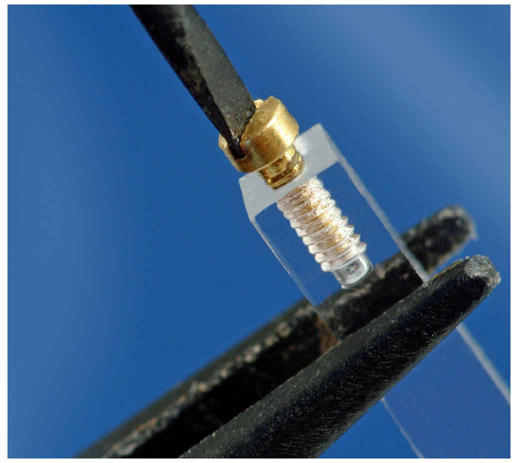
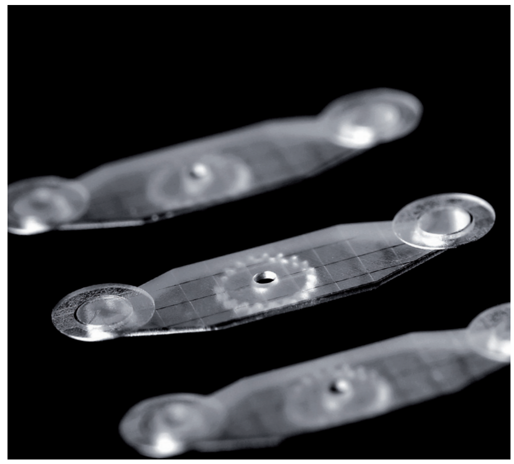
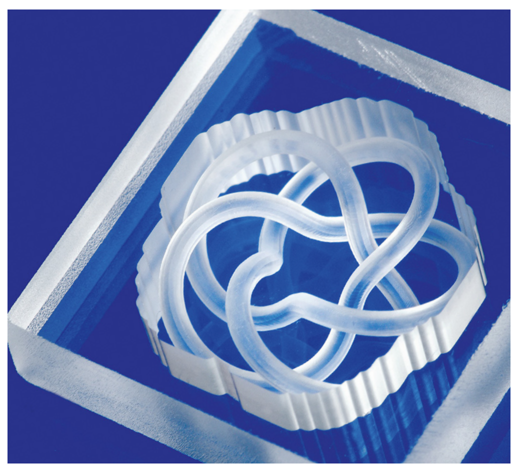
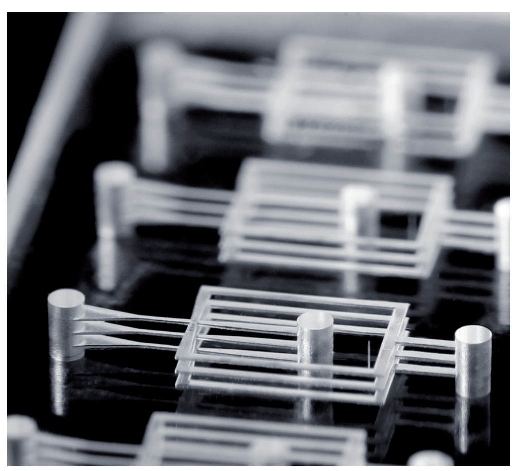
LightFab

SLE with LightFab 3D Printer









SLE (selective laser-induced etching) is a new laser technology for rapid manufacturing of true 3D devices made out of transparent material consisting of cavities, tunnels and even mounted moving parts.

SLE is a two-step process: In a first step ultra-short pulsed laser radiation is focused to micrometer-sized focus to permanently modify the transparent material internally. This laser modification is done without cracks and with high precision – not to be confused with the 3D pictures in glass consisting of micro cracks. An arbitrary 3D connected volume is exposed inside the glass by 3D scanning of the focus. In a second step of developing only the modified material is removed by wet chemical etching starting at a surface of the workpiece.

For the precision of the SLE technique the selectivity is essential. The selectivity is the ratio of the etching rate of the modified material and the etching rate of the untreated material. For example the selectivity in fused silica glass is larger than 500:1 resulting in long fine channels with small conicity. Therefore, by the SLE-technique complex 3D cavities can be produced, which are the basis of our products like micro fluidic structures and micro structured 3D parts.

Advantages of SLE are the large precision (~ 1µm), no debris, true 3D capability and the high processing speed using our LightFab 3D Printer. Therefore, the SLE technology is perfect for digital 3D printing of components made out of transparent material.

Present state of the art for our realization of the SLE process chain includes the straightforward laser tool path generation from 2D & 3D-CAD models in a wide variety of common file formats. That way design changes can be easily implemented and tested e.g. for rapid prototyping. After identification of an adequate prototype for your special application even series production can be performed with the same system due to speed of the LightFab 3D Printer unrivaled at the market. For mass production of single designs the production can be transferred to our High Speed Microscanner which has to be customized for the special design.

