Digital Polarization Optics for Adaptive Azopolymer Surfaces

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Azobenzene-containing polymers provide a versatile platform for light-driven surface structuring due to their ability to undergo reversible molecular reorientation under polarized light. In this contribution, we present a programmable approach for generating and dynamically reconfiguring polymer surface topographies using a spatial light modulator (SLM) to create vectorial light fields with tailored polarization distributions. By controlling the local polarization state, directed mass transport is induced within thin azopolymer films, enabling the formation of localized protrusions, depressions, periodic gratings, and arbitrary surface patterns. The method combines maskless, single-beam fabrication with real-time control of surface morphology and allows feature sizes below one micrometer. