SELECTIVE LASER ETCHING

APPLICATIONS

- Micro-mechanics
- Micro-fluidics
- Lab-on-chip
- Microoptics

FEATURES

- Subtractive manufacturing technique
- Arbitrary-shaped 3D structures from glass µm to cm scale
- Various glasses applicable
- Self-alignment system for automatic laser beam alignment
- Micrometer feature resolution

Selective laser etching (SLE) is a subtractive laser technology allowing fabrication of complex-shape 3D glass parts with micrometer precision. This technology consists of two fabrications steps: femtosecond laser irradiation and subsequent chemical etching. Tightly focused the femtosecond laser beam induces modifications of transparent material within the focal point of laser beam. By spatially moving the laser focus well-defined structure is written in point-by-point fashion up to substrate surface. Afterward, the sample is immersed in etchant solution, which etches out laser modified areas.

SLE is often used in the manufacturing of electronic devices and other precision components ensuring high accuracy and detail in etched patterns. Moreover, the highly focused light enables the creation of complex 3D shapes and intricate designs.

SPECIFICATIONS

Technology	Substractive manufacturing
Materials	Fused silica, borosilicate
Smallest feature size	> 1 µm
Minimum surface roughness	50* – 200 nm
Maximum object height	1 cm
Aspect ratio	> 1 : 200
Minimum micro hole diameter	5 µm
Writing speed	50 mm/s

* Applying additional polishing.

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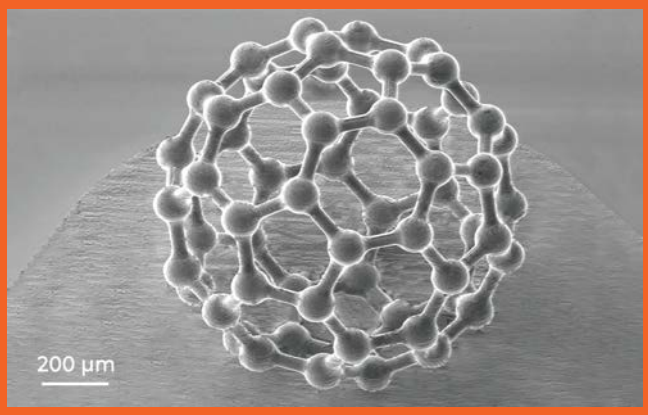
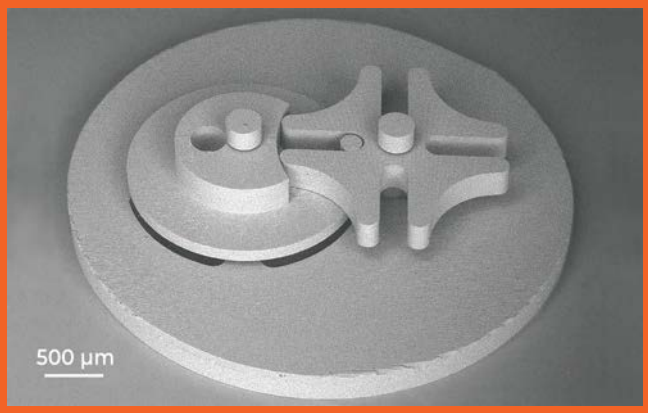
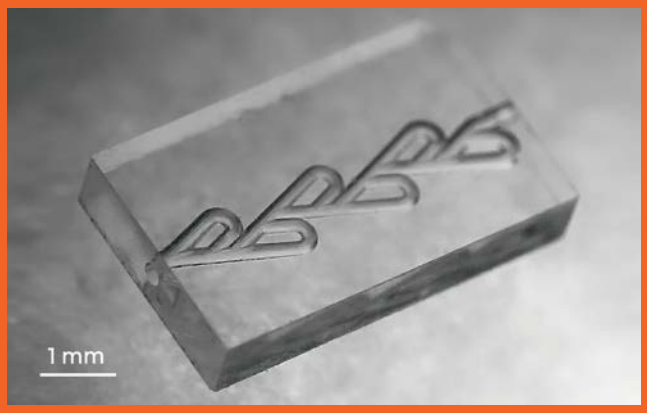


