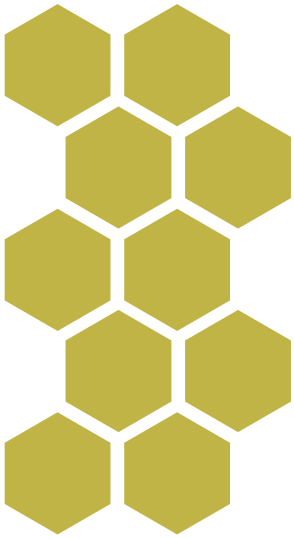

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MATERIALS
SUBSTRATES

NEYCO has a complete range of substrates for a wide variety of applications, including Semiconductor, Biotechnology, Nanotechnology, and MEMS. NEYCO is your one stop source for advanced materials for both R&D laboratory use and industry production.

STANDARD SINGLE CRYSTAL SUBSTRATE PARAMETERS

Substrates and wafers are manufactured by a technology, which is specially adapted to the respective material. Additionally we produce substrates and wafers customer-specific in all possible orientations, sizes and geometries and with smaller tolerance.

Orientations	(100), (111), (110) for cubic crystals (110), (001) for tetragonal crystals (0001), (1-102), (11-20), (10-10) for hexagonal crystals (110), (001) for orthorhombic crystals other orientations on request Standard: edges are oriented
Tolerance of orientation	Maximum 30' ; typical < 20' higher precision on request
Standard sizes	10x10 mm, 10x5 mm, 12.7x12.7 mm, 15x15 mm, 20x20 mm, 25x25 mm, ø 1", ø 2", ø 3" other sizes on request
Tolerance of sizes	+0/-0.05 mm
Thickness	0.5 mm, 1.0 mm (standard) other thicknesses down to 0.1 mm on request
Tolerance of thickness	+0.05/-0.05 mm
Polish	One side, two sides optical polish of lateral sides (cylinders) on request
Surface quality	Scratchfree at magnification of 50
Roughness: (at λ_{Cutoff} = 0.08 mm)	Ra: typ. 0.5 nm Rq: typ. 1 .0 nm Rt: typ. 2.0 nm
Parallelity	Typ. better than 10'
Flatness	Max. 1 µm/10 mm (test region 98% of the wafer area)

Micro-roughness measured with Kugler Interferometermicroscope (lateral resolution: 0.64 µm, vertical resolution (theoretically): 0.01 nm).

Glass & Fused Quartz Substrates

BOROSILICATE GLASS

Borosilicate glass, known under trade names such as Pyrex® and Duran®, is widely used in chemical and engineering applications.

This glass is chemically resistant, has a low thermal expansion coefficient and can be used at relatively high temperatures. Our high quality borosilicate glass substrates are optically polished on both surfaces. The excellent flatness and a low warp of our borosilicate wafers and the thermal coefficient of expansion close to the one of silicon, facilitate sophisticated applications in the semiconductor industry such as anodic bonding to silicon and various micro optical applications.

On request, our borosilicate glass wafers can be made with a ground SEMI standard flat or a notch.

Many types of glass are available :

Borofloat 33, D263T, pyrex, Bk7, B270, Eagle X,...

APPLICATIONS

- Semiconductor applications
- Micro lithography
- Substrates for anodic bonding
- Optical substrates
- Micro system technology
- Micro mechanics
- Microstructure applications

STANDARD SPECIFICATIONS (Borofloat)

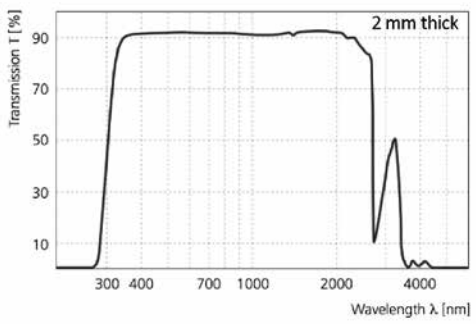
GENERAL PROPERTIES	
Density	2.23 $g.cm^{-3}$
MECHANICAL PROPERTIES	
Young's modulus	64 GPa
Hardness (Knoop test)	480

THERMAL PROPERTIES	
Max. use temperature	up to 500°C
Thermal conductivity	1.14 $W.m^{-1}.K^{-1}$
Coefficient of linear expansion	$3.3.10^{-6}K^{-1}$
ELECTRICAL PROPERTIES	
Volume resistance	10^{15} Ω.cm
Dielectric constant	4.6 (20°C, 1 MHz)
Dielectric strength	30 $kV.mm^{-1}$
OPTICAL PROPERTIES	
Refractive index n	1.474 at 588 nm (BOROFLOAT 33) 1.52 at 588 nm (B270 CLEAR)

AVAILABLE THICKNESS

From 0.3 mm to 25.4 mm.

TRANSMISSION SPECTRUM



ITO-COATINGS ON GLASS SUBSTRATE

Whenever an electrically conductive surface that also offers a high optical transparency is required, ITO-coating glass series are used. ITO-coating glass is achieved by sputter-coating a thin conductive layer of Indium-Tin-Oxide onto high quality glass substrates.

Because of the low electrical sheet resistances we have available, our ITO-coatings have often be used to shield electromagnetic fields while still transmitting most of the visible light.

Our series of conductive transparent oxide coatings feature a SiO_2 passivation layer. This quartz barrier layer is only a few nanometers thick, and is located between the substrate and the ITO-coating. This offers an increased electrical insulation performance and minimizes possible leaching of alkali-oxides from the glass into liquid crystals. The process of coating this SiO_2 passivation layer between the ITO thin film coating and the glass substrate, is advantageous for most electronic applications and is efficiently integrated into the production process.

APPLICATIONS

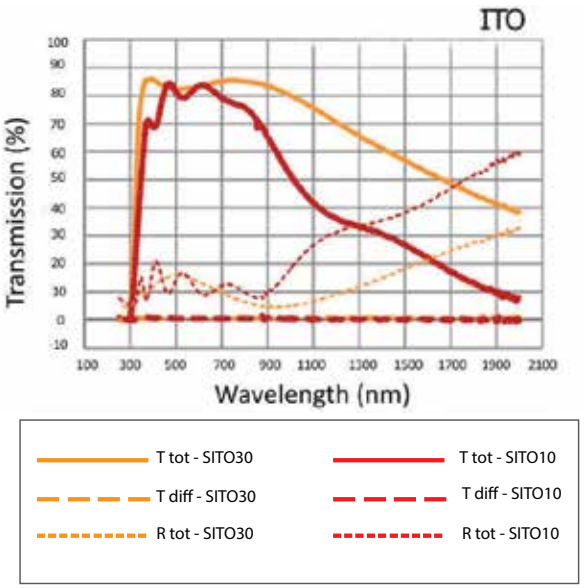
- Display technology
- Transparent ITO electrode
- ITO coated microscope slide
- Circuit substrate
- Micro structuring application
- Transparent EMF/EMI/EMC/RFI/HF shielding glass
- Flat antennas for mobile communication
- Conducting glass
- De-Icing applications
- Heatable ITO slide & cover slip

SPECIAL PROPERTIES

- Electrically conductive and optically transparent
- High VIS-NIR light transmission
- High quality glass substrate
- SiO_2 barrier layer
- Low roughness
- High sheet resistance homogeneity
- Uniform transmission homogeneity
- Reflecting in the infrared range

REFRACTIVE INDEX

We present the refractive index data for the ITO coating. It is the refractive index value used for calculating our ITO film performances. Remember that the ITO coatings made are sputtered and therefore are denser than coatings made by vacuum evaporation.



WAVELENGTH (nm)	REFRACTIVE INDEX	EXTINCTION COEFFICIENT
400	2.15	0.025
425	2.1	0.018
450	2	0.01
506	2	0.0087
600	2	0.0065
650	2	0.0044
700	2	0.0042
750	2	0.0042
800	2	0.004
1065	2	0.004

RESISTIVITY RANGE

Resistivity range: 10-15, 15-30, 30-60, 70-100 Ω.cm according ITO thickness.

QUARTZ/FUSED SILICA SUBSTRATE

Quartz glass is an extremely versatile material used in a range of different applications. It has outstanding thermal properties, excellent optical transmission, with good electrical and corrosion performance.

There are two basic ways of making quartz / silica glass:

- By melting silica grains either by gas or electrical heating (the type of heating affects some optical properties). This material can be transparent or, for some applications, opaque.
- By synthesising the glass from chemicals.

This synthetic material, normally referred to as synthetic fused silica, has better optical properties and is somewhat more expensive than the other type.

- Typical index homogeneity: < 8×10^{-6}
- Thermal expansion coefficient: 0.58×10^{-6} /K (0° to 200°)
- Density: 2.201 g/cm^3

There are mainly three types of fused silica, NEGS1, NEGS2, NEGS3, they are used for different applications. Please refer to below for details.

NEGS1 is mainly used for optics operating in the UV and the visible wavelength range. It is free of bubbles and inclusions. It is equivalent to Suprasil 1&2 and Corning 7980.

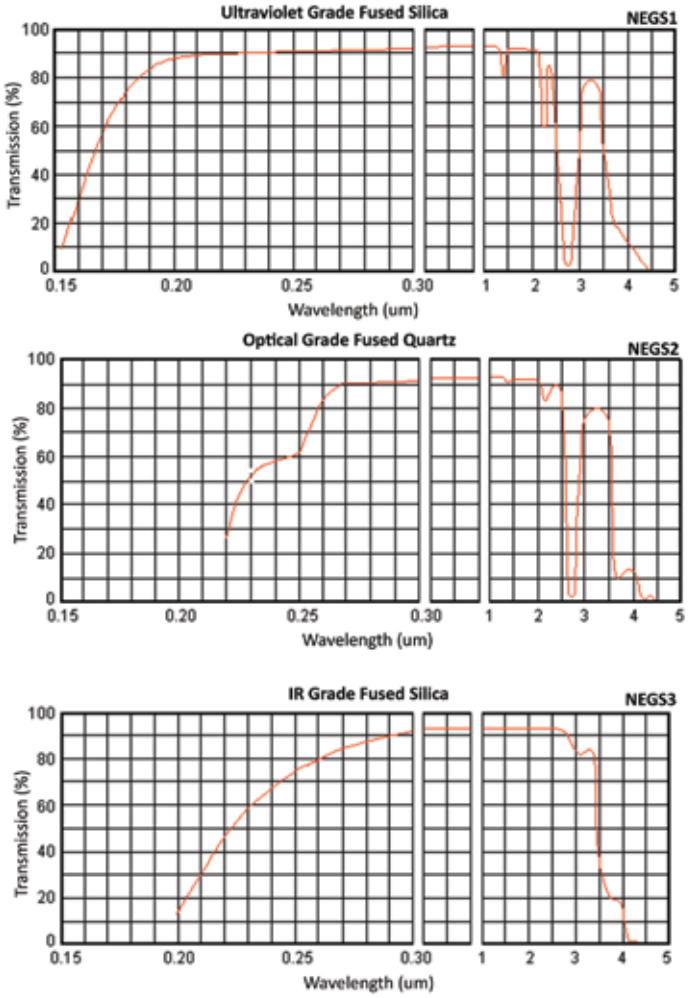
NEGS2 is mainly used as mirror substrate, as it has tiny bubbles inside. It is equivalent to Homosil 1, 2&3.

NEGS3 is transparent in the UV, visible and IR spectral regions, but it has many bubbles inside. It is equivalent to Suprasil 300.

PROPERTIES			
	NEGS1	**NEGS2**	**NEGS3**
Maximum size	< ø200 mm	< ø300 mm	< ø200 mm
Transmission range (medium transmission ratio)	0.17 ~ 2.10 µm (Tavg>90%)	0.26 ~2.10 µm (Tavg>85%)	0.185~3.50 µm (Tavg>85%)
OH-Content	1200 ppm	150 ppm	5 ppm
Fluorescence (EX 254 nm)	Vitually free	Strong V-B	Strong V-B
Impurity Content	5 ppm	20-40 ppm	40-50 ppm
Birefringence constant	2-4 nm/cm	4-6 nm/cm	4-10 nm/cm
Melting Method	Synthetic CVD	Oxy-hydrogen melting	Electrical melting
Applications	Laser substrate: Window, lens, prism, mirror....	Semiconductor and high temperature	IR & UV substrate

PROPERTIES	
Hardness	5.5 - 6.5 Mohs' Scale 570 KHN 100
Design tensile strength	$4.8.10^7$ Pa ($N.mm^{-2}$) (7000 psi)
Design compressive strength	Greater than $1.1.10^9$ Pa (160,000 psi)
Bulk modulus	$3.7.10^{10}$ Pa ($5.3.10^6$ psi)
Rigidity modulus	$3.1.10^{10}$ Pa ($4.5.10^6$ psi)
Young's modulus	$7.2.10^{-10}$ Pa ($10.5.10^6$ psi)
Poisson's ratio	0.17
Coefficient of thermal expansion	$5.5.10^7$ K^{-1} (20°C-320°C)
Thermal conductivity	1.4 $W.m^{-1}.K^{-1}$
Specific heat	670 $J.kg^{-1}.K^{-1}$
Softening point	1683°C
Annealing point	1215°C
Strain point	1120°C
Electrical receptivity	7.10^7 Ω.cm (350°C)
Dielectric properties (20°C and 1 MHz) **Constant** **Strength loss** **Factor dissipation**	3.75 5.10^7 $V.m^{-1}$ Less than 4.10^{-4} Less than 1.10^{-4}
Velocity of sound-shear wave	$3.75.10^3$ $m.s^{-1}$
Velocity of sound/compression Wave	$5.90.10^3$ $m.s^{-1}$
Chemical Stability (except hydrofluoric)	High resistance to water and acids

TRANSMISSION SPECTRUM



Ceramic Substrates

ALUMINA Al_2O_3 SUBSTRATE (MICROPOLISHED)

Pure alumina ceramic due to their high insulation resistance at elevated temperatures, high dielectric strength, low dielectric loss tangent at high frequencies is one of the best dielectric materials available for use in applications requiring electrical insulation.

The mechanical strength of pure alumina ceramics may be extremely high if properly controlled by the size and homogeneity of the constituent crystallites. It is recommended to use ceramics in compression because compressive strength is nearly 10 times the one of the flexural strength. This may be achieved through design or by the establishment of operating conditions.

Thermal and chemical properties of pure alumina ceramics are always of great interest. Thermal conductivity is nearly equivalent to stainless steel. Pure alumina ceramics is inert to oxidation, not corroded by chemical agents and not subjected to radiation damage.

APPLICATIONS

- Mechanical seal faces
- Nozzles for abrasives spraying corrosive reagents
- High pressure liquid media
- Laboratory apparatus components
- Metalized parts of high vacuum and high-voltage feed-through, and many other applications

STANDARD SPECIFICATIONS

Purity	99.6%
Color	White
Density	3.8 $g.cm^{-3}$
Thermal expansion	8.10^{-6} $°C^{-1}$

Thermal conductivity	27 $W.m^{-1}.K^{-1}$
Dielectric constant (at 1 MHz)	9.8
Surface finish	+/- 25 nm

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