



LASER POLISHING OF SLE-SURFACES

Selective Laser Etching (SLE)

SLE is a laser based process to manufacture complex glass parts even with inner geometries e. g. microchannels. By focusing ultrashort laser pulses (300 - 3000 fs) into fused silica the material's solubility in e. g. KOH is increased by a factor of 1000. A subsequent etching step removes the illuminated material and hence enables the precise (< 10 µm) manufacturing of three-dimensional cavities in and on glass substrates. But, as a result of the structuring and the etching process the roughness of the fabricated surfaces is too high (approx. 0.2 µm rms) for many applications. Hence, for smooth surfaces an additional process step is necessary.

Laser Polishing

Polishing glass materials with CO₂ laser radiation is based on the absorption of the laser radiation in a thin surface layer of the work piece. Due to the absorption the surface temperature can be increased above softening temperature. As a result, the viscosity of the material is reduced so that the roughness flows and the surface is smoothed due to surface tension.

In comparison to conventional polishing methods, laser polishing achieves a favorable small micro roughness (rms < 1 nm, spatial wavelength λ < 100 µm). Laser polishing can be adapted to a variety of surface shapes and glass materials (Fused silica, BK7, ULE...) with high processing rates of 1 - 10 cm²/s.

Combination of SLE and Laser Polishing

With the combination of SLE and laser polishing, complex surface geometries with polished surfaces can be manufactured. Due to the thermal process of laser polishing, even the roughness of inner surfaces can be reduced. Hence, with SLE generated micro channels can be post processed e.g. for visual observations of microfluidic processes. Typical applications of the fabricated glass parts are e.g. microfluidics, microoptics, prototypes, parts for sensors.

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- 1 *Aspheres manufactured with SLE and LP (fused silica).*
- 2 *Chess figures.*
- 3 *Microfluidic (right: SLE-surface, left: laser polished).*