3D-printed micro-optics for biomedical application

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Manufacturing of 3D-printed micro-optics using two photon lithography (2PL) has been advancing rapidly over the last decade. Enabling flexible production of high-performance optics, 2PL has been used to demonstrate a variety of miniaturized sensors, including imaging optics, OCT systems, spectrometers and optical tweezers. The small size on the micro scale qualifies them perfectly for use e.g. in endoscopy or in biomedical research.
The talk gives an overview of the fabrication technology, accessible surface quality and various examples of complex 3d-printed optical systems. The examples range from miniaturized imaging systems to fiber-based structured illumination systems, as well as spectral systems. In many cases, the 3D-printed optical system has to be immersed into fluids, e.g. water or glycerin. To prevent the fluids from entering and destroying critical parts of the optics, capsulation is required. Appropriate printing techniques are discussed. For proper focusing also actuation of the micro-optics is desirable, here a magnetically actuated printed system is presented. Generally, as the optical diameters are small, diffraction effects have to be considered in the optical design. To do so, an appropriate wave-optical simulation toolbox has been developed and simulation results are discussed.

Short biography:

Alois Herkommer is full professor for optical design and simulation at the Institute of Applied Optics at the University of Stuttgart, Germany. He received his PhD in physics in 1995 from the University of Ulm in the area of quantum optics. In 1996 he joined Carl Zeiss and worked as an optical designer, senior scientist and group leader in various positions. In 2011 he accepted a call to the Institute for Applied Optics. His main research interests are optical design of imaging, illumination and metrology systems, especially for medical applications, and 3d-printing of micro-optical systems.