

Borates in gold metallurgy

The mined ore is sorted, crushed, milled, and classified. A concentration procedure is then employed such as gravity concentration or flotation followed by cyanidation or amalgamation. The impure gold concentrates are then subjected to processes such as oxidation, sulphurization and smelting, in order to remove base metals and produce gold bullion.

Dehybor[®] anhydrous borax is used in the gold refining industry as part of flux formulations to dissolve metal oxides, as well as being used as a flux in gold assaying.



Gold ore types

Ore grades are divided into three fundamental divisions:

- Acid gangues which consist mainly of silica
- Basic gangues which are largely calcareous, including oxidizing ores with high contents of divalent metals (eg iron)
- Reducing ores such as pyrites

Borates are used in each of these ore types for:

- Facilitating attack of the ore at a lower temperature
- Making the slag more fluid at the furnace operating temperature –reducing viscosity

Refining of pure gold from bullion

Bullion ingots are melted in clay crucibles under an anhydrous borax cover. Oxygen is passed through the metal which then forms oxides of the impurities. These oxides dissolve in the *Dehybor* cover and produce a fluid borate slag. This slag is periodically removed and replaced with fresh *Dehybor*. Further refining steps are then carried out to produce bars which assay at least to 998 fine gold (ie 99.8% pure).

Addition rates of borate

The addition of *Dehybor* to the smelt is in the order of 10-50% of total smelt weight, depending on the process. The borax contribution to flux composition can be up to 60% of total flux weight but is typically around 30-40%.

Benefits of *Dehybor* use in gold refining

- The precious metal content is recovered with minimal loss to the slag.
- Inclusion into basic fluxes for use on acidic ores promotes a substantial reduction in sintering temperature of the charge.
- The powerful solvent effect on many oxides produces easily fusible borates.
- Non-combustibility with minimum fuming tendency.
- Formation of highly fluid slags with only mild attack on refractories.
- Ease with which the slag can be thickened if necessary and slammed.
- Avoids intumescence and puffing.

Requirements of borates for fluxes

- Low impurities – impurities delay smelting process in gaining temperature.
- Consistent granulometry (like sugar grains) – if the borate is too fine it will run into the electrodes and burn away; if too coarse, it melts too slowly.
- To prevent “spit and crackle” problems, the flux should be anhydrous.



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 east of Los Angeles. We pioneer the elements of modern living, including:

- **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:** 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 gold metallurgy:

