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Applications for Boron Nitride Coatings

Unique properties, as well as versatility, make boron nitride coatings suitable for a variety of applications in metals, glasses, plastics, and ceramic composites.

As an engineered ceramic, boron nitride has been recognized for its unique properties and versatility. Boron nitride combines such features as electrical insulation, thermal conduction, and high-temperature lubricity. It is inert to and not wet by most molten metals and salts.

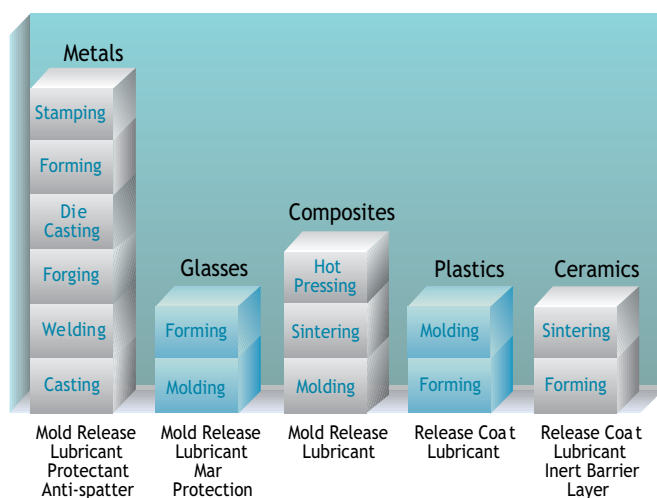
In both hot-pressed and powdered forms, this material has found acceptance in a diverse range of applications, from steel casting to aerospace.

Because of its lubricity and high-temperature stability, boron nitride readily lends itself for use as a high-temperature mold release agent. (See Table 1)

Metals Applications

In molten metal and metal forming operations, boron nitride coatings can be applied to surfaces which come in contact with hot and molten metals. A coating of boron nitride on the mold surface will inhibit corrosion, reduce chemical attack, and provide easier release, cleaner formed shapes, and longer mold/die life.

Table 1: Boron Nitride Coatings Use in Industry
Current uses of boron nitride coatings. New processes and novel production methods will continue to demand higher performance materials.



For example, a metal stamping operation was experiencing sticking and poor die life on a particularly difficult-to-form shape; several remedies were tried unsuccessfully. A thin layer of boron nitride was sprayed on the die surfaces. Not only did the stamping operation see a marked improvement in release of the part, but also because of the inherent lubricity of the coating, the die life was significantly increased.

Another manufacturer had a problem with metal “whiskers” forming on a molten metal nozzle. After a period of time, the cast would have to be aborted. Spraying the nozzle with a boron nitride coating reduced the whisker formation and allowed the cast to run to the limit of the other refractory materials.

Glass Applications

In glass forming operations, boron nitride is an excellent release agent and protective coating. Most glasses will not stick to boron nitride. The high-temperature lubricating ability of this material helps to minimize surface defects, provides cleaner release, improves mold/die life, and reduces clean-up time.

A glass forming operation was experiencing a marking problem when molten glass was drawn over a graphite tool. Applying a coat of boron nitride to the tool solved the problem. Another problem area developed from molten glass sticking to a forming plate. An application of boron nitride also alleviated this problem.

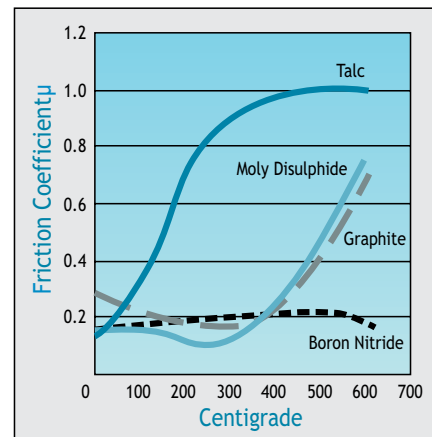


Figure 1: Frictional Properties of Various Solid Lubricants Its unique combination of properties makes boron nitride a logical choice for use as a high-temperature mold release and lubricant.

Plastics and Rubber

In plastics/rubber forming, boron nitride release coats have been shown to be effective in reducing defects, yielding cleaner formed shapes, extending mold/die life and increasing processing speeds.

A large producer of injection-molded plastics was experiencing sticking of white and other light-colored parts. The only release coating available that worked was black and tinted the parts. After applying a coat of boron nitride to the molds, not only did the parts release well, but they were also color correct, and the desired electrical properties were maintained.

Ceramic Composites

In composites manufacturing, boron nitride coatings have demonstrated flexibility in mold/die protection, oxidation resistance, cleaner forming and ease of release after sintering.

Sintering of ceramic composite parts is typically done on graphite plates. Problems exist with carbon contamination and reactivity at sintering temperatures. Many manufacturers have discovered that coating the plates with a thin layer of boron nitride can significantly reduce or eliminate contamination, reactivity and sticking. (See Figure 3.)

Types of Coatings

Many varieties of boron nitride coatings exist in the marketplace today. They can generally be classified into three groups.

Binderless coatings: These coatings are dispersions of boron nitride crystals in a solution containing no method to promote adhesion to a substrate. Although they can be chemically pure, the coating produced is friable and generally does not adhere well to the substrate.



Organically bound coatings: These coatings may contain a variety of organically based cross-linked binder systems. The dried coating exhibits excellent handling properties, but the binder will volatilize at temperatures above 300° C, resulting in outgassing and loss of adhesion.

Figure 2:
Boron nitride aerosol is useful as a mold release / lubricant in high-temperature processes.

Inorganically bound coatings: Inorganic binder systems typically can be used at relatively high temperatures while retaining their surface integrity. Some of these coatings require high-temperature curing to achieve handleability. Others rely on a two-phase inorganic system which delivers good handleability upon air drying and, when cured, will yield a harder coating for more severe requirements.

In general, the most versatile coatings are those with inorganic binders. They can perform well at both low and high temperatures, and adherence is excellent throughout the range.

All coatings offered by the Ceramics division of Momentive Performance Materials have inorganic binders, making them suitable for all applications.

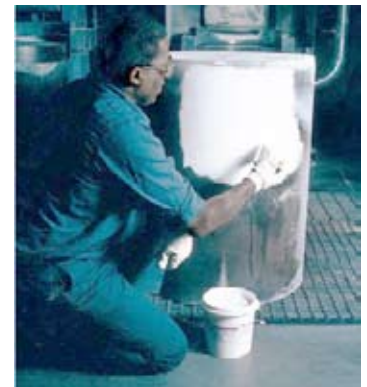
Boron nitride coatings are available worldwide in a wide range of coating systems. Water-based and solvent-based systems are available for use by spray, brush, roll, or dip coating methods. Aerosol spray cans also are available for convenience and simplicity.

We have described only a few of the uses for boron nitride coatings in this article. The combination of thermal, electrical, and physical properties possessed by boron nitride is unique and not found in any other natural or man-made product. New processes and novel production methods will continue to demand higher performance materials in these applications.

For More Information

Contact Momentive Performance Materials to discuss your boron nitride coating requirements.

Figure 3:
Water-based boron nitride coating being applied to graphite for oxidation resistance.



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