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Probing the nano-world with light-driven microtools

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The sci-fi inspired miniaturization of full-scale robotic manipulation down to the mesoscopic scale regime opens new doors for exploiting the forces of photons for micro- and nanobiologic probing, actuation and control. A generic approach for optimizing light-matter interaction on these scales involves the combination of optimal light-sculpting with the use of optimized shapes in micro- and nano-robotic structures. Micro-fabrication processes such as two-photon photo-polymerization offer three-dimensional resolutions for crafting custom-designed monolithic microstructures that can be equipped with optical trapping handles for convenient opto-mechanical control using only optical forces. Such microstructures as illustrated above can be effectively handled with simultaneous top and side view on our proprietary BioPhotonics Workstation (BWS) to undertake six degree of freedom optical actuation of tiny 3D-printed tip structures easily entering the submicron regime. Aided by our international collaborators who fabricated test structures for us, we were able to put our pioneering concept of optically steerable freestanding waveguides coined: wave-guided optical waveguides to the test using our BWS. We have also proposed using these techniques for generating two photon real time spatially sculpted light for the strongly emerging areas of neurophotonics and optogenetics.

Biography

Jesper Gluckstad established the Programmable Phase Optics in Denmark more than a decade ago and currently holds a position as Professor at DTU Fotonik, Dept. of Photonics Engineering at the Technical Univ. of Denmark, and a position as Guest Professor in Biophotonics at Lund Institute of Technology, Sweden. In 2004, he received the prestigious Doctor of Science (DSc) degree from the Technical University of Denmark for the dissertation entitled "The Generalised Phase Contrast method". Together with a colleague he has authored a Springer book on this topic published in the fall 2009. Prior to his achievements in Denmark, Prof. Gluckstad was a visiting scientist at Hamamatsu Photonics Central Research Laboratories and in the Physics Dept. at Osaka University in Japan. Since he obtained his PhD at the Niels Bohr Institute in 1994, he has published more than 250 journal articles and international conference papers and holds more than 25 international patents and patent applications. He has published papers in Nature Materials, Nature Methods and Nature Photonics. He is the year 2000 recipient of the Danish Optical Society Award and was elected as 'Scientist of the Year' in 2005 by the Ib Henriksens Foundation in Denmark. Prof. Gluckstad is a 2010 elected Fellow of the OSA and a Fellow of the SPIE as the only from Denmark. In 2012-2014 he is appointed for the prestigious SPIE Fellows committee. In 2013 he will be joining the Editorial Board of JEOS. Most recently he founded the DTU startup OptoRobotix originally spun out in Silicon Valley, CA, USA.

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