

# 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 percent. 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 Rio Tinto Minerals

Rio Tinto Minerals is the acknowledged world leader in developing industrial minerals – building blocks for life, and for products that contribute to better living – and in developing solutions to build its customers' businesses. The company supplies nearly half the world's demand for refined borates from its principal mine in California, and offers:

**Minerals that make a difference** – consistent product quality secured by ISO 9000:2001 registration of its integrated quality management systems

**People who make a difference** – world leaders 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*<sup>®</sup> Borax products

*20 Mule Team*<sup>®</sup> borates are naturally occurring minerals that have an excellent reputation for safety when used as directed. Borates are essential nutrients for plants, part of a healthy diet for people, and key ingredients in fiberglass, glass, ceramics, detergents, fertilizers, wood preservatives, flame retardants and personal care products.

*20 Mule Team*<sup>®</sup> Borax products in metallurgical applications:

**Borax Decahydrate**

***Neobor*<sup>®</sup> Borax Pentahydrate**

***Dehybor*<sup>®</sup> Anhydrous Borax**

***Optibor*<sup>®</sup> Boric Acids**

**Boric Oxide**

**Potassium Pentaborate**

**Potassium Tetraborate**

**Ammonium Pentaborate**