



1 Two-lens unit designed with partial automation.
2 Surface measurement of a blank after pressing.

Data chain for the digital production of individualized optics

Optical systems and applications are topics that cross many markets, from cameras and LIDAR sensors for autonomous driving to satellite-based systems to measure greenhouse gases. The core components of optical assemblies are precisely manufactured lenses, which are increasingly characterized by progressive individualization, more complex geometries and ever shorter product development cycles. Traditional subtractive manufacturing technologies, such as grinding and polishing, are quickly reaching their limits as technology and scaling advance. The production and delivery times for customized optics are often several weeks to months.

Laser-based optics production

Together with Fraunhofer IPT and IST, Fraunhofer ILT is developing a digitalized and laser-based production chain. The aim of the PREPARE project OPTICS48 is to produce individualized optical systems within 48 hours. The basis for the production chain is formed by blanks that can be produced cost-effectively in large quantities using glass molding. Customized optics are manufactured from these blanks with the laser-based shaping and modifying by ablation, polishing and precision shape correction. Thanks to the digital control of the laser processes, each individual system can be customized without incurring additional costs. Subsequently, an anti-reflective coating is applied, so that the new production chain can cover the entire added value of a glass optical element.

Semi-automated design of an achromatic two-lens unit

In a first step, Fraunhofer ILT linked the semi-automated optical design of an aspherical, achromatic two-lens unit and the digital shadow of the described production chain via a web server. Based on the focal length and the wavelength pair to be corrected, the achromatic lens is calculated from N-BK7 and P-SF69 blanks. The ablation time of the shaping process was then minimized while complying with the imaging quality requirements. With a web server user interface, all data required for the production and coating process can be downloaded, such as the angular distribution of the incoming and outgoing radiation. For continuous production tracking, the measurements taken during production will be linked to the achromatic lens via an upload.

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