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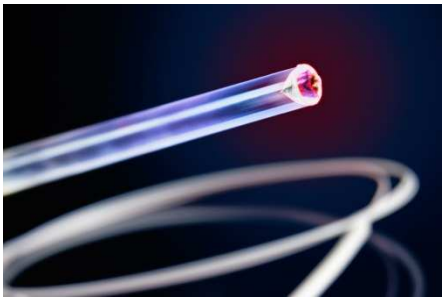
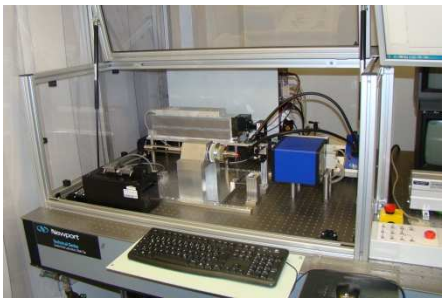


Side-fire-type laser structured fiber for medical application: Glass has been removed from the fiber tip to form a conical structure deflecting light to the sides, eliminating normal forward propagation.



IZM-made laser machine for inscribing patterns and modifying transmission from fiber end and side faces (side-fire and other geometries).

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Laser Structuring and Joining of Fibers and Capillaries

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

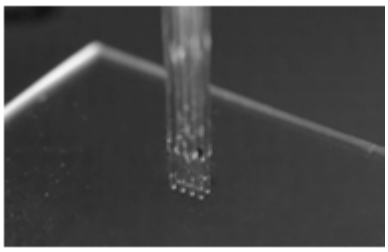
Conventional fiber fusion processes like arc and filament splicing are limited to connecting optical fibers of similar geometries and materials. There commonly is a limit of 1mm for the maximum diameter of fused components, so micro-optical lenses or gradient index (GRIN) lenses cannot be attached. These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

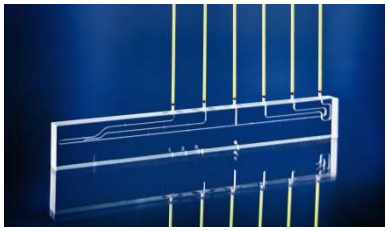
By using efficiently absorbed pulsed laser radiation in glass materials, heat for selective melting and ablation can be very finely applied in dose and space, without direct contact to the treated surfaces. This eliminates the necessity of an adhesive interlayer (e.g. epoxy), making the transmission of high optical power possible (no carbonisation). Optical properties can be preserved, because no aging or shrinkage of the adhesive occurs.

Fraunhofer IZM has a lot of experience in constructing customized laser machines which can also be used to form fibers as well as capillaries (e.g. bending) and/or fuse them with very different geometries, for which some examples are given here:

Sample of a 90° laser bent capillary.



Fiber array (2x4) of laser welded glass fibers; alternatively, cylindrical microoptical components like fiber caps, (GRIN) lenses, etc. can be attached.



Capillaries laser welded to a microfluidic glass chip.

Please consult with us to discuss your ideas.