5
B
10.81

- ↑ Hardness
- ↑ Conductivity
- ↓ Density

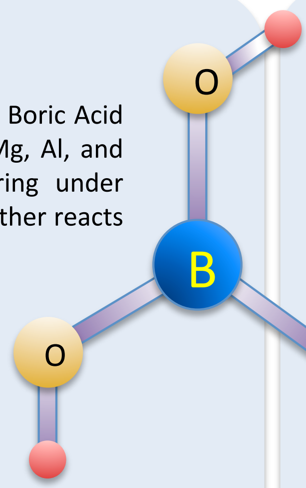
Powder Metallurgy (PM)

BORON in Ferrous & Non-Ferrous PM

In PM, the presence of **Metal Borides**, whether formed in-situ or added as a premix, provides multiple benefits to formed parts. **Boric Acid**, **Boron Nitride**, and **Boron Carbide** each form intermetallic phases in-situ by forming metal borides.

Non-Ferrous PM

In non-ferrous applications, both Anhydrous Boric Acid and Boric Acid are highly interactive with Mg, Al, and Cu. Boron is formed in-situ during sintering under either reducing or inert atmosphere, and further reacts to form metal borides.

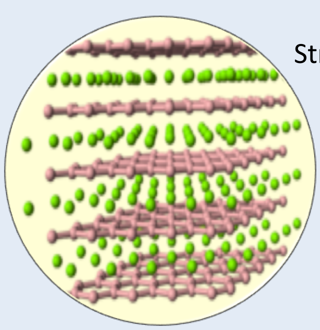


Reducing or inert atmosphere

Boric Acid or Anhydrous Boric Acid
- \+ Mg → Mg_2B
- \+ Al → AlB_2 or AlB_{12}
- \+ Cu → CuB

EXAMPLE: $B_2O3 + 3Mg = 3MgO + 2B$, and $B + 2Mg = Mg_2B$
(Small amounts of metal oxides formed can be leached.)

Reaction products Mg_2B, AlB_2, AlB_{12} and CuB impart **high conductivity,** being present as a dopant in the metallic interstices or around grain boundaries. Even a small addition of Boric Acid can make **a large difference in Mg.**



Structurally, the Boron atoms form graphite-like sheets with Mg/Al/Cu atoms between them.

Single crystals of metal borides exhibit metallic conductivity along the axis parallel to the basal hexagonal plane.

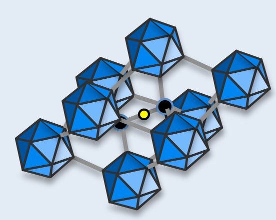
Boron is used in **Ti PM** for aviation (Ti-Al-V-B) to increase mechanical strength.

Ferrous PM

In Ferrous PM, the addition of boron has the following effects:

- ✓ Forms a **liquid phase** during sintering.
- ✓ **Increases density** and **hardness** with increasing sintering temperature.
- ✓ Significantly decreases **wear rate** and **weight loss**.
- ✓ Enhances corrosion resistance of steel.
- ✓ **Enables low temperature** sintering.

Boron Carbide



Boron Carbide Powder has a wide range of industrial applications:

- Wear parts
- Nuclear shielding
- Sintering Aid
- Abrasives
- Ceramic Armor

Parts made with Boron Carbide are **harder** and nearly **20-30% lighter** compared to SiC or Al_2O_3 parts.

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