

# 1. Optical materials

## 1.1. Optical glasses

### 1.1.1. Standard optical glasses

Optical glasses are inorganic products in molten form and with homogeneous and amorphous structure, without impurities and strains. The most important parameters of these glasses are: index of refraction, Abbe number ( $\nu_d$ ) and dispersion (rate of change of index with wavelength). Standard optical glasses is a group of glasses characterized by maximum transmission in the visible spectral range.

These glasses are classified into two basic groups:

- crown glasses (leadless glasses) ( $\nu_e > 55$ ), are weakly refractive and have low dispersion.
- flint glasses (potassium-lead glasses) ( $\nu_e < 50$ ), contained of lead oxygen, and have higher index of refraction, and stronger dispersion.

There are a few intermediate groups between the two mentioned above.

### 1.1.2. Special optical glasses

Special optical glasses are optimized from the point of view of precise requirements of optical properties, and generally have individual, dominate characteristic, that differs them from standard glasses with ordinary parameters.

- low and "zero expansion" glasses:  
Duran, Ultran, Pyrex®, Borosilicate glasses, E-6 ; ULE™
- high expansion glasses:  
HE2

- high transparent glasses  
B270 - superwite®
- infrared transmitting glasses  
RT2, IG, IRG
- glasses for electronics  
E2, E7
- laser glasses  
LG680  
LG750, LG760

### 1.1.3. Filter glasses

Filter glasses change the spectral properties of optical radiation by selective absorption in optical spectral range above 200nm up to 5200nm.

Selecting proper material it is possible to produce different kinds of filters:

*Bandpass filters* which selectively transmit the desired region

*Longpass filters* which block undesired, shorter wavelengths,

*Shortpass filters* which block undesired, longer wavelengths, and

*Neutral density and conversion filters* which exhibit more or less non-selective attenuation in certain regions.

UG black and blue glasses, ultraviolet transmitting

BG blue, blue-green and multiband glasses

VG green glasses

GG yellow glasses

OG orange glasses

RG red and black glasses, IR-transmitting

NG neutral density glasses with uniform attenuation of visible radiation

WG colorless, ultraviolet absorbing glasses

KG virtually colorless glasses with absorption of IR radiation (cold-light or heat-absorbing glasses)

FG bluish and brownish color temperature conversion glasses.

Our filters are produced with the use of glasses from all SCHOTT groups:

## 1.2. Glass ceramics

Glass ceramics is an inorganic, non-porous material having crystalline and glass phases together. Such material structure grants glass ceramics its extraordinary properties, and makes it an ideal material for very special tasks, which call for the highest precision. Mainly it is used for production of large mirror substrates (for astronomy) or very small

and light ones (for gyroscopes). Glass ceramics has unusual thermal stability.

The ZERODUR is the glass ceramic mainly used by our customers, but we can also produce other materials of this group:  
( MACOR; CLEARCERAM 55.63)

## 1.3. Quartz:

Quartz is characterized by good transmission from UV by VIS up to NIR. We use for the optics both structural forms of quartz :

- crystalline SiO<sub>2</sub>
- amorphous SiO<sub>2</sub> (fused silica)

**Crystalline quartz** is a material with double refraction, which is used for the polarizers, and retardation plates.

**Fused silica** has very low thermal expansion index, and is very resistive for the most of chemical

compounds. Another advantage its high damage threshold and very high melting temperature, which gives possibility of use in 1200 °C.

Production of our components is generally based on quartz glasses from Heraeus, Germany (Suprasil, Homosil, Herasil, Infrasil), but on special request we can produce optics with fused silica of other producers.

## 1.4. Crystals:

We produce optical elements using following crystals:

Elemental semiconductors	Si, Ge
Selenides	ZnSe
Oxides	MgO
Calcite	Ca CO <sub>3</sub>
Fluorides	CaF <sub>2</sub> , MgF <sub>2</sub> , BaF <sub>2</sub> ,
Lasing materials	Nd: YAG (Y <sub>3</sub> Al <sub>5</sub> O <sub>12</sub> :Nd <sup>3+</sup> ),
Potassium dihydrogen phosphate	KH <sub>2</sub> PO <sub>4</sub> (KDP)
Potassium dideuterium phosphate	KD <sub>2</sub> PO <sub>4</sub> (KDDP)
Lithium Niobate	LiNbO <sub>3</sub>