Custom-Sized Microlenses

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Optical components have joined the trend towards miniaturization. There have, however, been no methods available thus far to produce custom-sized glass lenses. A new process now enables the **low-cost, high-volume manufacture of microlenses with extreme dimensions.**

Miniaturization is a big issue these days. Micro-optical component manufacturers are increasingly being called upon to produce smaller and smaller lenses. The telecommunications industry, for example, uses them to couple optical signals with multi-fiber connectors. Tiny lenses used in fingerprint sensors for security applications such as checking cards or automobile anti-theft systems are also in high demand. Although these tiny components are typically made from plastic materials, the use of borosilicate glass is on the rise. This type of glass is highly scratch resistant, physically stable in shape and mechanically robust.

However, structuring glass in microtechnical processes has its limits. Currently available methods restrict the structural height of plasma-etched glass. Optical properties such as focal length can be customized to the particular application only through the selection of the material or the curvature of the lens. And if the material has been pre-selected, the only option to create the required optical properties is to produce lenses of various shapes and heights. Vacuum-based plasma etching is a costly, time-consuming process. Gases are fed into a vacuum chamber. Having changed into an ionized plasmas, they gradually but slowly erode the glass parts.

Researchers at the Fraunhofer Institute for Silicate Technologies ISIT

have come up with a novel process that offers decisive advantages. “With the glass flow process, we can reduce production costs to ten percent of current values,” emphasizes Peter Merz from ISIT. “Moreover, we can achieve 1:1 height to thickness ratios.” This means that a 0.1mm wide lens can have a height of up to 100 micrometers, about the diameter of a human hair. In comparison, plasma etching attains only one-fifth of this value.

Merz explains the viscous deformation process this way: “We begin with a silicon wafer preform. Using a rapid etching procedure, we create tiny depressions in the silicon that conform to the desired lens diameter. A substrate made from borosilicate glass is then hermetically sealed to the silicon preform. Under high temperature, the glass then slumps into the silicon cavity and forms a mould.” Temporal regulation of the temperature determines the topography and height of the lens. The contactless forming process results in lenses with very low surface roughness, hence they require no additional finishing.

Source: Fraunhofer-Gesellschaft