20 MULE TEAM®

Optibor®

Boric Acids

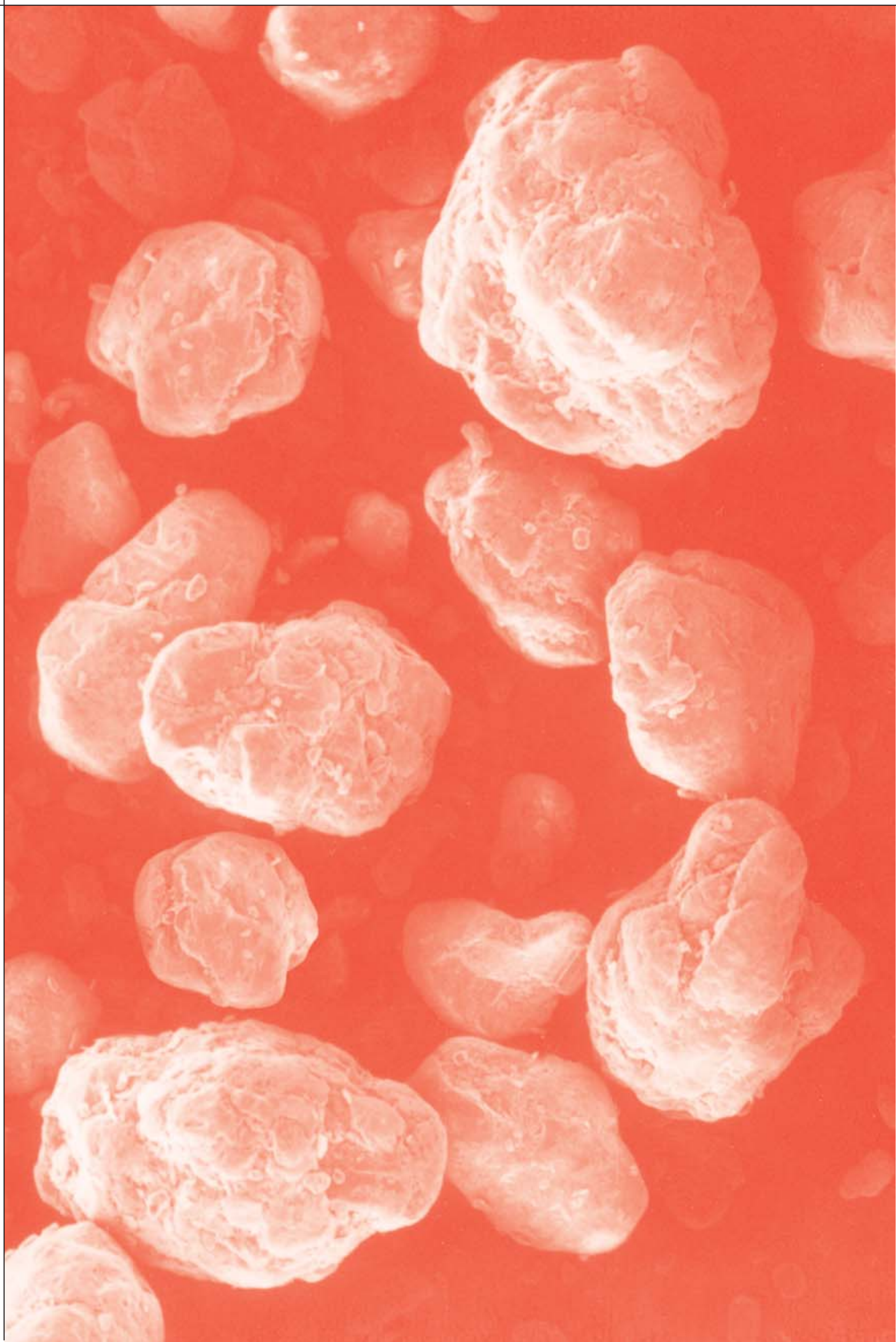
Product Profile

H_3BO_3
Orthoboric Acid
CAS/TSCA Number 10043-35-3

Technical Grades:
Granular and Powder

Pharmaceutical Grades
(NF & EP): Granular
and Powder

High Purity Grades
(SQ & HP): Granular



BORAX®

Optibor Boric Acids are a pure, multifunctional source of boric oxide (B_2O_3). Apart from borax pentahydrate, they are the most widely used industrial borate.

