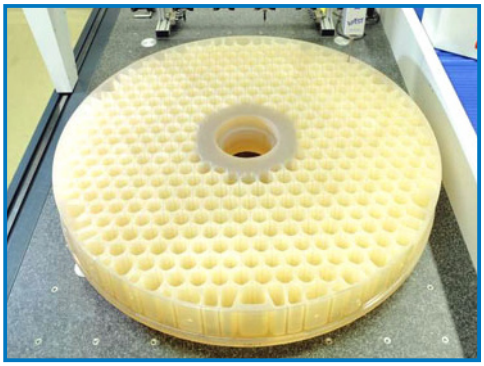
Vol. V, No. 1, January 2010

Enhanced CNC machining of ZERODUR® for demanding complex light weight structures

SCHOTT's research & development experts of the ZERODUR® product division at AOO have been putting a lot of emphasis on extending the capabilities for machining complex light weight structures with impressive results.

Last summer SCHOTT delivered the 1.5 m light weighted ZERODUR® primary mirror for the Solar Telescope GREGOR of the German Kiepenheuer Institute for Solar Physics. This mirror contains 420 pockets on the backside and a parallel facesheet for homogenous cooling to avoid the sun's thermal impact which deteriorates images and observation. The parallel facesheet was achieved through approximation of the convex curvature with steps of 0.2 mm in height at the bottom of the pockets. This approach required the usage of CAD/CAM technology in which the 3d design model generated the program code controlling the 5-Axis CNC machine. In order to master the very complex and time consuming process, a lot of effort was put into the preparation of the processing. The CNC machining team developed checklists, defined detailed measurement procedures, and developed a preventive maintenance plan for tools and the CNC machine. All these improvements resulted in the successful machining of the GREGOR mirror with its many tight geometrical and quality specification parameters.



Backside of the 1.5 m diameter GREGOR Solar Telescope primary mirror

Generally, specifications of light weighted mirrors for telescopes and satellites are continuously getting more challenging by requiring a light weight factor higher than 90%.

However, the tip and tilt M4 mirror of the future European Extremly Large Telescope (E-ELT) goes a step further and requires an even more demanding approach in light weighting. The elliptical plano mirror of approximately 3 m x 2.5 m is specified to a weight of less than 500 kg while offering a reliable and significant stiffness to enable stable images. One of the first design proposals by the customer specified a rib height up to 300 mm which SCHOTT successfully used to test the feasibility of machining the challenging ratios in rib thickness and pocket height of the E-ELT M4 design suggestions. A sample with an impressive small rib thickness of 2 mm together with pocket depths of 190 mm was achieved

with a 5-Axis CNC machine without using acid etching. For pockets 80 mm in depths, it was even possible to machine a rib thickness of 0.8 mm by using standard diamond tool grinding.

The realized process stability during the successful machining of the complex GREGOR mirror and the achievements in the machining of demanding aspect ratios proves the extension of capabilities within SCHOTT for complex light weighted structures of ZERODUR® for complex mirror designs.

Rib thickness of 2 mm and pocket depths of 190 mm achieved on a 300 mm diameter demonstrator with standard diamond tool grinding

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SCHOTT: your ideal partner for state-of-the-art optical components for all your optical systems

Optical systems used for binoculars, cameras, digital projectors, microscopes, or other demanding industrial applications need a great number of high-end optical components.

Most of these optical systems are comprised of different parts: the first part lets the light enter the system, for example microscope objectives; the middle part conducts the light through the system and the last part focuses the light to a receptor such as a screen, a CCD or even an eye. The first part of the system could be comprised of a single lens, as seen in a cell phone camera, or could contain a series of more than 20 spherical and aspherical lenses made of different geometries and glasses as required, for example for high end camera zoom. The middle part that conducts, disperses or refracts the light through the system is made of prisms, mirrors, and beamsplitters of different sizes and glass types. The last part focuses the light on the system receptor and could be made from an assembly of lenses. To conserve the interesting part of the light spectrum required in the optical system, high precision coatings made of 1 to 150 layers are applied on the components.

