

# Micro-lens machining on optical fibers

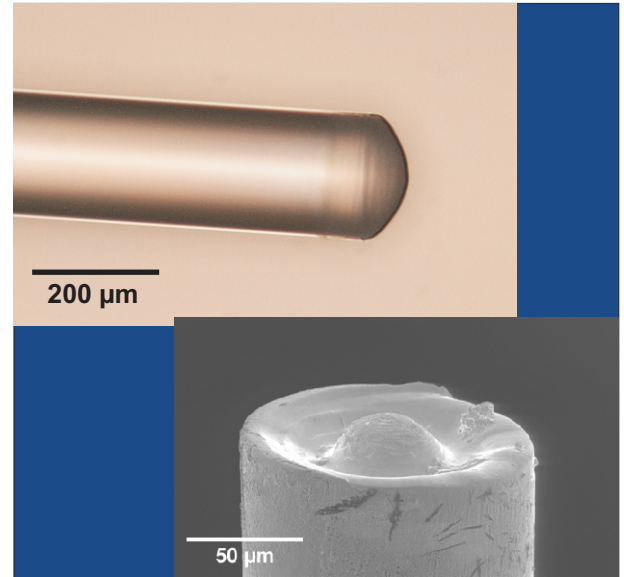
## Laser micro-fabrication

**Beam shaping at the output of optical fibers** is required in a variety of applications including optical sensors, telecommunication devices and medical applications.

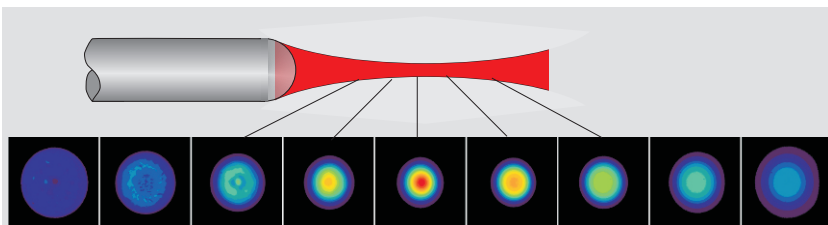
We use an **F<sub>2</sub>-laser micro-machining** technique to excise micro-lenses **directly upon the endface** of silica fibers.

This approach eliminates optical interfaces, **reduces losses** and improves the **thermal and long-term mechanical stability**. It also simplifies assembly and packaging.

Strong absorption of the employed **vacuum-UV** radiation at **157 nm** by the silica glass facilitates **precise structuring** without micro-crack formation.



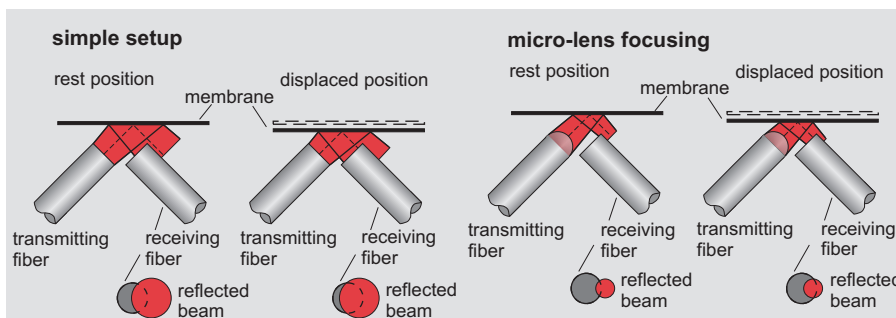
Micro-lenses on the end faces of 200 µm (top) and 50/125 µm (bottom) multi-mode optical fibers, excised by different F<sub>2</sub>-laser processing techniques.



Beam profile images at the output of a 200/230 µm multi-mode optical fiber shaped with a micro-lens of 120 µm radius. The axial distance to the fiber end increases from left to right by 40 µm each.

## Surface quality

- ▶ **SEM** characterization
- ▶ **AFM** measurements:  
35 nm rms surface roughness
- ▶ **Beam profile** analysis at fiber output:  
Gaussian focus spot  
~ 1/3 the core size



Application of a lens-tipped fiber in an optical distance sensor and optical microphone. Depicted is the operation principle of the sensor (left) and the improvement by using a lens-tipped fiber (right).

## Applications

- ▶ **Telecomm networks**
- ▶ **Medical instruments**
- ▶ **Fiber optic sensors**



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