Optibor Boric Acids (H_3BO_3) are theoretically composed of boric oxide and water. Crystalline in composition, white in appearance, they can be used as granules or as a powder. Both forms are stable under normal conditions, free-flowing, and easily handled by means of air or mechanical conveying. In solution, they are mildly acidic.

Glass Type	Thermal Expansion	Melting Temperature	Melting Rate	Glass Viscosity	Surface Tension	Chemical Resistance
Textile Fiber Glass (E Glass)		✓	✓	✓	✓	
Borosilicate Glass	✓	✓	✓	✓		✓
Glazes and Enamels	✓	✓	✓	✓	✓	✓

Applications and Benefits

Glass and glass fiber

B_2O_3 is both a flux and a network former; it assists the melt and influences the final product properties. In fiber glass, for example, it reduces melting temperatures and helps the fiberizing process. Generally, B_2O_3 lowers viscosity, controls thermal expansion, inhibits devitrification, increases durability and chemical resistance, and reduces susceptibility to mechanical or thermal shock.

Optibor Boric Acids may be used in combination with a sodium borate (borax pentahydrate or anhydrous borax) in order to adjust the sodium to boron ratio in glasses which require low sodium levels. This is important in borosilicate glass where B_2O_3 provides essential fluxing properties at low sodium and high alumina levels.

Frits, glazes, and enamels

For the glassy surfaces of ceramics and enamels boric oxide acts as both network former and flux. It initiates glass formation (at low temperatures), ensures 'thermal fit' between glaze and body, reduces viscosity and surface tension, increases refractive index, enhances strength, durability and scratch resistance, and facilitates lead-free formulations. High boron frits mature rapidly, improve the speed at which smooth, even glaze surfaces develop, and provide good bases for coloring oxides.

Optibor Boric Acids are used as the B_2O_3 source in the formulation of fast fire frits for tiles because of their requirement for low sodium levels.

Flame retardancy

Incorporated into cellulose materials, borates change the oxidation reactions and promote the formation of 'char', thereby inhibiting combustion. *Optibor* Boric Acids, alone or in combination with borax, are particularly effective in reducing the flammability of cellulose insulation, wood composites, and the cotton batting used in mattresses.

Metallurgy

Optibor Boric Acids prevent the oxidation of metal surfaces in welding, brazing, or soldering. They are also used as a source of boron for strengthening metal alloys and steel.

Corrosion inhibition

Optibor Boric Acids are incorporated in many aqueous and non-aqueous systems requiring corrosion inhibition, lubrication or thermal oxidative stabilization. *Optibor* Boric Acids find use in the manufacture of lubricants, brake fluids, metalworking fluids, water treatment chemicals, and fuel additives.

Adhesives

As part of the starch adhesive formulation for corrugated paper and paperboard, and as a peptizing agent in the manufacture of casein-based and dextrin-based adhesives, *Optibor* Boric Acids greatly improve the tack and green strength of the adhesive by crosslinking conjugated hydroxyl groups.

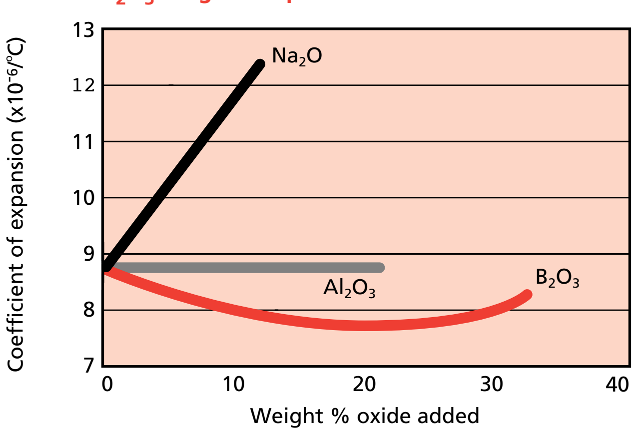
Personal care products

Optibor Boric Acid finds applications in cosmetics, toiletries and pharmaceuticals. It is used in conjunction with sodium borates for pH buffering, and as a crosslinking agent to emulsify waxes and other paraffins.

