

# ASTRONOMY

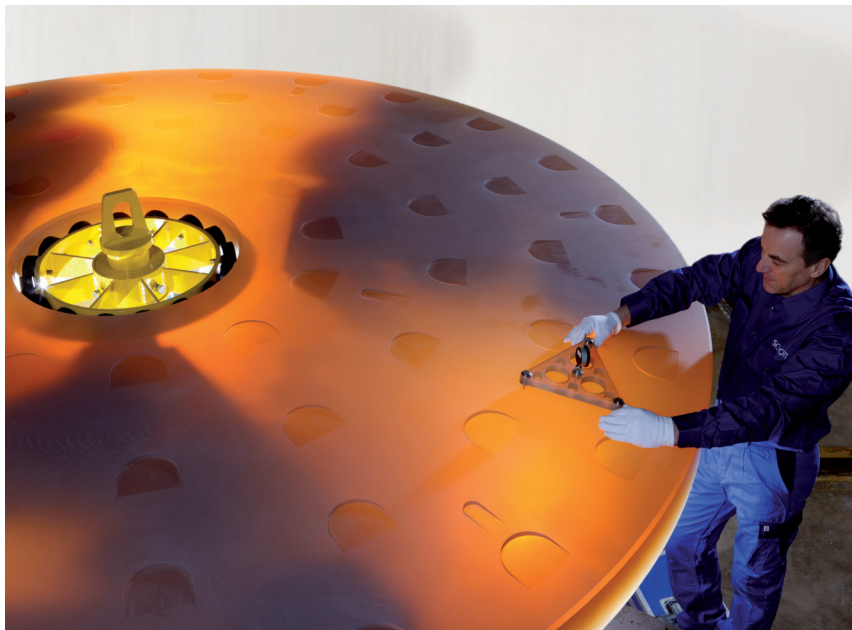
For more than 125 years SCHOTT has delivered a large variety of optical materials and components enabling the stunning advancement of ASTRONOMY. Highlights achieved with SCHOTT's support are the telescopes of the ESO-VLT (8 m), KECK and GRANTECAN (10 m), the x-ray space telescope CHANDRA and the wide field telescope VISTA.

The coming generation of giant observatories with 30 m (TMT) or 42 m (E-ELT) require large sets of hexagonal mirror elements. SCHOTT has proven the capability to deliver that large quantity.

Astronomical or solar telescopes are using sophisticated instruments with optical glasses and filters in outstanding quality sometimes in large dimensions.

## Materials

- ZERODUR® zero expansion glass ceramic for mirrors and structures
- ZERODUR K20® for high temperatures
- More than 100 optical glass types, among them N-BK7, F2, LLF1, N-FK5, LF5, SF6 in large sizes (1 m)
- More than 50 optical filter glass types
- Infrared transmitting glasses (IRG2)



## Quality Assurance

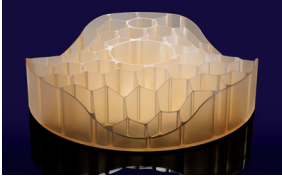
As inventor of the high quality optical glass production process and with more than 125 years of experience and ongoing developments, SCHOTT masters all melting and tempering processes with outstanding and highly reproducible quality results. Careful inspections at all stages of fabrication from raw material to the final product secure highest quality throughout the entire process chain. Certificates for all products are provided comprising the quality inspection results. For large projects these results will be verified on request in the presence of the customer. State-of-the-art measurement equipment is used for internal and dimensional quality inspection. All sites in our global production network operate according to certified quality and environmental management systems (ISO 9001/ISO 14001).

## Main Products and its Applications



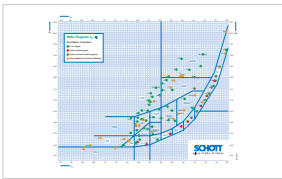
### ZERODUR®

ZERODUR® is an inorganic, non-porous glass ceramic with a very low thermal expansion coefficient. It is extremely homogeneous, chemically stable and can be processed and polished to very high surface qualities. It is used for telescope mirror substrates for astronomy, for reflecting optical elements in lithography and as dimensional reference in metrology.



### ZERODUR® Lightweight Structures

SCHOTT has a wide range of capabilities for shaping and light-weighting of ZERODUR®. With grinding, up to 90% weight reduction can be achieved. Subsequent acid etching can be used to increase the strength of the structures significantly.



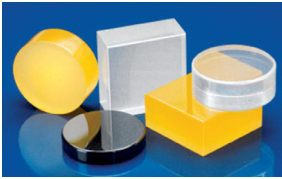
### Optical Glasses

Optical Glasses are used for imaging cameras, in focal reducers, for guiding the light of astronomical objects to spectrographs and for corrections of the atmospheric dispersion. SCHOTT offers special quality grades in the refractive index, dispersion, optical homogeneity, inclusion content, striae and stress birefringence, for some glasses in diameters up to 1000 mm, enabling excellent lenses working at the diffraction limit over a wide spectral range.



### Optical Lenses, Prisms and other Components

SCHOTT is capable to provide lenses, prisms and components of almost arbitrary shapes made of different optical glasses and other optical materials. Possible delivery forms can be ground near net shape, can be plane-parallel substrates as well as prisms and aspherical lenses polished or coated to high optical quality.



### UV- and IR-Materials

IR-materials are the choice for many UV and IR applications. Key quality features are the very low stress birefringence and the high optical homogeneity.



### Astronomical Filters

Optical filter sets made from optical filter glasses or coated glass substrates or from a combination of both serve for wavelength band selection in astronomical observation. SCHOTT has all production processes in house. So filter elements as well as complete filters even in larger dimensions can be provided.



### Optical Fibers and Fiber Components

Optical fibers with very high transmittance also in the short wavelength range serve for guiding multiobject light e.g. from a telescope focal plane to spectrographs. Fibers can be arranged in virtual any order thus allowing to produce tapers and faceplates e.g. for CCD coupling.

Detailed product flyers available!

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