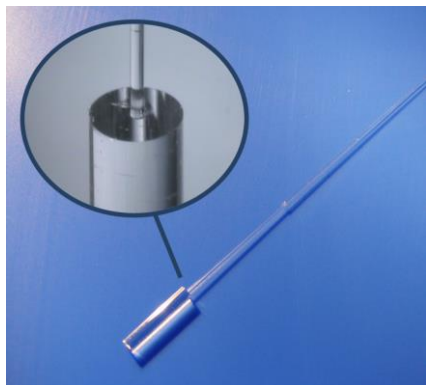


Various examples of laser-fused and laser-formed optical fiber tips, including GRIN optics, protective covers and fiber lenses.



Large core silica fiber fused with end cap (for handling high laser power densities).

Fusing and Forming of Optical Fibers and Micro-Optics by Laser

Fiber-optics and micro-optics are widely used in spectroscopy, sensing, illumination and data transmission in laboratories, medical applications and industrial environments.

Conventional fiber fusion processes like arc and filament splicing are limited to connecting optical fibers of similar geometries and materials. There commonly is a limit of 1mm for the maximum diameter of fused components, so micro-optical lenses or gradient index (GRIN) lenses cannot be attached. These are needed for shaping the emission of light from optical fiber probes, for collimation, focussing, deflection or dispersion of light.

To some extent optical fiber tips can be formed by mechanical means (cleaving, grinding, polishing) into wedge, conical or other forms, but this commonly requires manual work with long production times, small yields, and a large variation in produced samples even by skilled personnel.

By instead using pulsed laser radiation that is efficiently absorbed in glass materials at wavelengths around 10 μm (CO_2), however, heat for selective melting and ablation can be very finely applied in dose and space, without direct contact to the treated surfaces.

Fraunhofer IZM has developed diverse CO_2 -laser-fusing and laser-forming machines for exact fiber handling and highly repeatable production results. Extensive parameter sets for various fiber and bulk glass materials for UV, VIS, NIR and MIR wavelengths up to 5 μm wavelength exist. Furthermore, a wide range of fiber types and geometries (single mode, large core, photonic crystal fibers (PCF), capillaries) and micro-optical components have been successfully joined and made available for application.

At some points in processing fiber-optical components, e.g. tapers, couplers, bundles, conventional fusing and forming with arc discharge, filament and gas flame heating may come into play. For this IZM is equipped with state-of-the-art commercial machines as well as self-developed constructions.

Consult with us for specific applications!

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