

# 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.

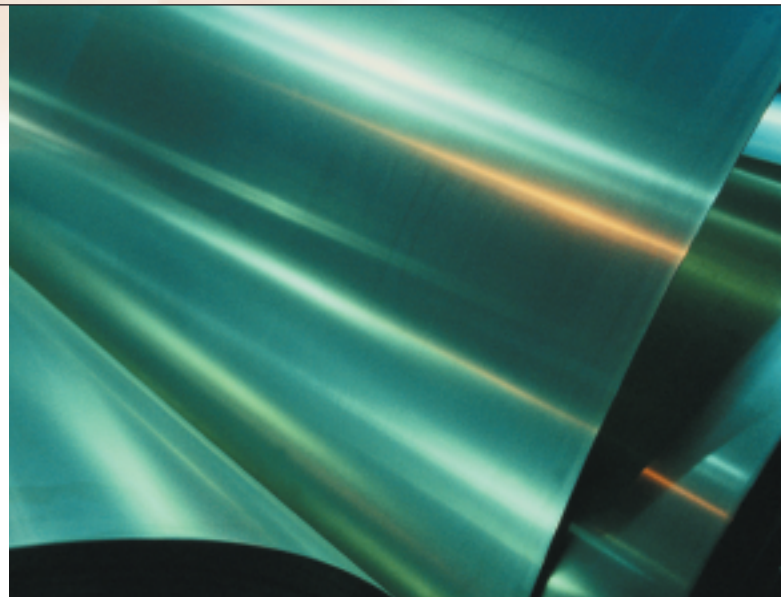
## **Precious metal recovery**

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

by rapidly cooling the melt to achieve the required amorphous quality.

## **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

## **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.



## **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**



### **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 the formulation**

Products used in metallurgical applications are listed on the reverse.

### **About the company**

Rio Tinto Borax supplies nearly half the world's demand for borates from its principal mine in California. The company offers an integrated approach to mining, refining, and distributing borates, as well as:

- Strategic Inventory Placement and long-term contracts with shippers to ensure supply reliability.
- Acknowledged world leadership in borate chemistry and technology development that translates to unparalleled technical support for customers.
- Consistent product quality supported by ISO 9000 registered Quality Management Systems, statistical process control and Certificates of Analysis.

### **About the products**

Borates are naturally-occurring mineral salts, essential for plant life and part of a healthy diet for people. Borate products have an excellent reputation for safety – and a long track-record of being safe when used as directed.

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