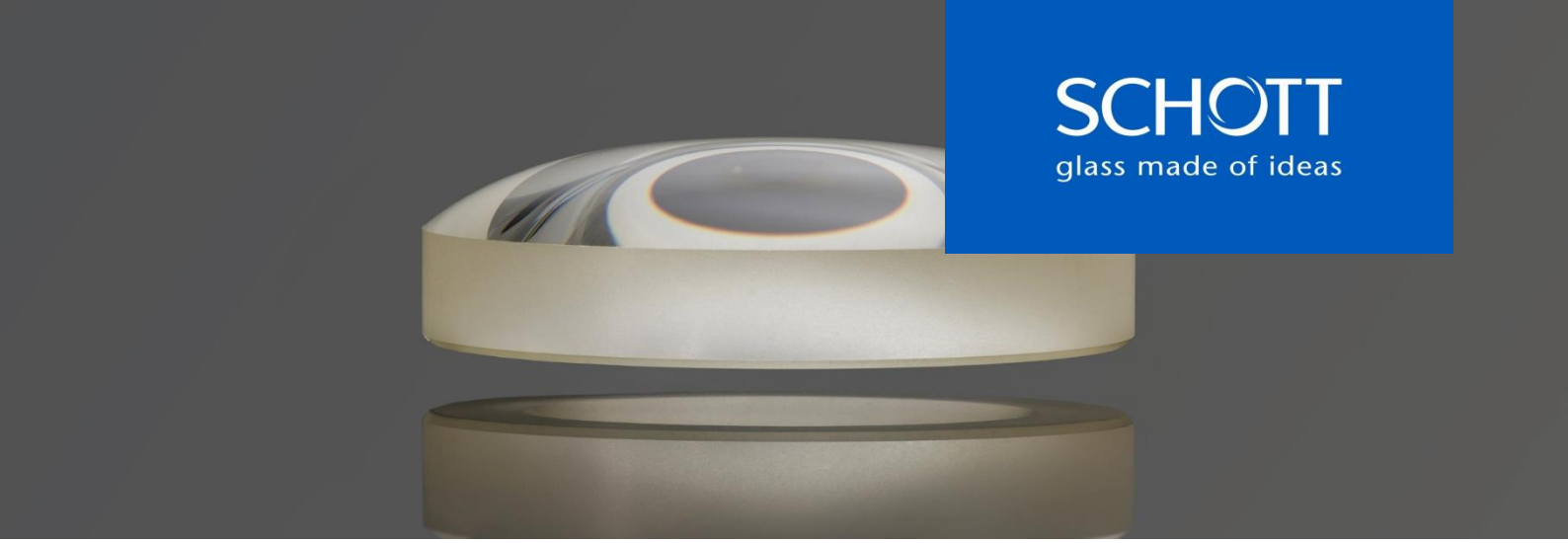

August 8, 2022

SCHOTT Aspherical Lenses

Precision Aspheres for High-End Applications

Introduction

SCHOTT Academy of Optics is a free, online seminar series designed to take your industry knowledge and expertise to new levels.

Throughout the series, you will learn from leading glass and material experts as they cover various topics pertaining to the optics industry.

Visit our website for more information or to register for an upcoming seminar: www.schott.com/trainings/academy-of-optics

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SCHOTT was a pioneer in developing aspheres and has been making these high-end optics for more than 20 years. We offer high-quality, custom designs by working across the entire value chain — from selecting the raw material and creating prototypes to applying coatings and moving to serial production.

1. Why are aspherical lenses essential in our everyday life?

The performance benefits of using aspherical surfaces in optical systems are undeniable. Aspheric lenses not only excel at eliminating spherical aberrations but also enable smaller footprints, which facilitates lightweight designs. Advances in manufacturing technologies have helped reduce costs and increase surface form accuracy to the point that high-end aspheric lenses are now used in a wide range of applications including laser processing heads, cinema projectors, and head-up-displays in civil and military aircraft.

2. When only the best will do – aspheres for various applications

One of the first applications of SCHOTT aspheres was for laser machinery. Laser scanning systems and processing heads used for drilling, welding, or cutting typically use fused silica aspheres between 10 and 130 mm in diameter with an irregularity less than 0.6 µm or RMSi less than 100 nm. For laser processing heads, aspheres are ideal for light collimation and focusing. However, the trend toward higher laser powers can bring new challenges.

High laser powers generate heat in the aspheric lens that creates a thermal lensing effect, shifting the light focus in a way that degrades laser performance. SCHOTT developed new antireflection (AR) coatings that can help mitigate this issue by offering absorption levels below 50 PPM for green wavelengths and below 10 PPM for infrared wavelengths. Additionally, our dual-wavelength setup for PPM-level absorption measurement allows detailed characterization of both AR coatings and the underlying substrates. If coatings don't lower the heat absorption enough, we can advise on using a different grade of fused silica material to further reduce thermal lensing effects.

You can also find aspheric lenses in high-end cinema projectors because they help the projectors produce outstanding image quality with high brightness. This application typically relies on aspheric lenses made of optical glass with diameters between 60 and 90 mm. In this market, customers have recently started asking for a tighter maximum slope error specification — which is currently less than 0.2 mrad with a slope RMS less than 0.1 mrad — to boost the performance of these projectors even more. SCHOTT can meet these needs thanks to its strong internal supply chain that spans from raw materials to blanks and finished aspheric lenses.

The high-end cameras used to make movies have lens systems with highly accurate aspheric lenses made of optical glass with diameters between 50 and 60 mm. For this application, form error requirements can be very demanding because of the high image quality needed. The coatings used for these lenses often come with stringent spectral requirements and must also pass several durability tests. In addition, these lenses are often blackened on the edges to suppress stray-light.

The heads-up displays used in civil and military aircraft rely on optical glass aspheres up to 200 mm in diameter to create a wide field of view. For these displays, it is common to have formfactors requiring complex CNC machining or for the aspheric lenses to be cemented together to form achromatic doublets that focus different wavelengths onto the same image plane.

3. Creating high quality optical components

SCHOTT uses a versatile and precise CNC grinding technique combined with magneto rheological finishing and local corrections to make high-end aspheres. The lenses are available with various form factors, including plano- convex, bi-convex, meniscus and concave as well as a wide range of diameters (currently 10 to 200 mm and soon up to 300 mm). Our precision processes can achieve typical height deviations between 0.2 and 0.7 µm with maximum slope errors between 0.2 and 0.7 milliradian.

SCHOTT's proven experience in coating design for aspheres means we can coat large parts up to 350 mm at the same site where the aspheric lenses are produced. Our team of coating experts can assist in developing the best solution for a specific application by drawing on a variety of coating methods and types that cover wavelengths from the UV to the longer infrared range.

We also offer on-site metrology and up to seven-axes CNC machining for edging, truncation, and drilling as well as durability and climatic testing. If stray light suppression is a concern, edge blackening can be an option. We also use the latest metrology instruments to control the optical fabrication process, check the surface for errors, center the lens, and characterize thin film coatings.

With an array of options and more than 120 optical glass types, we can meet the requirements for almost any application while machining, analyzing and coating the lenses at the same site. All our aspheres are custom components, and our setup is ideal for small- to mid-volume series production. Partnering with SCHOTT gives you access to more than 20 years of experience in making aspheres and world-class application engineers that can help turn your optical design into reality.

Want to learn more about precision aspheres for high-end applications?

Visit our website for more information and resources: www.schott.com/products/aspherical-lenses.

SCHOTT
glass made of ideas