For a single optical system, a large number of optical components made of different glass types and geometries are needed. It is difficult to find a single company that can produce the glasses and master the complete value chain offering the different components needed with the highest quality and a competitive price. The good news is: SCHOTT can do it. For all the optical glasses of SCHOTT and for further materials such as ZERODUR®, fused silica and others, SCHOTT offers polished windows up to 625 mm diameter, spherical and aspherical lenses up to 200 mm diameter, different types of prisms up to 200 mm, and much more. Of course all these components can be coated with state of the art technology.

To find all the possibilities that SCHOTT can offer as components please go to: http://www.schott.com/advanced_optics/english/our_products/processing_components/index.html or contact us at info.optics@schott.com.

A binocular from ZEISS showing the range of different optical components

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SCHOTT shares knowledge with its partner Philips

Workshop held at Philips facility for Consumer Lifestyle in Klagenfurt, Austria

In Klagenfurt, the regional capital of the southeast of Austria, you find the development center of the dutch electronics company Philips for all body care, health and well being products.

In December 2009 this center hosted a one day event on the topic of glass, during which experts from SCHOTT visited the Philips development center to give presentations on various subjects. Following a brief introduction about the SCHOTT Group, the SCHOTT visitors discussed the following subjects with their Philips hosts: optical glass in general and its properties in relation to optical specification, metrology and inspection methods of indicators such as the Abbe number, refractivity homogeneity, striae, bubble integration, stress birefringence, the latest advances in the field of measurement technology, certification elaboration, the advantages of glass over plastic for certain applications, lens manufacturing techniques and various production processes.

The day-long event also focused on optical filters and the following in particular: filter glass and interference filters; the physical and mechanical properties of optical filters; spectral properties (absorption, reflection and transmission); portfolio elaboration (grouping of BG, OG, etc.); respective examples as well as the ROHS directive and the EU's REACH framework. In addition the participants were given the opportunity to familiarize themselves with SCHOTT's calculation tool for filter glass.

About 25 people from Philips attended the event and took advantage of the opportunity to exchange information, ask questions, and float ideas for possible joint projects. The enthusiasm displayed by all concerned and the lively discussions throughout the day attested to the great interest that Philips and SCHOTT have in working with each other as long-standing partners who have already successfully carried out a number of joint projects.

SCHOTT's sales manager for the Philips Austria account, Jouri Ouvarov, commented on the event: "In addition to our strong commitment to exceptional quality, we feel it's important to let customers bounce ideas off us – which we've also found is a very good way to catalyze joint projects with our customers. During the workshop, we had the opportunity to show Philips personnel how glass is made, and at the same time clearly demonstrate our willingness to work closely with our customers on new projects and on optimizing existing solutions – and particularly to meet Philips' needs in a committed and robust manner."

Christian Hartl responsible for purchasing and supplier relations at Philips Consumer Lifestyle in Klagenfurt expressed the view that working closely with suppliers is crucially important. "Thanks to our excellent working relationship with SCHOTT, which is a specialist in the field of glass and lenses, in certain projects we have been able to develop exciting solutions featuring optimal component configurations in respect to quality and manufacturing cost."

If you are interested in hosting such as workshop in your facility please contact us at info.optics@schott.com.

Interested participants following the presentations of the SCHOTT experts

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SCHOTT supports Jena Technology conference and "Carl-Zeiss-Optical-Colloquium"

With the goal to strengthen the connection between industry and product innovations, the scientific-technical forum called "Jenaer Technologietag" was founded in 2004. Since then it has been held on a regular basis, hosting experts from industry, R&D and universities.

This year's event, held last November with the title "Laser as a tool for processing silicate materials" brought more than 250 participants to Jena and showed the latest results and current trends of topics ranging from research, development and new applications. Along with the exchange of ideas and important networking, presentations from internationally known experts from scientific and economic fields and public discussions formed the basis of this event while an exhibition completed the conference. SCHOTT supported the event and Dr P. Hartmann, Director Business Relations of the business unit Advanced Optics of SCHOTT AG spoke about "Optical glass - status, new aspects & trends". In addition Prof. Dr. A. Tünnermann, Head of the Fraunhofer-Institute IOF addressed the topic "Laser working of silicate materials."

