

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 5–20% 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

Borosilicate glass: 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 specialized 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 and metal vapor discharge lamps (used in street lighting) 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.

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, including:

- High strength-to-weight ratio
- Impact resistance
- 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 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.

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

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.

U.S. Borax products for borosilicate glass manufacturing

