

Borates in borosilicate glass

Borosilicate glass is the foundation for all heat-resistant glass applications and the myriad of products they make possible – from halogen lightbulbs to liquid crystal displays. Borosilicate refers to glass which contains from five to twenty percent of boric oxide (B_2O_3). Borates allow many valuable properties to be designed into borosilicate glass, including:

- Improved thermal shock resistance
- Increased aqueous durability and chemical resistance
- Greater mechanical strength
- Electrical neutrality
- Higher resistance to devitrification during processing
- A lower glass melting temperature
- An improved melt refining process
- Formability
- Optical properties



Borosilicate glasses – applications old and new

Where can you find borosilicate glass? You don't have to look far:

Heat resistant glass

Domestic ovenware and tableware, microwave dishes, and laboratory glasses that feature a high degree of thermal shock resistance depend on borates to control their coefficients of thermal expansion.

Display screens

The rapid development of thin film transistor liquid crystal displays (TFT LCD) which have effectively replaced cathode ray tube technology has been enhanced by the use of specialised borosilicate glasses. The forming technology for these flat glass screens has to keep up with continued demand for ever thinner and lighter screens, which puts very tight tolerances on the finished glass, and on the raw materials.

Lighting glass

Sealed headlights, lamp covers, halogen bulbs and fluorescent tubes are designed not only for high electrical resistance, but also for strength, chemical durability, and thermal shock resistance – all imparted by borates.

Sealing glasses

Tungsten filament lamps, metal vapor discharge lamps used in street lighting, radio valves and television cathode-ray tubes require some form of glass-to-metal connection, often being vacuum-tight. High electrical insulation is also typically required. Special glasses containing high levels of borates are used to make these glass-to-metal seals.

Neutral glasses

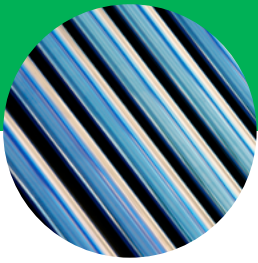
Neutral glasses—used in ampoules and vials for medicine, as well as vacuum flasks—rely on borates for increased chemical resistance and aqueous durability.

Cosmetic containers

These are made from borosilicate glass where chemical resistance and optimum brilliance is maintained.

Solar glass

Cover glass and substrate glass for flat photovoltaic cells have specific quality and performance requirements which can be met by specialized borosilicate glasses. These include high strength to weight ratio, impact resistance and surface compatibility with electronics materials. Evacuated solar collector tubes for solar water heating rely upon the tight control of thermal expansion, the ease of formability, and the durability and impact resistance of borosilicate glass. Some concentrated solar power generation stations in hot countries use large arrays of borosilicate collector tubes to gather reflected radiation from parabolic mirrors for the generation of electricity in steam driven turbines. These tubes require very careful matching of glass/metal thermal expansion, and durability in the demanding and remote conditions in which they are installed.



Glass microspheres

Solid microspheres are used for airport runway reflector systems. Some borate-containing glass beads are also used in plastics as reinforcement-extenders. Hollow microspheres are used to manufacture automotive parts and patching compounds. Their low-density, high compressive strength—combined with good heat and sound insulation—make them ideal as light-weight fillers for polymeric materials.

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

Other specialty glasses

Borates are also used in the production of optical glasses, prisms and lenses, glass-ceramics, art glass, decorative containerware, opal glassware, optical fiber cladding and couplers, Vycor glass, space protection glass and other specialty glasses for electronic packaging, optical communications, heat-resistant windows and telescope mirror blanks.

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 borosilicate glass:

