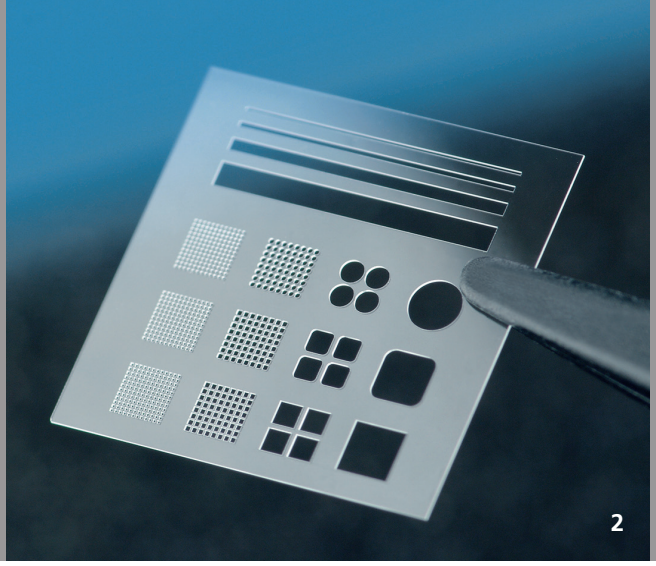

PRECISION MACHINING OF THIN GLASS WITH ULTRASHORT PULSED LASER RADIATION

Task

Ultrashort pulsed laser radiation with pulse durations less than 10 ps has made it possible to process transparent glass that has a thickness of less than 1 mm. Due to the high intensities of the laser radiation, complex non-linear interaction processes of material and laser radiation occur, which can lead to material modifications or defects such as microcracks. Processing such materials faces a major challenge: to control the deposition of the irradiated pulse energy in the material and, consequently, to achieve defect-free results. In particular, a comprehensive understanding of the underlying processes is required to produce geometrical forms with structure sizes in the range of 10 to 50 µm with minimal material damage.

Method

The choice of the process parameters leads to a direct ablation of the glass substrates either on the upper or lower side. In a second process step, the material can be modified selectively when the laser radiation is focused into the glass volume. The modified material is then removed in a second wet-chemical process step (selective laser-induced etching). By characterizing the structures with optical and temporal high-resolution pump-probe microscopy, Fraunhofer ILT can identify suitable process windows and contribute to an understanding of the relevant physical effects.

Results

Direct laser-induced ablation of glass substrates can be used to generate almost any structure desired on thin glass that has a large aspect ratio. Furthermore, the selective etching process can produce – on surfaces and in volumes – structures that are significantly smaller than 100 µm and have particularly smooth edges.

Applications

Both the direct laser-induced ablation and the selective etching of thin glass can be used, in particular, for the production of interposer structures for the electronics industry.

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1 Thin glass surface structured by direct laser ablation.
2 Different geometrical structures produced by selective laser-induced etching.

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