



## FLEXIBLE MULTIBEAM PROCESSING IN SELECTIVE LASER-INDUCED ETCHING

### Task

The selective laser-induced etching (SLE) process can be used to produce microcomponents made of fused silica with almost any desired geometrical shape and a high degree of customization. Currently, process times for the SLE method are limited, however, due to the high level of precision. Applying multi-beam intensity distributions should shorten the process time and reduce the process cost, and using flexible beam shaping allows the quality and geometry freedom of the processing to be maintained.

### Method

Together with the project partner LightFab GmbH, Fraunhofer ILT has used a spatial light modulator (SLM) in the ZIM project MB-SLE4MF to implement flexible beam shaping during processing. For this purpose, an SLM was added to an existing microscanner, and an iterative algorithm is used to generate predefined multi-beam intensity distributions in the focal plane. The beam profile is controlled by camera feedback and the intensity distribution dynamically adjusted in each step.

### Results

This approach has demonstrated that the SLE process works well with seven parallel partial beams and significantly increases the process speed. At the same time, the selectivity and scan field size could be maintained compared to single-beam processing.

### Applications

So far, the SLE process has been used, for example, to manufacture microfluidics for lab-on-a-chip applications in medical technology, for micromechanics, for components in quantum technology or for ion traps in quantum computing. By scaling the SLE process, research can reduce component costs. Multi-beam processing enables the SLE process to be scaled in different areas. The system technology presented here will allow the industry to fabricate almost any 3D geometrical shape with high precision and high degree of customization.

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3 *Microstructuring system with SLM for flexible beam shaping.*

4 *In-situ analysis of the beam distribution in the glass volume.*