Visionen leben
Exceeding expectations in new ways

Visionen leben – Bringing visions to life. With this mission, asphericon is continuously pushing the boundaries of what is possible and establishing new milestones in the world of optics. asphericon’s passion for revolutionizing the manufacturing of aspheric components with new technologies is changing the degree of precision and quality that is possible.

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Aspheric solutions made by one source

asphericon combines a researcher's pioneering spirit with the practical ability to implement customer-oriented, economical solutions. The latest manufacturing technologies, continually evolving proprietary control software, world class measurement equipment, and highly qualified employees ensure that asphericon provides over 600 customers worldwide with innovative solutions. We will assist you from the initial optical design, through manufacturing and coating, precision metrology and documentation, to the assembly of optical modules and optical characterization.
Precision out of passion
asphericon sets standards in asphere production

High-End Finishing
= ION-Finish™
= MRF® technology
= asphericon Ångström-Polishing

Manufacturing technologies
= CNC processing
= Diamond turning
= Measuring
= Coating

Forms
= Aspheres
= Spheres
= Acylinders
= Diffractive elements

Wavelengths
= UV
= VIS
= NIR-IR-FIR

Materials
= Glass
= Fused Silica
= CaF₂
= Metals
= IR lenses / IR crystals
= PMMA

Applications
= Optical design
= Optical characterization
= Optical assembly

Systems
= Beam expansion
= Beam shaping
= Fizeau lenses

Making it possible

Perfect in terms of quality and precision: every asphericon lens is the product of knowledge, expertise, and experience gained in a large variety of demanding projects. Our technologies make it possible to manufacture optical components in various shapes for all wavelengths, using a very wide range of materials. Combining this with our high-end manufacturing processes and applications, we routinely achieve unique levels of dimensional precision. asphericon impresses with accuracy beyond the standard.

asphericon is committed
to high-quality working processes and meets all of the requirements of the ISO 9001:2015.
Driven by the idea of developing new technologies and optimizing existing ones, we are continuously refining and improving our processes. In doing so, we strive constantly to achieve better quality and ever greater precision – without ever losing sight of our customers’ economic interests.
Leading by pioneering technology
Individual solutions at the highest level

Our patented technology to control CNC grinding and polishing machines with the ability to simulate processing methods, specifically developed by asphericon, forms the basis for our manufacturing process. Thanks to this unique equipment, anything from prototypes to high-volume production can be manufactured with a high level of precision and optionally measured interferometrically over their entire surface.

### CNC processing

<table>
<thead>
<tr>
<th>Dimensions [ISO 10110-1]</th>
<th>Standard</th>
<th>Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter</td>
<td>mm</td>
<td>8 - 300</td>
</tr>
<tr>
<td>Tolerance</td>
<td>mm</td>
<td>± 0.10</td>
</tr>
<tr>
<td>Center thickness</td>
<td>mm</td>
<td>2 - 60</td>
</tr>
<tr>
<td>Tolerance</td>
<td>mm</td>
<td>± 0.10</td>
</tr>
<tr>
<td>Surface form [ISO 10110-3; 12]</td>
<td>mm</td>
<td>geometry dependent up to</td>
</tr>
<tr>
<td>Radius of curvature – local cc</td>
<td>mm</td>
<td>15</td>
</tr>
<tr>
<td>Clear aperture</td>
<td>% of Ø</td>
<td>95</td>
</tr>
<tr>
<td>Clear aperture surface slope</td>
<td>degree</td>
<td>75</td>
</tr>
<tr>
<td>Surface form tolerances [ISO 10110-3] and Aspheric surfaces [ISO 10110-12]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tolerance of radius of curvature</td>
<td>%</td>
<td>± 0.10</td>
</tr>
<tr>
<td>Sagitta deviation – A (Power)</td>
<td>mm</td>
<td>10 - 100(7.5 - 2.5)</td>
</tr>
<tr>
<td>Irregularity – B (PV)</td>
<td>fringe (µm)</td>
<td>10 - 2 (0.5 - 1)</td>
</tr>
<tr>
<td>Rotational invariant irregularity – C</td>
<td>fringe (µm)</td>
<td>4 - 1.5 (1.0 - 0.6)</td>
</tr>
<tr>
<td>RMS irregularity – RMS – D</td>
<td>fringe (µm)</td>
<td>3 - 1 (0.75 - 0.3)</td>
</tr>
<tr>
<td>Slope tolerance – F / G / H</td>
<td>arcsec/mm</td>
<td>180 / 170 / 1</td>
</tr>
<tr>
<td>Centration [ISO 10110-6]</td>
<td>4/ σ (L)</td>
<td></td>
</tr>
<tr>
<td>Edge thickness variation (defines tilt angle)</td>
<td>µm</td>
<td>25</td>
</tr>
<tr>
<td>Tilt angle of the aspheric surface to the second surface – φ</td>
<td>arcmin</td>
<td>2.50</td>
</tr>
<tr>
<td>Lateral displacement of the aspheric to the edge of the lens – L</td>
<td>mm</td>
<td>0.02</td>
</tr>
<tr>
<td>Lateral displacement of the aspheric to the second surface – L</td>
<td>mm</td>
<td>0.03</td>
</tr>
<tr>
<td>Surface imperfections [ISO 10110-7]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dig – N x A</td>
<td>2 x 0.60</td>
<td>2 x 0.10</td>
</tr>
<tr>
<td>Scratches – L N x A²</td>
<td>L2 x 0.10</td>
<td>L2 x 0.06</td>
</tr>
<tr>
<td>MIL – Scratch / Dig</td>
<td>40 - 20</td>
<td>20 - 10</td>
</tr>
<tr>
<td>Surface texture [ISO 10110-8]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface roughness – Rq</td>
<td>nm</td>
<td>2.0 - 3.0</td>
</tr>
<tr>
<td>Measurement</td>
<td></td>
<td>Full-surface interferometric measurement</td>
</tr>
</tbody>
</table>
Achievable optical component geometries