3D glass structures

3D nozzle

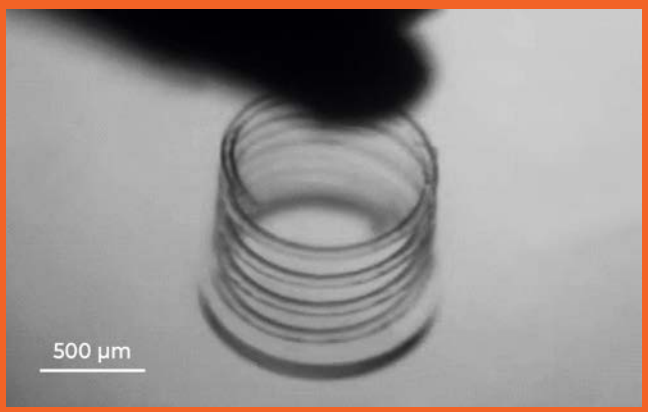


Geneva mechanism



Tesla valve

Microchannels



Glass spring

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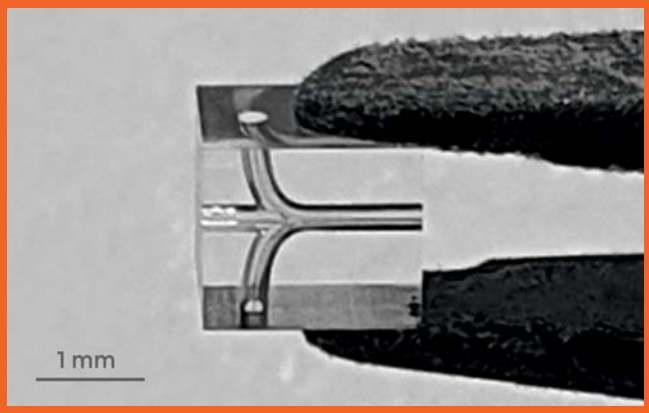
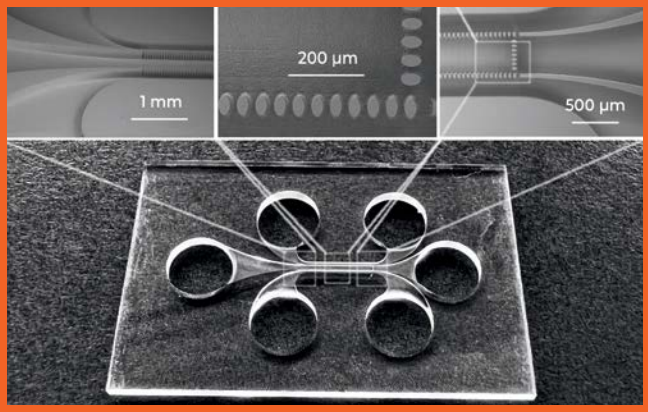
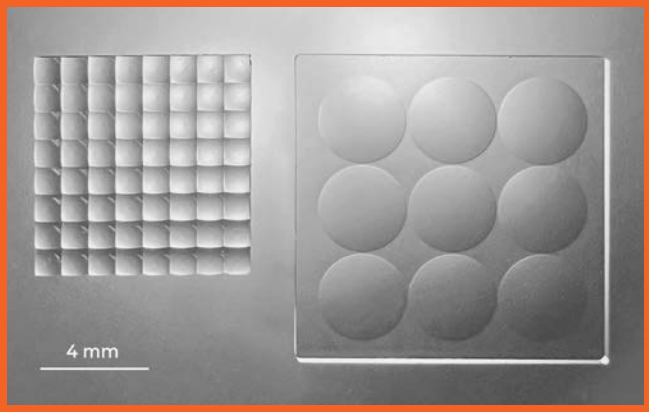
Gears system