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PRISM AWARDS WINNER

Light Fab, Prism Award Winner 2016, Category Industrial Lasers

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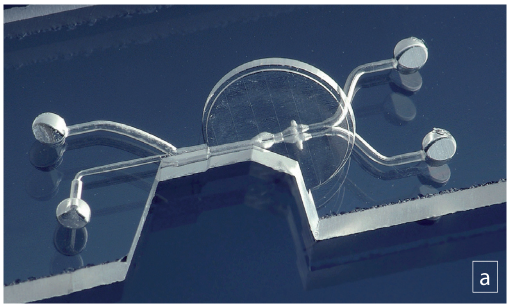
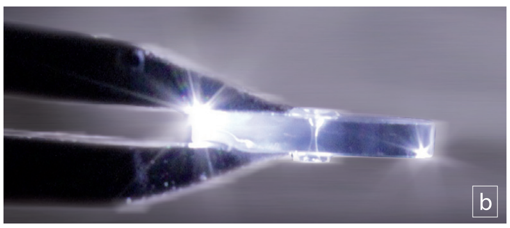
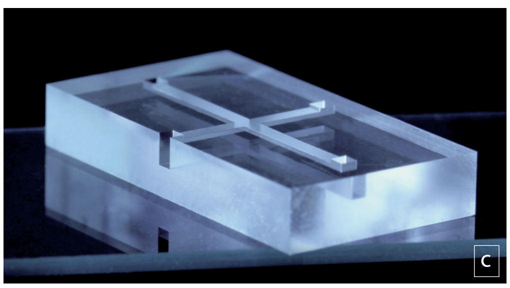
In close collaboration with partners from universities, research institutes and industry we constantly develop the process further towards the needs of our partners.

Recent advances in terms of higher precisions, new materials, smaller feature sizes and larger processable blanks have led to several application prototypes.







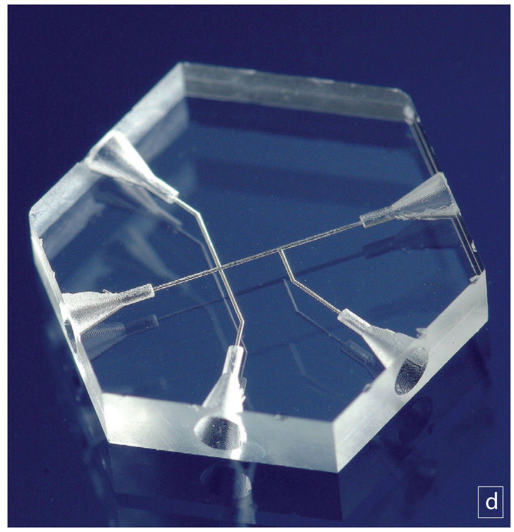
a A cell sorter for quicker antibiotic resistance test is being developed in cooperation with the group of Clinical Diagnostics from Fraunhofer ILT

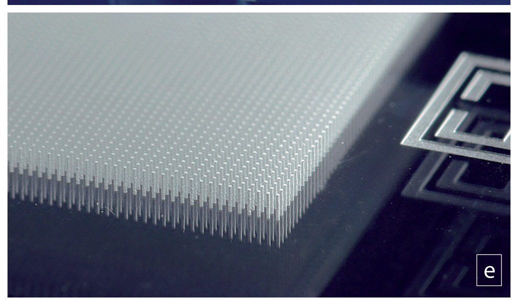
b Laval nozzle inset focusing gas streams for a new type of laser driven particle accelerators (cooperation with FZ Jülich)

c Microfluidical cross-section chip in Fused silica (collaboration with Okinawa Institute of Science and Technology)

d A microfluidic chip for more efficient coupling of capillaries in capillary electrophoresis (cooperation with group of Analytical Chemistry at University of Tübingen)

e Hole field of 2500 holes 0.045mm diameter in 1mm Fused Silica (left) and precision casting mold for RFID antennas (right)





Materials	**Selectivity**	**Possible structures with SLE today**
Fused Silica	500-1500	3D up to 7mm thickness
Sapphire	~10000	2.5D cuts up to 0.5mm thickness
Borosilicate Glass	<10	1mm Through holes, high conicity
Aluminosilicate Glass	<50	single Micro Channels

Features in Fused Silica	**State of the art**
Undercut angle	No limit found
Min. channel width x,y	10µm
Min. channel height z	20µm
Typical surface roughness Rz	1µm
Max. Precision x,y	+-1µm
Max. Precision z	+-2µm
Max. workpiece dimensions x/y/z	100mm x 200mm x 7mm
Max. channel length from surface	10mm

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