

Newsletter

Advanced Solutions for Optics, Opto-Electronics, Lithography and Science!

SCHOTT
glass made of ideas

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TECHNICAL INFORMATION & PRODUCT NEWS

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Expansion of manufacturing expertise in the area of IR materials

SCHOTT opened its production facility for chalcogenide glasses in Duryea, Pennsylvania, in December 2011. The opening event was attended by industry experts and customers who are actively interested in finding innovative solutions for their IR applications. These glasses are mainly used in heat detection, an area that includes a wide variety of different types of applications. More specifically, these products are used in the lenses of camera systems that allow for night vision and permit temperatures to be measured without making direct contact (thermography).

Since the facility first opened, SCHOTT has continuously extended its processes and capabilities along the IR value chain from materials to finished components. SCHOTT can now be considered a fully integrated manufacturer of chalcogenide products that provides the IR industry with the most comprehensive and detailed technical data and thus demonstrates the reliability and efficiency of the materials it offers. As a high-tech manufacturer of advanced materials and components, SCHOTT offers reliable high-quality products from its IG family of glasses along the entire value creation process –

whether it be cut blanks, concave or convex matte pre-forms or even coated components shipped with a reliable test certificate.

In addition to expanding its expertise, SCHOTT firmly believes it is important to educate and inform its customers of the advantages of chalcogenide glasses, especially compared to germanium. Customers and renowned industry experts were therefore invited to attend a series of events and participate in interactive webinars and seminars. For instance, at this year's Photonics West in San Francisco, California, Dr. Bruce Bernacki from Pacific Northwest National Laboratory gave a presentation entitled



Chalcogenide glasses as final components

VISIT US AT:
OPTATEC 2012

May 22–25, 2012

Frankfurt

Hall 3, D 12

“SCHOTT – Your Partner for
Excellence in Optics”

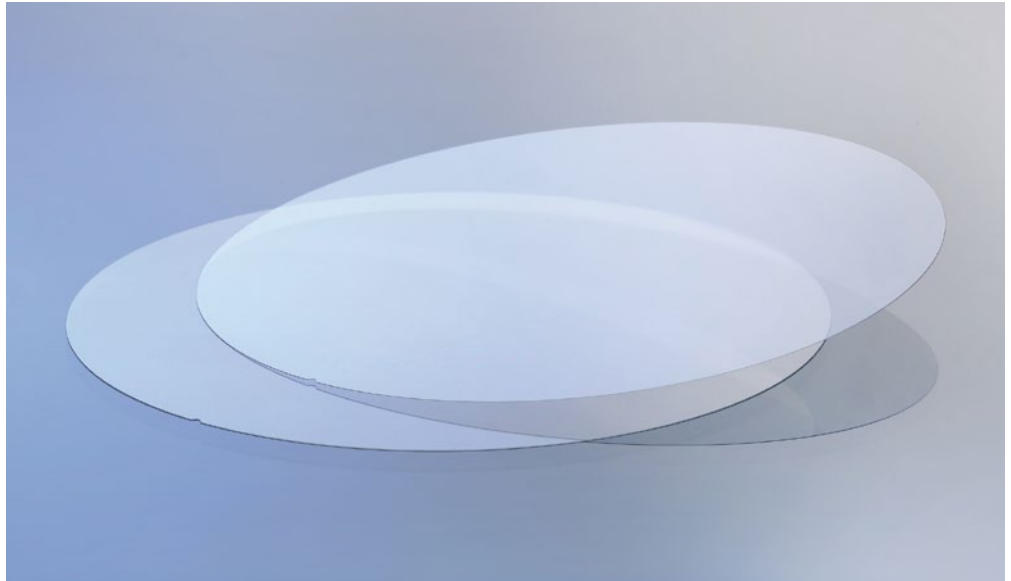
“Infrared Design Considerations When Utilizing Chalcogenide Materials.” His lecture included a comparative overview of the advantages of chalcogenide and Ge-materials. Dr. Bernacki shared even more detailed information at the “SPIE Defense, Security, and Sensing Exhibi-

tion and Conference” held in Baltimore, Maryland, in April.

Please contact us, if you would like to learn more about these presentations or our IG glasses: info.optics@schott.com.

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MEMpax® successfully qualified



MEMpax® – the new ultra-thin borosilicate glass from SCHOTT

SCHOTT MEMpax® is an ultra-thin borosilicate glass that features fire-polished surfaces and has a coefficient of linear thermal expansion (CTE) of $3.25 \times 10^{-6} \text{ K}^{-1}$. It is available in thicknesses of between 0.7 and 0.1 mm. MEMpax® was first launched at the beginning of the year.

Since then, we have continued to improve this product and have set ourselves the goal of explaining the benefits this material offers to our customers and partners and thus help them make the best possible use of this product.

Now that SCHOTT has managed to sign up a leading European MEMS manufacturer as a key customer, the material is being tested by other European customers. Its introduction to the market in the NAFTA region is also off to a successful start, as can be seen from the initial sample orders that have been placed. Visits will be paid to customers and partners in

Asia over the next few months by conducting a roadshow aimed at sharing how it can be used and discussing the benefits this material offers.

To improve its offerings even further, SCHOTT will be offering a defined range of thicknesses that meet specific customer needs. Furthermore, downstream processes can be reduced and the material can be used directly as a wafer, thanks to its high-quality fire-polished surface. This allows for a significant increase in efficiency and makes MEMpax® the material of choice for applications in the semiconductor industry and MEMS.

If you would like more information on MEMpax® or to meet with us during our roadshow, please write to us at:

info.optics@schott.com

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ZERODUR® goes EXTREME

ZERODUR® now features
customized zero expansion

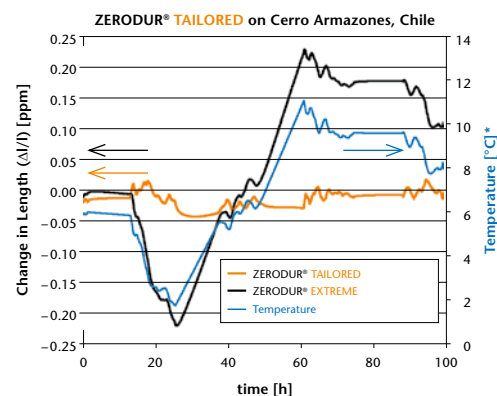
Effective immediately, SCHOTT will be offering its tried and tested zero expansion glass-ceramic ZERODUR® in considerably tighter expansion classes designed to better suit customer demands.

The most unique characteristic that the glass-ceramic ZERODUR® offers, its extremely low thermal expansion, is defined by the mean coefficient of linear thermal expansion (the CTE value) in a temperature region of between 0°C and 50°C.

Until now, ZERODUR® has been available in 3 different expansion classes, the tightest of which is class DK0 with tolerances of 0 ± 0.020 ppm/K.

Now, SCHOTT Advanced Optics will be offering ZERODUR® in two new versions of the expansion class 0 with much tighter CTE tolerances: ZERODUR® SPECIAL with a CTE of 0 ± 0.010 ppm/K and ZERODUR® EXTREME, at 0 ± 0.007 ppm/K, currently the tightest tolerance available on the market. These new classes are made possible by improved process control and high measurement accuracy when it comes to thermal linear expansion.

Nevertheless, this reduction in the expansion classes is not the only new development with ZERODUR®. "With ZERODUR® TAILORED, a material will now be available that can be modified to suit the temperature profile of a specific customer application. This is even more important," explains Dr. Thomas Westerhoff, responsible for strategic marketing of ZERODUR® at SCHOTT Advanced Optics. By using a physical method the company developed on its own that simulates the thermal expansion properties of ZERODUR® glass ceramic for any number



* Temperature data from: Public Database Server: <http://sitedata.tmt.org/> from June 1 and 4, 2008, air conditioned during the day

of temperature profiles, it is now possible to define the exact demands that ZERODUR® must meet on the basis of a specific customer's temperature profile (e.g. a low temperature for a typical telescope location, hardly any changes in temperature with room temperature, etc.). The result of this simulation is then used to precisely set and control the manufacturing process so that it meets specific customer demands. In other words, SCHOTT is not only able to offer its customers a material that has been modified to meet the specific needs of an application, but also allows for a higher level of precision for all final applications.

This example presents a typical temperature profile from the peak of the Cerro Armazones, the intended site of a large telescope in the Chilean Atacama Desert. This diagram shows the thermal expansion of ZERODUR® TAILORED compared to ZERODUR® EXTREME. As this illustrates, ZERODUR® TAILORED offers much lower absolute thermal expansion for the prescribed temperature profile.

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Class	CTE* (0°C; 50°C)
ZERODUR® SPECIAL	0 ± 0.010 ppm/K
ZERODUR® EXTREME	0 ± 0.007 ppm/K
ZERODUR® TAILORED	Optimized for application temperature profile

* Coefficient of Thermal Expansion

SCHOTT extends its range of climate-resistant Blue Glass

New supply forms and filter types

SCHOTT offers one of the broadest portfolios of optical filters that was enhanced last year with the introduction of the new Blue Glass types BG60 and BG61 that are mainly intended for use as special IR blocking filters in the digital cameras in smart and cell phones. BG60 and BG61 were designed to deliver 50% transmission at 0.3 mm thickness at around 633 nm (BG60) and approx. 648 nm (BG61). This means our customers can apply advanced coatings to their optical filter glasses that meet even the most demanding specifications. With the appropriate coatings, both glasses are capable of withstanding severe climatic conditions and extremely demanding tests at 85°C and 85% relative humidity for more than 1000 h.

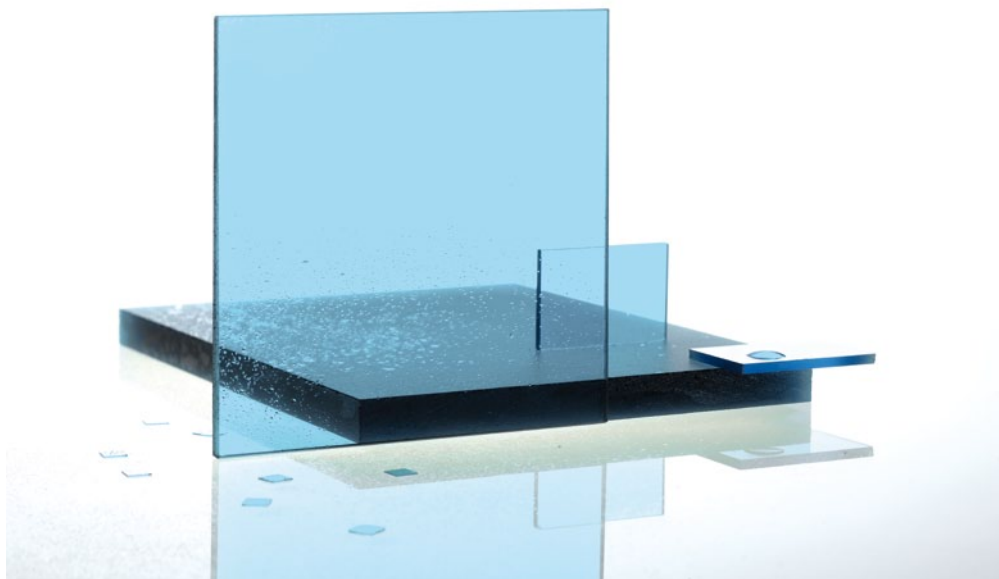
SCHOTT is now ready to offer customer-specific Blue Glasses and is constantly extending its offerings. Additional supply forms are being tested as part of the division's ongoing efforts to expand its product spectrum. A 0.33 mm thick wa-

fer with an 8-inch diameter will be presented at this year's OPTATEC.

These types of Blue Glass wafers can be used for so-called wafer level packaging and simplify the manufacturing process. SCHOTT's objective is to improve processing of Blue Glass at its customers' sites and create new ways of leveraging the benefits this new material offers by offering new supply forms. In addition, SCHOTT is currently developing yet other types of Blue Glasses and will be launching a new type of glass shortly. Furthermore, other types of Blue Glass can be custom designed with respect to their transmission performance so that they meet more specific customer requirements and thus offer even better and more customer-friendly solutions.

We would appreciate your feedback on possible supply forms so that we can review and improve our product line. Send us an e-mail to: info.optics@schott.com.

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Climate-resistant Blue Glass – now also available in wafer form

HT glass from SCHOTT makes the brightest premium binoculars in the world possible and brings significant improvements for hunting optics

SCHOTT
HT GLASS



Binoculars from Zeiss' VICTORY HT Series

SCHOTT Advanced Optics and Carl Zeiss Sports Optics GmbH agreed to collaborate at the end of 2011 and have decided to work together closely in the future on developing innovative products and making new features possible by using select new SCHOTT materials.

One of the first projects was a new product for Carl Zeiss Sport Optics GmbH that was presented at the IWA in Nuremberg, Europe's largest hunting trade show held in March of this year. Zeiss presented binoculars and riflescopes from the new VICTORY HT series at the IWA, considered to be the most important annual meeting in the industry for expert visitors from the hunting and sports markets. Both product lines rely on high-quality components made of highly transmissive glass from SCHOTT, whereby the binoculars also feature new and optimized ergonomics.

By using SCHOTT HT glasses, it is possible to significantly improve the brightness of these binoculars and increase transmission to more than 95 %, with noticeable improvements in visibility at twilight time. Zeiss has thus once again proven that it offers the brightest premium binoculars in the industry.

SCHOTT HT glasses are special types of the established optical glasses, however they offer significantly improved transmission. SCHOTT currently markets eleven of these special versions that are labeled HT or HTultra and is working hard to expand its offerings on an ongoing basis (NEW: N-BAK4HT). Both the color and the image quality has improved thanks to increased transmission, particularly in the blue spectral range, and mesopic vision has been optimized. Moreover, the "thermal lensing effect" has been reduced through lower absorption of energy. This makes HT glasses the perfect choice for use in sport optics and high-performance projectors like those used in 3D cinemas.

The positive effect of the HT glasses was experienced directly for the first time with the introduction of the VICTORY HT series, with customers confirming this and thanking Zeiss as well as SCHOTT indirectly by making this event the most successful IWA ever for Zeiss with orders for the VICTORY HT products exceeding all expectations.

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Prisms as key elements of optical devices

People have been aware of the importance of prisms for some time. For example, prisms are often used as color filters, leveraging its characteristics to divide white lamplight into the color components red, green and blue.

Prisms are one of the main focuses for SCHOTT and the company has introduced many developments in recent years aimed at strengthening and extending its experience in this area.

For example, extensive grinding and polishing equipment was installed at its Penang site in Malaysia along with advanced technical capabilities. SCHOTT Advanced Optics is thus now able to offer prisms made of different optical materials in various sizes and levels of finishing (polished, coated, cemented, etc.). Thanks to these developments, Advanced Optics is now in full command

of the entire supply chain and always able to reach back on its own comprehensive range of optical materials.

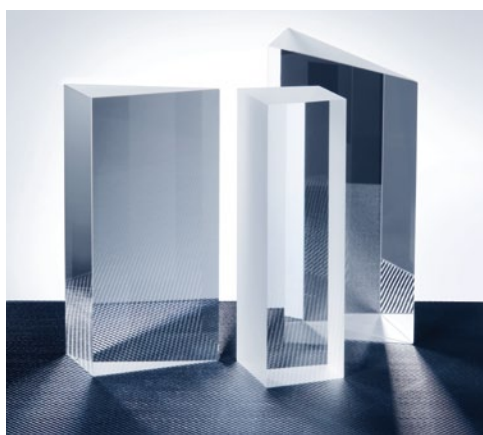
The table below provides you with an overview of our offerings:

Possible materials

- Optical glasses e. g. N-BK7HT, N-BAK4HT, N-SK4, SF57HTultra, SF6HT, SF2, SF11
- **NEW:** N-BAK4HT
- Synthetic quartz glass

Possible prism shapes

- 90° prism
- Rhombic prism
- Penta prism
- TIR prism
- Cube beamsplitter
- Customer specific shapes



Prisms from SCHOTT - key elements in optical devices

Thanks to these offerings, SCHOTT prisms can now be found as the key element in high-performance projectors in 3D cinemas, industrial microscopes, but also riflescopes and binoculars, all applications where good transmission and excellent refractive power are of crucial importance.

For detailed information, please write to us at: info.optics@schott.com.

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Manufacturing Capabilities

Attribute	Commercial Quality	Precision Quality	Ultra Precision Quality
Size	10 to 200 mm	10 to 200 mm	10 to 200 mm
Size Tolerance*	±0.2 mm	±0.1 mm	±0.05 mm
Angle Tolerance*	<1.5 arc minutes	<1 arc minutes	<10 arc seconds
Surface Accuracy*	1 λ	λ/4	λ/10
Surface Quality (S & D)*	80/50	40/20	20/10
AR Coating*	Ravg <1.5 %	Ravg <0.5 %	Custom designed
Cementing*	Custom designed		
Order Quantity*	From 1 piece to series production		

*Depending on customer's specification.

SCHOTT Advanced Optics continues to expand its Center of Excellence for Coatings and Components in Yverdon

New facility opened

After bundling its most important coating equipment and expertise at its Center of Excellence for Coatings and Components in Yverdon, Switzerland, SCHOTT Advanced Optics has continued to focus its efforts on expanding and strengthening its capabilities in this field.

A new production facility was developed just recently, following the addition of a magnetron sputtering tool to its extensive coating equipment at the beginning of last year. The new building offers more than 8500 square meters of space and will house new office rooms and production areas that focus on sub-assembly for the OEM business. Production capacities are being expanded and

a more efficient and more practical configuration of the existing working space and equipment used is being pursued in order to be able to optimize processes and operational sequences. This will result in better service for our customers and provide a new boost for our Center of Excellence. The opening was celebrated together with guests from the local authorities, partners and customers in late March. The new set-up that is already operational will be enhanced by adding a new production layout dedicated to specific product lines over the next few months.

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The new facility in Yverdon

How does it work ...