Nuclear energy

Being a highly effective absorber of thermal neutrons, the boron-10 isotope is essential to the safety and control systems of nuclear power stations. *Optibor* Boric Acid is made for the nuclear industry, and can be isotopically enriched to increase the available proportion of boron-10.

Effect of B_2O_3 on glass expansion



Reduction in linear coefficient of expansion in glass when silica is replaced proportionately by boric acid. This facilitates "thermal fit" in ceramic glazes and heat resistance in borosilicate glass. *From Glass by Horst Scholze 1991*

Chemical reactions

In the manufacturing of nylon intermediates, *Optibor* Boric Acids catalyzes the oxidation of hydrocarbons and increases the yield of alcohols by forming esters that prevent further oxidation of hydroxyl groups to ketones and carboxylic acids.

They are also used in preparing various important industrial products such as boron halides, borohydride, fluoborates, metallic borates, borate esters, and boron containing ceramics.

Some other applications

- Dye stabilization
- Electroplating
- Electrolytic capacitors
- Paints
- Sand-casting (magnesium)
- Textile finishing
- Leather processing and finishing

Chemical and Physical Properties

When heated above 100°C (212°F) in the open, *Optibor* Boric Acids gradually lose water first changing to metaboric acid, HBO_2, of which three monotropic forms exist. These have melting points respectively of 176°C (348.8°F), 201°C (393.8°F), and 236°C (456.8°F). Dehydration stops at the composition HBO_2 unless the time of heating is extended or the temperature raised above 150°C (302°F). On continued heating and at higher temperatures all water is removed leaving the anhydrous oxide, B_2O_3, the crystalline form of which melts at 450°C (842°F). The amorphous form has no definite melting point, softening at about 325°C (617°F) and becoming fully fluid at about 500°C (932°F).

Stability

Optibor Boric acids are a stable crystalline product that does not change chemically under normal storage conditions. Wide fluctuations in temperature and humidity can cause recrystallisation at particle contact points, resulting in caking. Care should therefore be taken to avoid such fluctuations during storage of the product. Also, it is, of course, essential to maintain the integrity of the packaging.

Characteristics

Molecular Weight	61.83
Specific Gravity	1.51
Melting point	171°C (340°c)
Heat of Solution (absorbed) @18°C	3.64×10^5 J/kg (157 BTU/lb)

Solubility in water

Temp °C (°F)	Boric acid % by weight in saturated solution
0 (32)	2.52
5 (42)	2.98
10 (50)	3.49
20 (68)	4.72
25 (77)	5.46
30 (86)	6.23
35 (95)	7.12
40 (104)	8.08
45 (113)	9.12
50 (122)	10.27
55 (131)	11.55
60 (140)	12.97
65 (149)	14.42
70 (158)	15.75
80 (176)	19.10
85 (185)	21.01
90 (194)	23.27
95 (203)	25.22
100 (212)	27.53
103.3 (217.9)*	29.27

***Boiling point of solution**

Hydrogen ion concentration

Aqueous solutions of *Optibor* Boric Acids are mildly acidic, the pH decreasing with increasing concentration.

%H_3BO_3 by weight of solution	pH @ 20°C (68°F)
0.1	6.1
0.5	5.6
1.0	5.1
2.0	4.5
3.0	4.2
4.0	3.9
4.72 (saturated)	3.7

Solubility in other solvents

Organic Solvent	Temp °C (°F)	Boric acid % by weight in saturated solution
Glycerol (98.5%)	20 (68)	19.90
Glycerol (86.5%)	20 (68)	21.10
Ethylene glycol	25 (77)	13.60
Diethylene glycol	25 (77)	13.60
Ethyl acetate	25 (77)	1.50
Acetone	25 (77)	0.60
Glacial acetic acid	30 (86)	6.30
Methanol	25 (77)	22.66
Ethanol	25 (77)	11.96
1-Propanol	25 (77)	7.34
2-Methyl-1-propanol	25 (77)	5.32
3-Methyl-1-butanol	25 (77)	4.36

Notice:

Before using these products, please read the Product Specifications, the Safety Data Sheets and any other applicable product literature.

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