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All-polymer planar optical sensing devices integrated in thin foils

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Planar optical sensor devices integrated into thin polymer foils hold great promise for a wide range of new applications in structural health monitoring for buildings and aircraft or process control in production environments and the life sciences. Various such applications demand for fully integrated, large area optical foils with extensive optical sensor functionality. Therefore, the primary challenge is to develop sensor concepts which translate the physical and chemical parameters into optical signals, such that the resulting sensor networks will allow large-area, spatially-resolved measurements, and to manufacture and integrate all components required, e.g. laser sources, detectors, optical waveguides and coupling elements into thin foils, ideally using high-volume, roll-to-roll manufacturing technology. Consequently, research in the field has been very active during the last few years and, besides the investigation of suitable optical sensor concepts, revolves about the development of novel production technologies, often through combination of modern laser technology and state-of-the-art micro-structuring, as well as concepts for large-area integration. In my talk, I will give an overview on our research in this field. Our activities range from the realization of efficient optical waveguides and coupling elements using laser and hot embossing techniques, the development, simulation and demonstration of all-polymer optical sensor devices for detection of, e.g., strain, humidity, or concentration to combination of such systems to more complex arrays intended for distributed 2D sensing. I will present some of the results we recently obtained and discuss the next steps of our work as well as the route towards resource and cost-efficient implementation.

Biography

Bernhard Roth obtained his PhD in 2001 at University Bielefeld. From 2002-2007, he served as Group Leader at University Duesseldorf and obtained his Habilitation in Quantum Optics in 2007. From 2007-2010, he worked as Associate Professor at University Duesseldorf and from 2011-2012 as Managing Director at the research centre innoFSPEC, University Potsdam and Leibniz Institute for Astrophysics Potsdam. Since 2012, he is Director of the Hannover Centre for Optical Technologies and since 2014 serving as Professor at the University Hannover. His scientific activities include research in laser development and spectroscopy, polymer optical sensing and optical technology for illumination, information technology and the life sciences.

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