Dr. P. Hartmann in discussion with attendees of the "Technologietag" in Jena

SCHOTT also supported the monthly "Carl-Zeiss Optical Colloquium" and Dr. Peter Hartmann spoke about "Optical glass and glass ceramics from SCHOTT". He explained the properties of optical glass and the glass ceramic ZERODUR® and reported on the progress made in the past years in the metrology and measurement methods. The " Carl-Zeiss Optical Colloquium" is a scientific forum with a long tradition which attracts a wide range of people interested in optics by inviting excellent representatives from the industry.

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Progress report concerning establishment of SCHOTT's Center of Excellence for optical components and coatings in Europe

In October of last year we announced our project involving the establishment of a Center of Excellence in Yverdon, Switzerland for the manufacture of precision engineered optical components.

The goal of this project is to combine know-how and equipment for modern coating technologies, thereby meeting customer needs more effectively through the synergies created by such a center. By investing in new equipment, SCHOTT will also enrich its competencies.

Prior to the transfer of the relevant manufacturing equipment from Intervac in Mainz to Yverdon and its installation in mid-December, state-of-the-art production facilities were built at the Yverdon site to ensure the highest product quality.

The Center's staff is receiving outstanding and extensive training that centers around machine operations, all relevant processes that are upstream and downstream of the coating processes, handling processes and quality assurance. This will ensure that during the systematic production ramp-up phase, our customers receive the excellent service they have come to expect from us.

Installation, commissioning and ramp-up are proceeding according to schedule, and production has begun early this year. We are therefore confident that all orders, whether new or existing, will be delivered on time right from our new competence center in Yverdon.

If you are interested in detailed information regarding the relevant contact persons, please send your request to info.optics@schott.com. We will be pleased to answer your questions and can send you respective information as requested.

SCHOTT's site in Yverdon – the new center of excellence for optical components

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Dedication of the New Solar Telescope (NST)

Dignitaries and alumni from NJIT, including faculty President Robert Altenkirch, along with noted astronomers, astrophysicists, observatory personnel and guests, gathered on October 12, 2009 to dedicate the NST, or New Solar Telescope, the world's newest and largest solar observatory. Also present representing SCHOTT North America was David Fritz, Product Sales Manager for ZERODUR® for the Americas, and Arnie Bazensky, West Coast Sales Manager. Over 2 years ago, SCHOTT supplied the 1.7 meter diameter ZERODUR® primary mirror blank that has become the heart of the NST, also being called the National Solar Telescope.

Dr. Buddy Martin, Director of Manufacturing for the University of Arizona's Steward Observatory Mirror Lab, who fabricated the ZERODUR® primary mirror, spoke to the audience about the unique design of the NST. He noted that this instrument would be a "pathfinder" for new and innovative solar telescope designs, and would be used as the model for future, next-generation solar observatories, including the Advanced Technology Solar Telescope, a 4 meter diameter instrument, to be located within the next 10 years, on the summit of Haleakala, on Maui in the Hawaiian Islands. Martin also noted that the primary mirror design was the most difficult and challenging astronomical observatory mirror fabrication to date, due to its saddle-shaped off-axis asphericity. He used a potato chip to demonstrate the shape of the NST primary, much to the amusement of the audience. This revolutionary mirror design will be scaled up and used for the New Giant Magellan Telescope, which is in its early stages of development at the Mirror Lab in Tucson.

