Fiber Optics

LASER COMPONENTS®

Custom Optical Fiber Solutions

LASER COMPONENTS has not only consistently invested in its manufacturing and measuring equipment but in building a cross-disciplinary team that develops custom fiber-optic solutions. The extended technology park makes it possible to provide optical fibers equipped with custom fiber tips. When it comes to the finishing of fiber end faces, LASER COMPONENTS benefits from its more than 30 years of experience in the field of laser optics.

Cross-disciplinary R&D Team

LASER COMPONENTS' young, motivated development team consists of fiber optics experts, electrical engineers, and thin-film process specialists. This cross-disciplinary approach and the exchange between the different disciplines are deliberately promoted by LASER COMPONENTS. This has proven to be a key factor in the success of innovative products maturing to series production quickly and efficiently.

The R&D team works with the manufacturing department when developing new, practical solutions for custom orders. The experience gained in the coating of laser optics has been particularly helpful in developing specific AR coatings for optical fibers. The manufacturing department uses the ISO standard 10110 as a guide when inspecting the coating because it has been adapted to the requirements of fiber optics technology.

The cooperation between electrical engineers and fiber experts resulted in the fiber-coupled white light source ALBALUX®, which today not only delights customers but is also used, among other things, in the NA measuring station of fiber optics production.

Close contact with colleges and universities in the region has a long tradition at LASER COMPONENTS. Over the years, numerous students have used the company's laboratories and facilities for the practical part of their bachelor's or master's degrees. It is not uncommon for thisresearch work to lead to a permanent position upon completion.

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Anti-reflection Coatings for Optical Fibers

When the laser beam is coupled into the fiber, reflections on the fiber end face can cause power losses. This can be reduced by using AR coatings. These are applied using physical vapor deposition (PVD), which is also used for laser optics. In this process, an electron beam source provides enough energy to vaporize the dielectric coating materials in a vacuum. The molecules deposit in clusters on the fiber end face with an energy of about 0.1 eV, forming low-scattering layers that can withstand high laser power.

Anti-reflection coatings can be used for one wavelength (single AR), two wavelengths (dual AR), or an entire wavelength range (broadband AR). LASER COMPONENTS offers broadband and narrow-band coatings for wavelengths between 532 nm and 1550 nm. All materials – from fused silica fibers to sapphire fibers – can be processed. However, it is important to keep in mind that the surrounding protective cladding must be able to withstand the demands of a high-vacuum environment. Anti-reflection coated fibers are mainly used in medical technology and material processing. They are also particularly well suited for use with diode lasers.

Shaped Fibers

The properties and characteristics of the light beam can be influenced when it enters or leaves the fiber by changing the shape of the fiber or by adding lenses or elements at one end. The different variations are individually adapted to the customer's requirements.

Spherical lenses are required primarily in medical technology. For this purpose, the fiber end at which the beam emerges is heated and shaped into a sphere with a maximum diameter of 2.5 times the fiber diameter. This reduces the beam angle. In the best case, the emerging beam is almost collimated (see Fig. 2). In medical applications, the rounded fiber end also reduces the risk of injury to the body. LASER COMPONENTS processes fused silica fibers with diameters up to 2 mm. The fibers are processed according to the specifications of ISO 13485 for medical technology products and are sterilely packaged upon request.

