SIMAX GLASS

Technical Information

By its chemical composition and properties Simax glass ranks among the types of glass of the group of clear „hard“ borosilicate glass „3.3“, which excel in a high heat and chemical resistance and which are defined by international ČSN ISO 3585 Standard. It complies to the full with the properties prescribed by these standards.

A wide range of technical and laboratory glass products, industrial equipment and household boiling glassware is made of SIMAX glass. Thanks to their properties and a high use value these products have become much-sought-for in many countries all over the world.

Owing to its properties SIMAX glass is utilized there, where the highest demands are made on the products with regard to the heat and chemical resistance and neutrality in relation to substances or preparations, which may be in contact with them. i. e. in chemistry, petrochemical, food and power energy industries, metallurgy, medicine, microbiology, pharmacy, machinery and laboratories,

Products made of SIMAX glass mass are smooth and imporous, perfectly transparent, indifferent to catalysts, corrosion resistant even in a heavy duty operation of up to 300 degrees Centigrade without a sudden temperature variation.

SIMAX glass is very much environmentally-friendly and in terms of environmental protection it is absolutely faultless.

SIMAX Glass Chemical Properties

Products made of SIMAX glass have chemical stability, they are practically inert, and, may be noted by a high resistance to the effects of water, water vapours, acids, salts solutions and by relatively a fair resistance to alkali.

Glass is etched by hydrogen fluoride and concentrated trihydrogen phosphate (phosphoric acid), while concentrated hot alkaline solutions corrode glass. Corrosion may be increased, if acid medium alternates with alkaline medium permanently.

SIMAX glass chemical resistance has been provided by ISO 3585 Standard, eventually, ČSN ISO 3585, and, it has been accurately assessed using standard international testing methods defined by ISO and DIN ISO Standards.

Components

Components	Content (percentage by weight)
SiO2	80,3
B2O3	13,0
Al2O3	2,4
Na2O + K2O	4,3

SIMAX Glass Resistance to

water at 98 °C	(pursuant to ČSN ISO 719)	HGB 1
water at 121 °C	(pursuant to ČSN ISO 720)	HGA 1
acids	(pursuant to ČSN ISO 1776)	1
the effect of alkali mixture water	(pursuant to ČSN ISO	A2 or

solution	695)	better

SIMAX Glass Physical Properties

SIMAX glass physical properties have been exactly assessed using standard international testing methods defined by ISO Standards.

By its physical properties, which have been specified in the below table, SIMAX glass mass corresponds with ČSN ISO 3585 Standard.

Coefficient of mean linear thermal expansion	(pursuant to ČSN ISO 7991) a(20/300)°C	3,35 ×10-6 K-1
Density	(pursuant toČSN 70 05 13) r	2,23 g.cm-3
Heat conductivity	(at100 °C)l w (20/200)°C	1,16 W.m-1.K-1
Specific heat capacity at a constant pressure	(pursuant to ČSN EN 60672-2) cp(20/100)°C	0,8× 103 J.Kg-1.K-1
Temperatures of main points ata viscosity of h in dPa.s	10 4 working range (ISO 7884-2, ISO 7884-5) 1260 °C 10 7,6 softening point – Littletons at this point (ISO 7884-6) 820 °C 10 13,2 upper limit cooling temperature (ISO 7884-7) 558 °C 10 14,7 lower limit cooling temperature (ISO 7884-7) 507 °C	

Transformation temperature	(ISO 7884-8)	525 °C
Modulus of elasticity (Young's modulus (E)		63,2×103 MPa
Poisson's ratio		0,19
Tensile strength R m		35 až 100 MPa

Glass mass has an important property, which is also its viscosity that is fundamental for all the production stages and glass treatment and through the effects on the ionic mobility it even influences the electrical properties.

SIMAX glass mass pertains to glass masses shorter in terms of viscosity, i. e. the interval between subsequent heat treatment is narrower.

SIMAX Glass Mechanical Resistance

Glass mass scratch hardness of 6 degrees of Mohs scale	
Admissible tensile stress	3,5 MPa
…bending stress	7 MPa
…compressive stress	100 MPa

Mechanical properties and service life of a product made of SIMAX glass are mostly given by the condition of their surface, in particular, their integrity, i. e. the depth of surface deterioration in handling and secondary heat treatment.

SIMAX Glass Thermal Properties

High resistance of products made of SIMAX glass to sudden temperature variations – heat resistance – is given by a low coefficient of mean linear thermal expansion, relatively low modulus of elasticity in tension (E) and relatively high heat conductivity.

In cooling down and heating a glass product, an undesirable internal stress formation occurs. Cracking may occur in quick cooling down, if the undesirable internal stress exceeds the admissible limit. Simax glass products‘ values of resistance (D 0C) to a heat shock, depending on the wall thickness, have been specified in the below table:

Wall thickness (in mm)	Resistance to a heat shock (D °C)
1	303
3	175
6	124
10	96

SIMAX Glass Annealing

Annealing represents a thermal process, the purpose of which is preventing the formation of undesirable and unadmissible high thermic stress inside glass, which could decrease the product resistance, and, eventually, removing the already formed stress.

The annealing cycle consists of three stages:

The temperature rise (product heating) at a heating speed from the inlet temperature to the upper limit annealing temperature.

Dwell on temperature (annealing, tempering, stabilization) of a product for a certain time at the upper limit annealing temperature, when temperature variations inside the product must be equalized and the stress decreased to an admissible limit.

Temperature drop (annealing and after-cooling) of a product at an annealing speed from the upper limit annealing temperature to the lower limit annealing temperature (this period is essential, as constant stress may be formed) and from the lower limit annealing temperature to the final temperature or up to ambient temperature (which is important for the product subsequent practical handling).

Specific annealing cycle is mentioned in the below table.

Range of Temperature

	Rise	Dwell	Temperature Drop		
Maximum wall thickness	20 - 550 °C	560 °C	560 - 490 °C	490 - 440 °C	440 - 40 °C
3 mm	140 °C/min	5 °C/min	14 °C/min	28 °C/min	140 °C/min
6 mm	30 °C/min	10 °C/min	3 °C/min	6 °C/min	30 °C/min
9 mm	15 °C/min	18 °C/min	1,5 °C/min	3 °C/min	15 °C/min
12 mm	8 °C/min	30 °C/min	0,6 °C/min	1,6 °C/min	8 °C/min

SIMAX Glass Optical Properties

SIMAX glass is clear and it does not show any substantial absorption within the visible spectrum. Ultra-violet rays transmittance enables the products to be utilized for photochemical reactions.

With a wall thickness of 3 mm SIMAX glass light transmittance lies in the field of visible light between 90 and 92 percent.

Simax glass refractive index (l = 589,30 nm) nd	1,472
Photoelastic constant B	3,6.10-6 MPa-1.

SIMAX Glass Electrical Properties

Specific electric resistance in a moisture-free medium (20 °C)	greater than 1013- 1015 W× cm
Permitivity e (20 °C, 1 MHz)	4,6
Loss angle tg d	4,9 × 10-3

At current temperatures, SIMAX glass mass is non-conducting – it is an insulant.

Dielectric losses increase very steeply with the rising temperature and change together with the frequency.