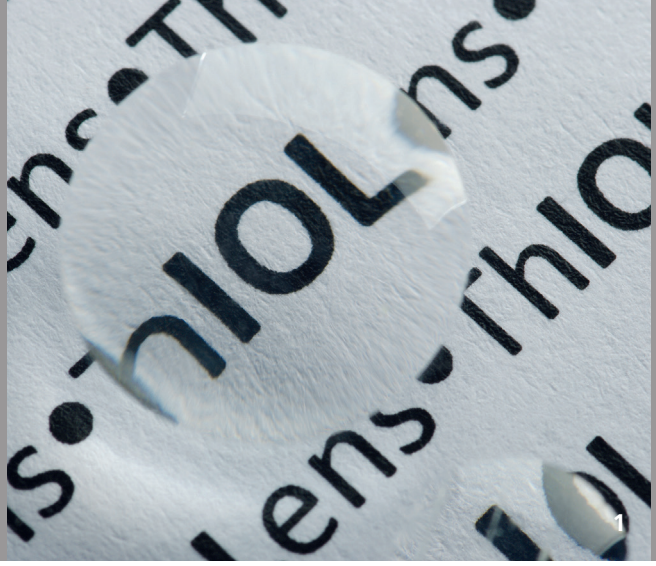

ADDITIVE MANUFACTURING OF INDIVIDUAL POLYMER OPTICS

Task

Transparent plastics are used in mass fabrication processes for optical components such as (micro) lenses, prisms and waveguides because they are light and easily moldable. In particular, parameters such as transparency, color, spectral transmittance and reflectance, refractive index and optical dispersion are essential for their use in optics. Within the framework of the BMBF project »ThIOLens«, Fraunhofer ILT is investigating the fundamentals of a laser-based additive process technology for the individualized production of optics with high refractive index and low optical dispersion.

Method

Individual polymer optics shall be manufactured with laser-based additive processes such as stereolithography and multi-photon polymerization. Along with the development of the associated process technology, extensive investigations on the material side are necessary in addition to those on optical properties and on aspects of process stability and handling. The aim of the development is a process control with an initiator-free photo resin for the production of individual optics with good optical and mechanical properties.

Results

For the laser polymerization of the optics, a stereolithography system was developed in which a continuous laser-beam source is used in the deep UV range for curing. The polymerization depth and the degree of crosslinking should be controlled locally by a rapid power and beam modulation in such a way that isotropic properties are achieved in the volume. For this purpose, Fraunhofer ILT developed a photo resin that can be crosslinked without initiator and has a high transparency (Fig. 1). Further investigations are planned to research the additive manufacturing of specific optics.

Applications

Especially in ophthalmology, there is an increasing need for individual artificial intraocular lenses for the aging population. This field of application is being researched together with the Institute for Experimental Ophthalmology at the University of Saarland.

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1 Polymers optics based on polythioether.