3D interconnect channels

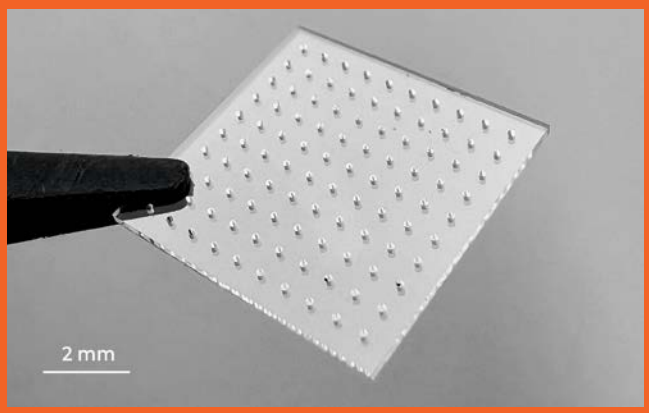


Microfluidics



Microoptics, microlenses

Threads for screw



Quantum computing / TGV

FEATURES

- Combine additive and subtractive manufacturing in one system
- Wide tunability enables efficient fabrication of micro-nano structures using a wide range of materials
- Stitching-error-free manufacturing
- User friendly, wizard-guided software for model preparation and system operation
- Modular and customizable system
- Integratable into production lines

TECHNICAL SPECIFICATIONS

Technology		**Selective Laser Etching**	**Multiphoton Polymerization**	**Hybrid**
LASER SOURCE				
Femtosecond laser	Wavelength	1030 ± 10 nm	780 ± 10 nm	1030 ± 10 nm and 515 ± 10 nm
	Repetition rate	Single-shot – 1 MHz	> 80 MHz	Single-shot – 1 MHz
	Pulse duration	250 fs (450 fs) – 10 ps (tunable)	< 150 fs	190 fs – 10 ps (tunable)
	Max. average power	5 W	> 250 mW	from 5 W to 20 W*
	Long-term power stability	< 0.5% RMS over 100 h	< 0.5% RMS over 24 h	< 0.5% RMS over 100 h
POSITIONING				
Linear stages with synchronized Galvano scanners	XYZ POSITIONING STAGES MOUNTED ON GRANITE BASE WITH BRIDGE			
	Travel (XYZ)	160 mm × 160 mm × 60 mm *		
	Accuracy (XYZ)	± 300 nm		
	Resolution (XYZ)	1 nm		
	Maximum speed (XY)	200 mm/s		
	GALVANO SCANNERS			
	Accuracy	50 µrad		
	Repeatability	0.4 µrad RMS		

Technology	Selective Laser Etching	Multiphoton Polymerization	Hybrid

OTHER PARAMETERS

Monitoring on time	The fabrication process is monitored by an integrated machine vision system		
Stitching	Stitchless fabrication using Infinite Field of View (IFoV)		
Focusing optics	Objectives – from 0.25 to 0.45 NA *	Objectives – from 0.4 to 1.4 NA *	Objectives – from 0.25 to 1.4 NA *
Autofocus system	Automatic glass/polymer or glass/air interface optical detection		
Self-Align-System (SAS)	Automatic laser beam path alignment system		
Substrate	Universal vacuum sample holder with computer-controlled, position synchronized illumination for transparent samples		

Beam delivery & control	Motorized attenuator, polarization rotator, beam expander. Integrated power meter enables real-time power monitoring
Software	Convenient control of all necessary process parameters and machine settings. The software handles standard formats of 3D designs created by popular CAD programs, like STL
Laser safety	Ergonomic housing to ensure laser safety class 1 and environment stability conditions for laser microfabrication process

* Customizable.

PHYSICAL DIMENSIONS

Dimensions when all doors are closed (W × L × H)	1790 mm × 920 mm × 2270 mm
Dimensions when doors are opened (W × L × H)	2680 mm × 1900 mm × 2300 mm
Weight	870 kg

ENVIRONMENTAL & UTILITY REQUIREMENTS

Operating temperature	20 °C ± 2 °C
Relative humidity	≤ 60%
Electrical requirements	110 V AC, 20 A – 230 V AC , 10 A
AC power (normal operation)	typical 2 kW

The conditions of the environment are preferred to be as stable as possible.