

# 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.

## 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 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 metal surface 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.

# BROCHURE: BORATES IN METALLURGICAL APPLICATIONS

## 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 650 customers with more than 1,800 delivery locations globally. We supply around 30% of the world's need for refined borates from our world-class mine in Boron, California, about 100 miles northeast of Los Angeles.

## About 20 Mule Team products

U.S. Borax produces the *20 Mule Team*® borates family of products from naturally occurring minerals and have an excellent reputation for purity and safety when used as directed. Borates are key ingredients in a number of industrial applications including fiberglass, glass, ceramics, batteries and capacitors, wood preservatives, and flame retardants.

High quality, high reliability, high performance borate products. It's what we're known for.