1. Depends on diameter and material.
2. Often also referred to as PV-error of the measured surface. This means that the total surface deviation is corrected for the sagitta error (power).

Processable materials

- Available technologies
  - Diamond turning with 2 and 3 linear axes
  - Fly cutting
  - Slow Tool Servo

- Manufacturing dimensions (ISO 10110-1)
  - Achievable diameters (mm) 1 - 420
  - Center thickness (mm) from 0.5
  - Surface shape (ISO 10110-1; 5; 8; 12) up to
    - Irregularity - B (PV) (nm) 100
    - RMS irregularity - RMS - D (nm) 20
    - Surface roughness - Rq (nm) 1

1. Depends on diameter and material.
2. Often also referred to as PV-error of the measured surface. This means that the total surface deviation is corrected for the sagitta error (power).

- Available technologies
  - Copper, Aluminum, Brass, Nickel Silver, Nickel
  - Nickel-Phosphorus layers
  - Synthetic materials
  - Silicon, Germanium, Zinc Sulfide
  - IR lenses

- Achievable optical component geometries
  - Aspheres = Microlenses
  - Spheres = Fresnel structures
  - Cylinders = Diffractive optical elements
  - Toroids = Freeforms

Diamond turning

Ultra-precise cutting, using monocrystalline diamond tools, is the key technology for manufacturing virtually any optical functional surface with the utmost precision. This allows the processing of non-ferrous metals, nickel-phosphorus coatings, plastics, crystals and IR materials.
Exceeding standards

Ultra precise for the highest demands

Challenging optical applications demand ever greater surface form precision. asphericon delivers the required finish for your high-end products.

With asphericon ION-Finish™ and Magnetorheological Finishing-Technology® (MRF), it is now possible to process demanding aspheric optics in mass production for the first time. Thanks to this procedure, shape deviations are achieved that significantly exceed the current international standard.

If every photon counts or high laser output is involved, scattered light should not be an issue thanks to the novel asphericon Ångström-Polishing, which enables roughness values of 5 Å (Rq according to ISO10110) to be achieved on all aspheric surfaces.

High-End Finishing

<table>
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<tr>
<th>Dimensions [ISO 10110-1]</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>Tolerance</td>
</tr>
<tr>
<td>Center thickness</td>
</tr>
<tr>
<td>Tolerance</td>
</tr>
<tr>
<td>Surface form [ISO 10110-1; 12]</td>
</tr>
<tr>
<td>Radius of curvature – local cc</td>
</tr>
<tr>
<td>Clear aperture</td>
</tr>
<tr>
<td>Clear aperture surface slope</td>
</tr>
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<td>Surface form tolerances (ISO 10110-5) and Aspheric surfaces (ISO 10110-12)</td>
</tr>
<tr>
<td>Tolerance of radius of curvature</td>
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<td>Sagitta deviation – A (Power)</td>
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</tr>
<tr>
<td>Surface imperfections [ISO 10110-7; 5/N x A; L N° x A°]</td>
</tr>
<tr>
<td>Dig – N x A</td>
</tr>
<tr>
<td>Scratches – L x N° x A°</td>
</tr>
<tr>
<td>MIL – Scratch / Dig</td>
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<tr>
<td>Measurement</td>
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</table>
The latest interferometric and tactile measuring instruments make it possible to manufacture aspheric optics flexibly at the highest technological level. A specially developed and integrated database system enables measurement results from all manufacturing steps to be documented, evaluated precisely, and accessed at any time. A wide range of measuring instruments is used to achieve accurate measuring results. These instruments include:

**LuphoScan 260 and 420**
- Measurement technology: Fiber optic based multi-wavelength interferometry (MWLI®)
- Measurement range: 420 mm (diameter) x 100 mm (height)
- Longitudinal resolution: 0.1 nm

**Zygo Verifire Asphere™**
- Measurement technique: Laser-based, three-dimensional, mechanical phase shifting interferometry (6° Fizeau interferometer) combined with heterodyne positioning interferometry
- Measurement capability:
  - Surface form of aspheric, spherical and flat optics, and semi-automated determination of radius of curvature of spherical parts
  - Aspheric measurement performance up to 60 nm (λ/10)

**MarSurf LD 120 MarWin**
- Two-dimensional measuring of optically rough surfaces
- Exact reproduction of aspheres, based on a resolution of 2 nm (0.08 μin) and form deviations of less than 100 nm (4 μin)

**MarSurf LD 260 Aspheric**
- Highly accurate 2D / 3D measurement of optical components
- Direct measuring range up to 260 mm
- Maximum diameter up to 400 mm
- Resolution: 0.8 nm

**MarForm MFU 200 Aspheric 3D**
- 2D / 3D measurement for highly accurate results
- Wide measuring range up to 260 mm in diameter
- Vertical resolution of 1 nm and form deviations of <100 nm (<± 50 nm)

**Zygo NewView™ 7100 and MarSurf WM 100**
- Measuring of roughnesses on aspheric surfaces up to 0.5 nm
High-quality coatings in 24 to 48 hours

Contact us:

Fast lane – Our service for ultra-fast delivery times!

High-quality coatings in 24 to 48 hours

Contact us:

+49 (0) 3641-31 00 560

sales@asphericon.com

Technologies

Coating

High-end coatings for your challenging products - outstanding quality, reasonable delivery times and the reliable asphericon service. Equipped with state-of-the-art manufacturing and measuring technologies, our experienced team of technicians turns your coating ideas into reality.

**Metallic mirrors**
Reflective surfaces based on metals (e.g. Al, Ag) are cost-effective options to manufacture reflectors.

**Beam splitters**
The customer-specific splitting ratio (T/R) is achieved with thermally stable dielectric layers.

**Dielectric mirrors**
Manufacture of absorption-free, stress-minimized mirrors optimized for various angles of incidence with reflections greater than 99.9%. 

**Anti-reflection coatings**
Individually manufactured reflection-minimizing coatings - as single and broadband coatings or specially optimized for laser applications, as required.

**Filter coatings**
By using dielectric layers, it is possible to separate various wavelengths as a short or long pass filter.

Thin films in asphericon quality
A wide spectrum for each application
asphericon – your partner from initial design concept to successful completion. Based on your requirements, individual optical designs are developed, optical characterization is carried out and optic components are assembled into complete systems. Everything from one expert source.
Individual designs
Custom-fitting and functional

Analysis
- Analysing your technical requirements
- Developing an initial feasibility study within 3 days

Conception
- Optical design (refractive, diffractive and reflective elements; optics for ultrashort laser pulses)
- Tolerance analysis for production and measurement
- Developing the design description
- Drafting of an adapted coating design
- Precise solutions for frames and holders

Implementation
- Monitoring of in-house testing processes
- Approval for prototype and series production
- Assembly of optical components

Characterization
- High resolution wavefront measurement (300 x 400 pts, 400 - 1064 nm)
- Measurement of MTF, PSF and Strehl ratio

Optical design, characterization, assembly

The right partner for every step: from product architecture and design through implementation and characterization. Based on the requirements and specifications of our customers, asphericon develops optimal design solutions for optical applications. The diverse range of services also includes the design of frames and holders for optic components. When realizing individual design solutions, we are focused on development, production times and outstanding quality, while always keeping an eye on the costs for our customers. Optic components can also be mounted according to your specifications.
asphericon combines its technological leadership in a comprehensive product range – the perfect basis for your optical application at the highest level. Use the innovative diversity offered by the StockOptics product range or choose an Custom solution tailored to your needs.
Individual and unique
Aspheric optics made for special applications

asphericon Custom
Discover the variety of customer-specific elements - from classic aspheres through to complex surface shapes and specially coated lenses. asphericon turns your ideas into customized solutions - ultra-precise, efficient and repeatable at any time.

