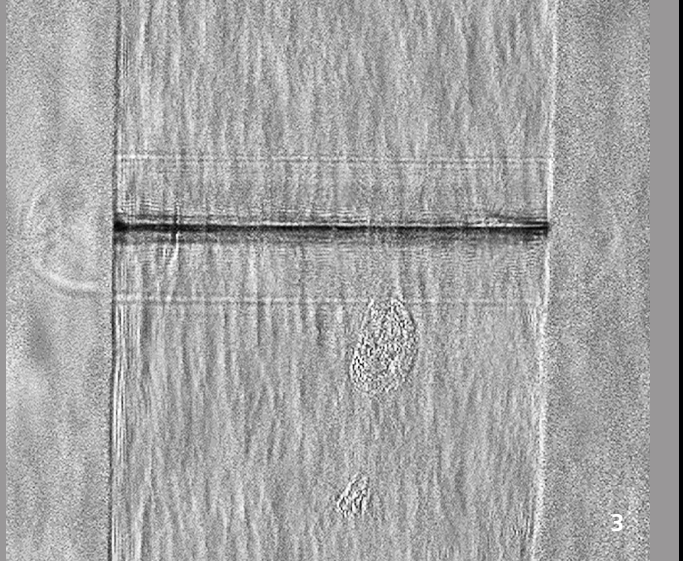

GLASS PROCESSING WITH APPLICATION-SPECIFIC BEAM SHAPE

Task

Advances in global digitalization are driving the demand for highly individualized glass components in applications such as consumer electronics, automotive construction, and telecommunications. Conventional methods, such as mechanical scribe and break, cannot meet the high requirements for novel glass components without costly post-processing since they either lack flexibility or generate a high concentration of defects. Here, the tool »laser« makes a contactless, efficient and highly flexible glass processing technology possible. For this, the laser radiation for a specific application of the glass component must be customized. Fraunhofer ILT is developing innovative spatial and temporal beam shapes and evaluating their potential for specific applications.

Method

To generate application-specific modifications of glass, the energy deposition must be adjusted selectively. For this, the influencing factors must be determined and their dependence on the used laser and material parameters understood.
The energy deposition in the glass volume can be displayed with »in-situ pump-probe microscopy« and analyzed in a time-resolved and spatially resolved manner. By adapting the spatial and temporal intensity distribution by beam shaping, Fraunhofer ILT can adjust energy deposition for a specific application.

Results

Pump-probe microscopy makes it possible to develop process-specific beam shapes for cutting, structuring and modifying surfaces and volume elements of transparent materials. Thus, for example, by adapting the spatial beam shape, Fraunhofer ILT has developed a separation process of large-area glass with speeds of ~ 100 mm/s for glass thicknesses ≥ 500 µm. The cut edge has a surface roughness of R_a ~ 1 µm with negligible conicity. With pulse durations in the range of ~ 100 fs, the process can selectively ablate the glass surface. An influence on the glass volume is almost completely avoided thanks to an appropriate choice of intensities.

Applications

A separation process can be used, in particular, to cut displays for consumer electronics. Moreover, the haptic properties of a glass surface can be adjusted selectively with laser ablation. When modifications with structure sizes of ~ 1 µm are generated, spots are created that are only visible at a defined illumination angle. Such modifications can be used as scattering spots for the illumination of functional display elements.

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3 Laser-cut and -structured glass component.
4 Time-resolved image of energy deposition in glass..