SCHOTT Advanced Optics looks back on over 125 years of experience in the area of optical glass and has expanded its range and expertise over many decades. In moving forward, we would like to provide you with a closer look at our processes, procedures and sequences and are planning to examine a specific

topic in greater detail on a regular basis in each of our newsletters.

Please let us know if you are interested in a specific topic by writing to us at: info.optics@schott.com.

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...selecting raw materials and manufacturing batches in the production of special glass ...

Optical glasses and special glasses have specific outstanding characteristics. Special raw materials with particular properties must be selected in order for these to be achieved. These raw materials include e.g. fluoride and phosphate, along with very expensive raw materials such as rare earths, tantalum oxide and niobium oxide, which in some cases can cost more than €100/kg. In addition to the high requirements that pertain to chemical composition, purity and homogeneity, only the slightest traces of any chemical impurities such as iron, chrome or nickel can be tolerated.

It is increasingly difficult to meet these challenging demands because the requirements are constantly becoming more rigid. For this reason, we rely solely on synthetically processed raw materials that are manufactured in elaborate, complex and extremely expensive chemical processes that are used to produce optical and special glasses.

Since there are very few global manufacturers with the appropriate expertise on how to produce high-purity materials, Advanced Optics relies on support from a highly skilled and professional purchasing department to purchase the products needed in a strategic manner. In this case, both the statutory requirements like REACh (Regulation, Evaluation, Authorization and Restriction of Chemicals) and RoHS (Restriction of Hazardous Substances) and extremely high technical, economic and ethical requirements are observed.



Besides the raw materials, manufacturing homogeneous batches represents a basic prerequisite for producing optical glasses. Established formulas are weighed out and mixed in a precise manner and supervised by an experienced and well-trained team in the batch area. Taking special care and assuming responsibility are the top priorities here, since the smallest errors can significantly impair quality in the downstream melting phase. Issues like occupational safety therefore play an important role in protecting both our employees and the environment.

Once it has been successfully weighed and mixed, the batch is ready for melting. We will be covering this topic in our next edition.

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SCHOTT Advanced Optics at this year's OPTATEC

SCHOTT Advanced Optics is exhibiting at the 11th OPTATEC and will be pleased to welcome its guests and partners.

In addition to presenting its familiar range, the following new products and highlights will also be on exhibit:

- **MEMpax®** – A new, ultra-thin borosilicate glass for wafer thicknesses of 0.7–0.1 mm that is perfectly suited for all semiconductor and MEMS applications
- **BG60 & BG61** – New, climate-resistant Blue Filter glasses with outstanding internal quality, excellent optical characteristics, good bending strength, and broader bandpass regions for use as IR blocking filters
- **ZERODUR®** – Three new tighter toleranced thermal expansion grades

SCHOTT will be holding presentations on two of these main topics as part of the OPTATEC Forum. Visit us at our booth (Hall 3, Booth D 12) and be our guest for the following presentations:

ZERODUR® goes EXTREME:

SCHOTT Advanced Optics introduces three new tighter toleranced thermal expansion grades of its extremely successful ZERODUR® glass ceramic
Wednesday, May 23, 3:30–4:15 pm

New BG 60 & BG 61 – New filter glasses for use in IR blocking filters deliver far superior image quality
Thursday, May 24, 3:30–4:15 pm

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Upcoming SCHOTT Events

Here we are listing the events where “Advanced Optics” proactively attends as an exhibitor, speaker or has an active part such as “chair of technical conferences,” etc.

[OPTATEC](#)

May 22–25, 2012,
Frankfurt, Germany, Hall 3, Booth D12

[DGaO Conference](#)

May 29–June 2, 2012,
Eindhoven, The Netherlands

[SID](#)

June 5–7, 2012,
Boston, MA, USA, Booth 443

[OPTO Taiwan](#)

June 19–21, 2012,
Taipei, Taiwan, Booth K416

[Eurosatory](#)

June 11–15, 2012,
Paris, France, Hall 6, Booth G641

[SPIE Astronomical Telescopes + Instrumentation](#)

July 2–4, 2012,
Amsterdam, The Netherlands, Booth 307

[SEMICON West](#)

July 10–12, 2012,
San Francisco, CA, USA, Booth 947

[Micromachine Japan](#)

July 11–13, 2012,
Tokyo, Japan, Booth D24

[SPIE Optics & Photonics](#)

August 14–16, 2012,
San Diego, CA, USA, Booth 616

[CIOE Shenzhen China](#)

September 6–9, 2012,
Shenzhen, China

[Opto Paris](#)

October 23–25, 2012,
Paris, France

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