

# Borates in metallurgical applications

Borates are used in the production of steel and non-ferrous metals, alloys, rare earth magnets, amorphous metals, welding fluxes and plating compounds.



## Applications include:

### Steel and non-ferrous metal production

Borates act as a flux during the smelting operation, dissolving metallic oxide impurities that are then removed with the slag. Borates are also used as a cover flux to protect metals against air oxidation.

### Precious metal recovery

Borates readily associate with metallic oxide contaminants at a sufficiently low temperature to minimize the loss of precious metal and to reduce wear and tear on melting equipment.

### Brazing/welding/soldering fluxes

Almost all dry paste welding and brazing fluxes contain borates. The ideal flux for these applications perform key functions, including:

- Protecting the surface of the metal to prevent oxidation
- Acting as a solvent in dissolving the metal oxides surrounding the area to be joined
- Serving as a detergent—removing oxides, grease, and other foreign matter

### Amorphous metals

Using soft magnetic cores made from amorphous metal alloys reduces energy loss in electrical transformers by up to 85%. These boron-containing alloys are produced by rapidly cooling the melt to achieve the required amorphous quality.

### Rare earth magnets

Rare earth-iron alloys exhibit superior magnetic properties as magnet powders for bonded magnets, and as permanent magnet materials. Ferroboron has a role in their production.

### Plating

Electroplating nickel using a Watts bath features current passed through an electrolyte composed of nickel sulfate, nickel chloride and boric acid. Boric acid is used to control pH during electrolysis, preventing the nickel deposits from cracking and pitting. The major applications for fluoboric acid are plating solutions—including electroplating of printed circuits—and as an intermediary in the manufacture of fluoborate salts.

### Mining

Ammonium nitrate explosives are unstable in certain regions where copper is mined, due to mineral sulfides that encourages instability, or hot spots. Hot spots can be stabilized by spraying blasting holes with ammonium borate solutions.



## About U.S. Borax

U.S. Borax, part of Rio Tinto, is a global leader in the supply and science of borates—naturally-occurring minerals containing boron and other elements. We are 1,000 people serving 500 customers with more than 1,700 delivery locations globally. We supply 30% of the world's need for refined borates from our world-class mine in Boron, California, about 100 miles northeast of Los Angeles. We pioneer the elements of modern living, including:

- **Minerals that make a difference:** Consistent product quality secured by ISO 9001:2015 registration of its integrated quality management systems
- **People who make a difference:** Experts in borate chemistry, technical support, and customer service
- **Solutions that make a difference:** Strategic inventory placement and long-term contracts with shippers to ensure supply reliability

## About 20 Mule Team® products

20 Mule Team borates are produced from naturally occurring minerals and have an excellent reputation for safety when used as directed. Borates are essential nutrients for plants and key ingredients in fiberglass, glass, ceramics, detergents, fertilizers, wood preservatives, flame retardants, and personal care products.

20 Mule Team Borax products in metallurgical applications:

 **Ammonium  
Pentaborate**

 **Neobor®**

 **Borax  
Decahydrate**

 **Optibor®**

 **Boric Oxide**

 **Potassium  
Pentaborate**

 **Dehybor®**

 **Potassium  
Tetraborate**

