 3mm thick or produced in custom shapes such as crucibles for semiconductor and crystal growth applications. | MBE crucibles, MBE furniture, Electrical insulators, Vacuum furnace insulation, LEC, VGF, Crucibles, Heating element supports |

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