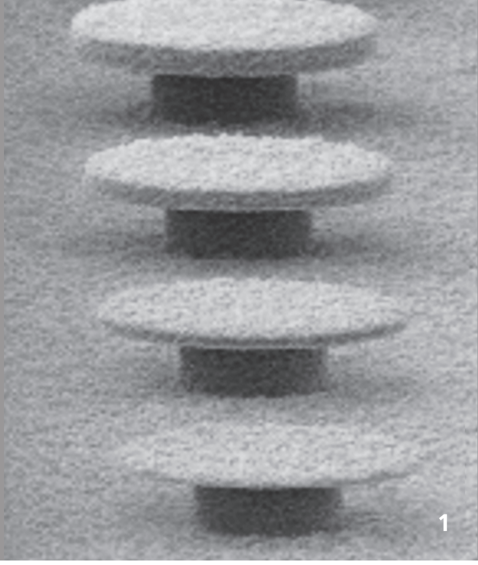

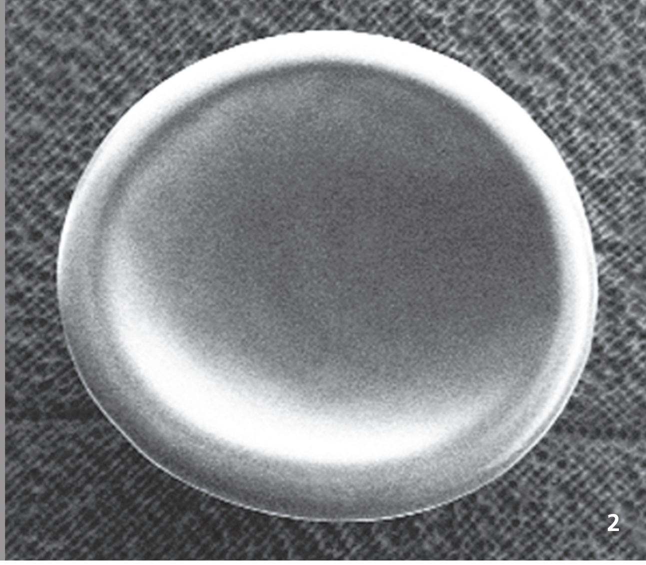

Subject to alterations in specifications and other technical information. 06/2020.

SELECTIVE LASER ETCHING FOR THE MANUFACTURE OF FUSED SILICA MICRO RESONATORS

Task

As networking in the industrial and private sectors grows worldwide, high-performance optical network technologies are increasingly in demand. These are commonly based on the wavelength division multiplexing (WDM) process. Here, light of different wavelengths is mixed in order to transmit several pieces of information simultaneously. Currently, the light of each wavelength is generated with a separate laser beam source, but the energy consumed in this process is increasingly becoming an environmental factor and cost driver. Therefore, research is focusing on the development of novel, energy-efficient and compact light sources in different materials. Optical microresonators are a promising possibility to make these light sources a reality.

Method

Fraunhofer ILT is using selective laser-induced etching (SLE) as an innovative process for manufacturing micro-resonators out of fused silica; this process can be used to generate almost any geometrical shape. For this purpose, the resonator geometries to be manufactured are created in a CAD/CAM process chain, structured into the substrate by means of ultrashort pulsed laser radiation and then exposed by wet chemical etching.

Result

The manufactured disc-shaped microresonators have a diameter of 50–200 µm and a disc height of 2–10 µm. The roughness on the upper side of the disc is reduced to Ra ~ 50 nm by laser polishing. The bottom side of the disc has a roughness in the range of Ra ~ 0.5–1.0 µm, depending on structuring and etching before polishing. The geometry of the disc can be adapted individually by adjusting structuring and etching.

Applications

Microresonators can be used as frequency combs in optical network technologies, thus representing an alternative to the light sources currently used. Microresonators in optically nonlinear materials enable an adjustable frequency conversion through appropriate phase matching, which is required in the field of optical quantum sensor technology to generate entangled photons.

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1 Disc resonators with 100 µm diameter (REM).

2 Micro resonator after laser polishing (REM, top view).

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