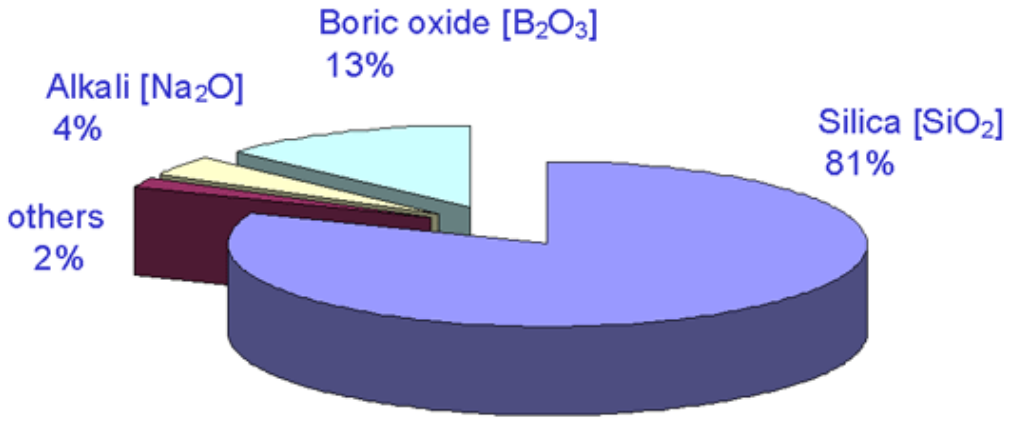
Scientific Glass Laboratories Ltd

Technical Help

Composition and Corrosion Resistance of Borosilicate Glass 3.3

Chemical Composition of Borosilicate Glass 3.3

The special properties – especially its high chemical resistance, its resistance to temperature and its low coefficient of linear expansion – of the borosilicate glass 3.3 exclusively used by SGL for the construction of glass plant and pipeline are achieved by strict adherence to its chemical composition, which is as follows:

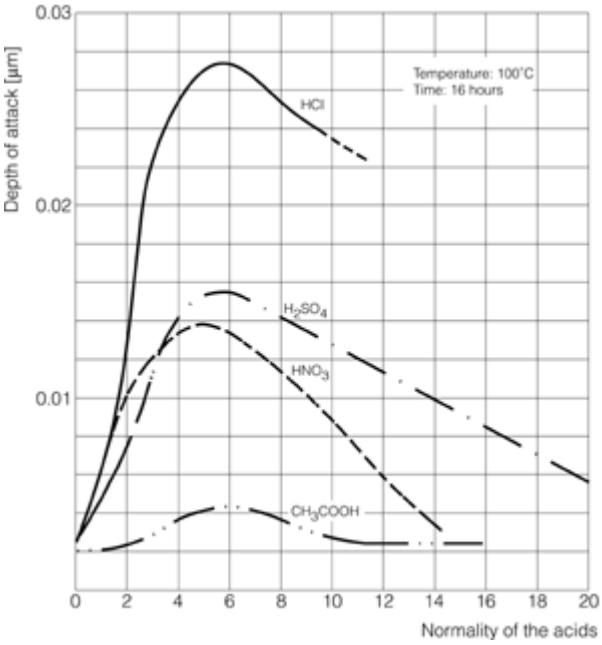


Chemical Resistance

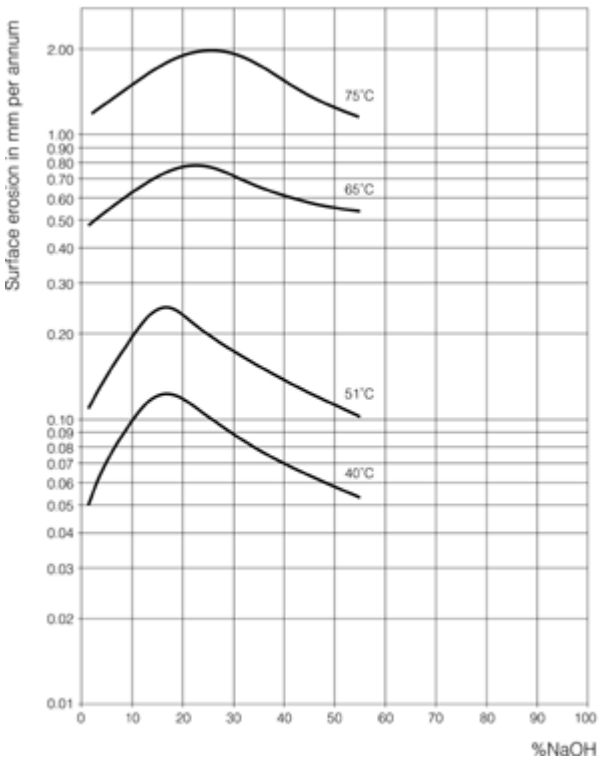
Borosilicate glass 3.3 is resistant to chemical attack by almost all products, which makes its resistance much more comprehensive than that of other well-known materials. It is highly resistant to water, saline solutions, organic substances, halogens such as chlorine and bromine and also many acids. There are only a few chemicals which can cause noticeable corrosion of the glass surface namely hydrofluoric acid, concentrated phosphoric acid and strong caustic solutions at elevated temperatures. However, at ambient temperatures caustic solutions up to 30% concentration can be handled by borosilicate glass without difficulty.

Borosilicate glass 3.3 can be classified in accordance with the relevant test methods as follows (see also ISO 3585 and EN 1595):

Hydrolytic resistance at 98 ºC	Hydrolytic resistance grain class ISO 719-HGB 1
Hydrolytic resistance at 121 º	Hydrolytic resistance grain class ISO 720-HGA 1
Acid resistance	Deposit of Na2O < 100 mg/dm² to ISO 1776
Alkali resistance	Alkali resistance class ISO 695-A2



<<<< Fig. 1
Acid attack on borosilicate glass 3.3 as a function of concentration
Further information about acid and alkali attack can be obtained from the figures.
The corrosion curves in fig.1 show a maximum for different acids in the concentration range between 4 and 7 N (HCl for example at the azeotrope with 20.2 wt %). Above that the reaction speed decreases markedly so that the eroded layer amounts to only a few thousandths of millimetre after some years. There is, therefore, justification for referring to borosilicate glass 3.3 as an acid-resistant material.



<<<< Fig. 2
Alkali attack on borosilicate glass 3.3 as a function of temperature
It can be seen from the corrosion curves in fig. 2 that the attack on the glass surface initially increases as the concentration of the caustic solution increases but after exceeding a maximum it assumes a virtually constant value. Rising temperatures increase the corrosion, while at low temperatures the reaction speed is so low that reduction of the wall thickness is hardly detectable over a number of years.