Ian Huss, Chief Project Engineer from DFM Engineering, who manufactured the telescope in Longmont, CO noted that when he first saw the unusual design, he truly did not believe it could be built. Perseverance and support from DFM owner, Dr. Frank Melsheimer, saw the telescope through the challenging manufacturing process, culminating in this event. Dr. Phil Goode, noted Astro-Physicist and Professor of Physics at NJIT, and Director of the Center for Solar Research, will be the Director of the new facility, and worked closely with SCHOTT personnel from both North America and Germany on the procurement of the 1.7 meter ZERODUR® mirror blank. Phil, intimately familiar with the telescope since its inception, explained to the gathered audience, that this telescope has given astronomers a chance to image the sun with resolution never available before. He explained that this instrument enables astronomers to resolve the fundamental questions about solar magnetic fields, resolving the fundamental structures of these fields on a very fine scale, to a level below .1 arc seconds. The sun's surface covers about 2000 arc seconds. One of the first images taken after "First Light" from the sun was of a very specific chain-like pattern, which showed the interaction of the sun's magnetic fields. This is made possible because of NST's unique design, where the secondary mirror, also made of ZERODUR®, lies out of the path of incoming light, and does not cast a shadow on the primary mirror. This allows for observation of the sun with no obstructions. Active mounting of the primary allows it to be bent to eliminate distortions caused by solar heating.

Big Bear telescope in the hills of San Bernardino Mountains in Southern California

ZERODUR® was chosen for both the primary and secondary mirrors because of its temperature stability, allowing the observation of the sun throughout the day, where other materials would likely fail due to the stresses of heat build up. NST will become part of a constellation of other telescopes located around the planet, which observe the sun non-stop, 24 hours a day, year round. With so much focus on the effects of the sun on our daily lives, NST will get a good workout, and provide scientists very valuable and timely information about our closest star, and its effect on our world.

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SCHOTT exhibits at BIOS

SCHOTT North America Inc.'s Advanced Optics Segment exhibits at BiOS held in conjunction with Photonics West on January 23 - 28, 2010. This is SCHOTT's first time participating in this conference which is the world's largest and most prestigious international biomedical optics and imaging conference. SCHOTT will be showcasing a broad portfolio of products starting from its high quality materials to polished and coated optical components. Stop by Booth 8406 to see our latest products such as high performance filters, made of color glass or thin film coatings, as well as cutting edge precision optical components reflecting our capabilities and ability to provide solutions for Medical, Life Science, Analytical and other applications.

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SCHOTT participates in Exhibit Product Spotlight Demos and Technical Sessions at BIOS & Photonics West

Experts from SCHOTT in Germany and the United States will be conducting product demos during both BIOS and Photonics West.

Product Spotlight Demonstrations:

Saturday, January 23rd: 12:30 pm - South Hall

High Performance Optical Filters & Components for Biotechnology

Bryan Herbst, SCHOTT North America, Inc.

Tuesday, January 26th: 10:30 am – South Hall A – Demo Area 1

Novel Materials for Laser Components

(New materials for lasers used in medical, industrial & defense applications. Complementary precision optical components are being introduced as well.)

Dr. Angela Hohl-AbiChedid, SCHOTT North America, Inc.

Tuesday, January 26th: 3:30 pm – South Hall A – Demo Area 1

ZERODUR® for more sophisticated applications

(The newest results of ZERODUR® bending strengths investigation clearly demonstrates that ZERODUR® successfully can withstand much higher stress loads known so far.)

Dr. Thomas Westerhoff, SCHOTT AG

Wednesday, January 27th: 3:30 pm – South Hall A – Demo Area 1

Solarization Resistant N-BK7 for CPV

Dr. Steffen Reichel, SCHOTT AG

Thursday, January 28th: 11:30 am – South Hall A – Demo Area 1

Micro-Optics for LED Collimation

Dr. Steffen Reichel, SCHOTT AG

Technical Session:

Tuesday, January 26th: 4:20 pm

Yb:YAG composite ceramic laser

Paper 7578-39 of Conference 7578

Author: Edgar Pawlowski, SCHOTT AG

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Industry Experts share their knowledge at SCHOTT Booth 1701 during Photonics West 2010

Each day during Photonics West 2010, SCHOTT will have an industry expert on hand to share their knowledge in their respective fields by answering your questions or just sharing their viewpoints.