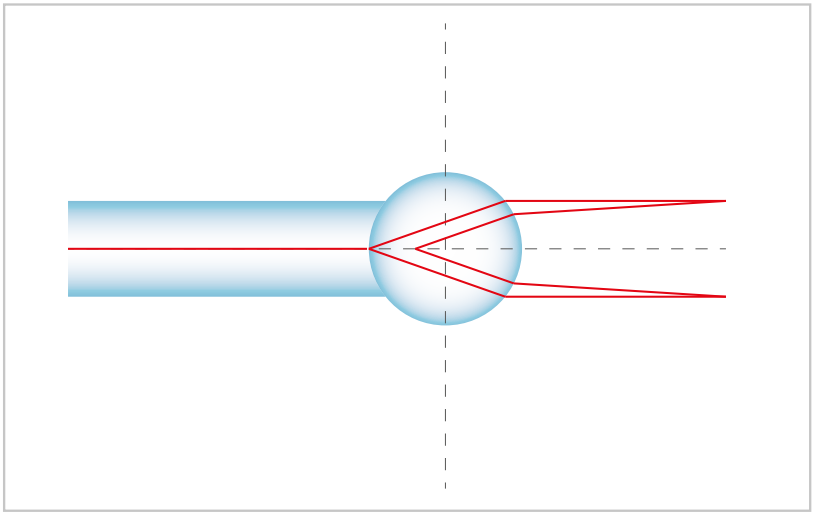

Fig. 2: Beam characteristics of a spherical lens

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End caps are cylindrical pieces of fused silica spliced to the end of the fiber to reduce the power density of the coupled laser beam as it transmits to the fiber. Their diameter is invariably larger than that of the fiber core. At the point of transition between air and fused silica, the fiber is subjected to the greatest stress. When a laser beam is coupled, this transition is located at the focal point of the beam, where it has the highest power density. This can easily lead to fiber burnout, especially in optical fibers with small fiber diameters. By using an end cap, the beam hits a larger-diameter glass sooner (see Fig. 3). This increases the damage threshold of the fiber, while the full power density of the beam is maintained.

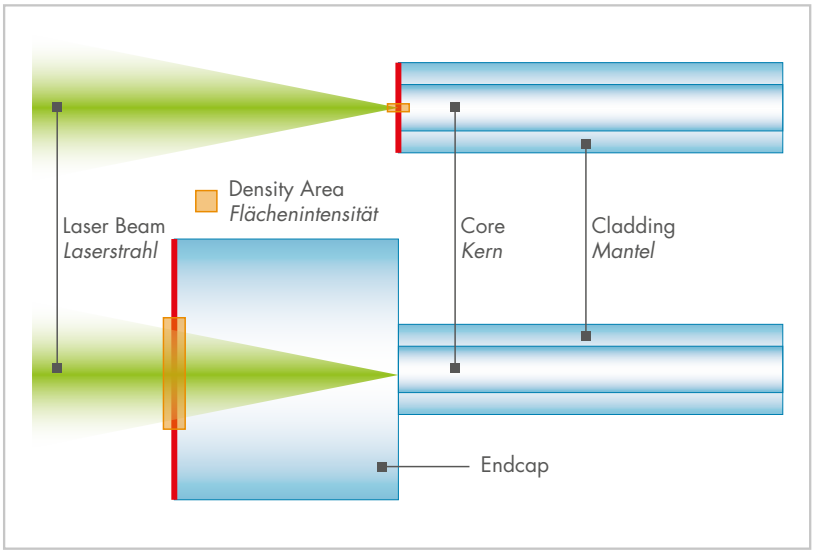

Fig. 3: Operating principle of an endcap

Gradient index lenses, so-called **GRIN lenses**, are used to collimate the outgoing beam. These are cylindrical optical components with diameters of less than 2 mm, the refractive index of which decreases from the center to the outside. Their small dimensions are impressive and, in contrast to rod lenses, they have flat end surfaces that do not protrude from the end of the connector ferrule. They are easier to integrate into assemblies.

LASER COMPONENTS' GRIN lenses are particularly small in design. They are spliced directly to the fiber and integrated into FC connectors. Therefore, they feature a particularly low beam angle error.

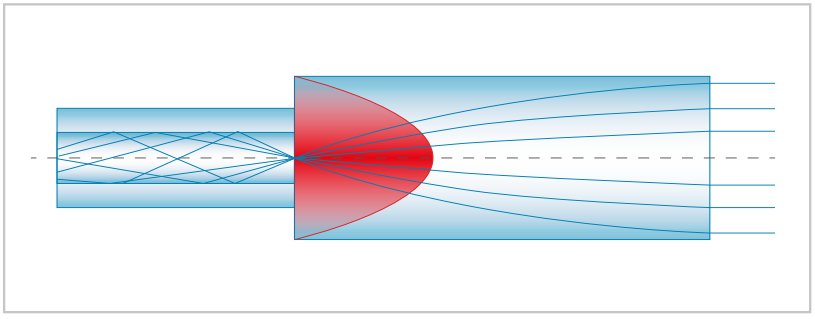

Fig. 4: Beam path of a GRIN lens

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Tapers are fiber ends in which the diameter tapers conically, while the size ratio between the core and cladding diameter remains unchanged. This results in the beam leaving the fiber with a larger beam angle.
LASER COMPONENTS recommends tapers only where light is to be distributed over a larger area, for example in lighting applications.

Competence in Fiber Optics

LASER COMPONENTS specializes in individual fiber-optic solutions according to customer requirements. The focus is on fiber-optic assemblies for high-power lasers and medical technology. The high quality of the products is guaranteed by scientific competence, the technical precision of the manufacturing department, and numerous measuring devices, which are used to document transmission properties, end surface quality, centricity, and numerical aperture, etc.

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