Axicons
Axicons are offered in a large variety in angles, sizes and materials. We can process almost every type of glass as well as Silica, Germanium, Silicon, IR lenses and Zerodur.

Aspheres
Compared with spherical lenses, aspheres lead to much better imaging properties and reduce the overall number of optical elements in most applications. asphericon produces diameters from 4 up to 300 mm with a roughness from 3 - 0.5 nm Rq.

Acyinders
Aspheric cylinders can be realized in planoconvex, plano-concave, bi-convex or biconcave shapes. Specific lenses with a cylinder surface and both spherical and aspheric rear surfaces are available. In particular cases, the outer shapes can be user-defined.

Reflectors - Off -Axis
Our technology enables the production of off -axis mirrors and reflectors. Depending on geometry and deflection angle, we manufacture according to individual requirements.

Reflectors - On-Axis
Mirrors and reflectors with parabolic or custom-defined aspheric surface curvatures are one of our specialties. All designs will be delivered in the well-known asphericon quality.

Products
Setting the standard of tomorrow
Innovative diversity meets aspheric precision

## asphericon StockOptics

The asphericon StockOptics range - your introduction to the world of aspheres. Benefit from a unique selection of standard aspheres, axicons and acylinders as well as perfectly aligned mounted optics. Precision-polished optical components with excellent optical properties are available for delivery off the shelf.

### Products

#### Mounted Optics
- Pre-aligned aspheres, axicons and acylinders in high-precision mounts
- Diameter [mm]: 12.5 – 25.4
- Quality: < 10 µm decentration
- Material: S-LAH64, N-BK7, Fused Silica

#### Axicons
- Ideally suited for high-power laser applications
- Diameter: 25.4 – 50.8 mm
- Quality: RMS < 0.07µm
- Material: Fused silica

#### High-NA
- Short focal length
- Diameter [mm]: 10 – 100
- Quality: RMS ≤ 0.5 µm
- Material: S-LAH64, N-BK7

#### Acylinders
- Short focal length
- Diameter [mm]: 25.4 – 50.8 mm
- Quality: RMS ≤ 0.5 µm
- Material: Fused silica

#### UV-grade fused silica
- Ideally suited for UV applications
- Diameter [mm]: 12.5 – 50
- Quality: RMS ≤ 0.3 µm
- Material: Fused silica

#### Low-NA
- Short focal length
- Diameter [mm]: 10 – 100
- Quality: RMS ≤ 0.5 µm
- Material: S-LAH64

#### Long focal length
- Diameter [mm]: 10 – 100
- Quality: RMS ≤ 0.5 µm
- Material: N-BK7

### Available from stock

Shop all StockOptics conveniently online:

[www.asphericon.com](http://www.asphericon.com)
Innovative Design meets superior Quality
Ultra-light, ultra-fast, ultra-precise

**a|BeamExpansion**
- Aspheric beam expansion system consisting of: BeamExpanders, Waveλdapt, Adapters and AspheriColl (fiber collimator)
- Design wavelengths: 355, 532, 632, 780, 1064 nm
- Wavelength range: 355, 500 – 1600 nm
- Expansion: Up to 32x (230 possibilities)
- Quality: Diffraction-limited

**a|BeamShaping**
- Innovative beam shapers TopShape and AiryShape
- Wavelength range: 300 – 1600 nm
- Quality: Homogeneity > 95%
- Laser induced damage threshold: 12 J/cm², 100 Hz, 6 ns, 532 nm
- Application areas: Metrology, microscopy, laboratory, material processing

**a|FizeriC**
- Lenses for Fizeau-interferometer comprising aspheric surfaces
- Fizeau lens: λ/10 and λ/20 (P-V)
- Beam Diameter: 4", customized
- Quality: Diffraction-limited wavefront
- Application area: Metrology

asphericon Webshop
All systems available online at:
www.asphericon.com

asphericon Systems
Experience beam expansion and beam shaping with the highest precision and the maximum flexibility. All elements can easily and quickly be combined according to the desired area of application - plug and play in perfection.

With the development of the world's first aspheric Fizeau lens, asphericon redefines Fizeau interferometry and presents high quality, lightweight Fizeau lenses that allow you to get the most out of your measuring instrument.