Tuesday, January 26th: 1:00 – 3:00 pm

Dr. Raymond V. Wick – ***Critical Materials & Optics for Defense Applications***

Research Staff Member, Institute of Defenses Analysis

Raymond V. Wick, holding a Ph.D. degree in Laser Physics from Penn State University since 1966 (focus on Electro-Optics and Spectroscopy) received a National Research Council Post Doctoral Fellowship under US Air Force sponsorship and later joined the Civil Service at the Air Force Research Laboratory (AFRL) as a research scientist. After retiring as Chief Scientist for the Space Technology Directorate at the Phillips Laboratory Ray was Executive Director of the Navy's Center of Excellence for Electro-Optical Manufacturing Technology in Vandergrift, Pennsylvania. Since 1998 Ray consults a number of companies, holds a position as an Adjunct Staff Member of the Institute for Defense Analyses supporting DoD in many technical arenas (e.g. Militarily Critical Technology List reviews, Developing Science and Technology List reviews and updates) and is technical advisor for Export Controls and International Technology Security in support of the Defense Technology Security Administration (DTSA).

His experience in the field of lasers, sensors, and electro-optics, spans over 40 years. He has served on national and international technical steering and review committees in the areas of optics and lasers.

Ray is a Fellow of the International Society for Optical Engineering (SPIE) and the Optical Society of America (OSA), a Senior Member of the American Institute of Aeronautics and Astronautics (AIAA), and is a Member of both the American Institute of Physics (AIP), and Sigma Pi Sigma. Ray currently serves on the SPIE ESTeP Committee.

Wednesday, January 27th: 1:00 – 3:00 pm

*Tony Hull – **Optics for Astronomy***

Director Business Development, L-3 Tinsley

Tony Hull graduated from the University of Pennsylvania with Academic Honors in Mechanical Engineering. is graduate studies in Astronomy and Astrophysics were also at Penn where he held a three-year NASA traineeship.

Tony held various positions with Perkin-Elmer, OCA and JPL before accepting a position with Tinsley. In 2004, he was drafted to manage the mirror build of the James Webb Space Telescope, NASA's flagship mission, which is an impact program at Tinsley, a small but elite optics company. He was Director of Large Optics, and he developed the facility, and the team for building all the high profile JWST mirrors. Toni Hull feels privileged to have worked on two NASA flagship missions and has participated in observational astronomy instrumentation covering the wavelength span from microwave through the x-ray. Today he is still actively supporting L-3 Tinsley and Brashear Optics on a part time basis.

Thursday, January 28th: Noon – 1:30 pm

*Tom Bifano – **Adaptive Optics***

Director, Boston University Photonics Center

Professor, Mechanical Engineering, Boston University

Dr. Bifano directs the Boston University Photonics Center (BUPC), a core facility and academic center of excellence comprised of thirty-five faculty members from seven academic departments, eighty graduate students, and ten staff members. He leads BUPC programs for education, scholarly research and development of advanced photonic device prototypes for commercial and military applications. He oversees a state-of-the-art facility that includes more than a dozen special-purpose and shared research laboratories and a large business incubator.

Dr. Bifano has been a Professor of Mechanical Engineering at Boston University since 1988, and was Chair of the Manufacturing Engineering Department from 1999-2006. He has organized and led international symposia and technical conferences in photonics, precision engineering, and MEMS, has authored more than a hundred publications, and is named as inventor on six patents. He is a founder and CTO of Boston Micromachines Corporation of Cambridge, MA, a leading producer of deformable mirrors for applications in astronomy, bio-imaging, and defense. His technology has received two R&D100 Awards for innovative product development.

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Upcoming Events

Here you also find as usual the list of the events where "Advanced Optics" proactively attends as an exhibitor, speaker or has an active part such as "chair of technical conferences," etc.

SPIE's Bios, January 23-24, 2010, San Francisco, CA – Booth #8406

Photonics West 2010, January 26-28, 2010, San Francisco, CA – Booth #1701

Lens Expo 2010 - Lens Design & Manufacturing Expo, April 21-23, 2010, Pacifico Yokohama, Japan

CLEO, May 18-20, 2010, San Jose, CA – Booth #2006

DGaO Conference, May 25-29, 2010 Wetzlar, Germany

OPTATEC, June 15-18, 2010, Frankfurt, Germany - Hall 3, Booth D12

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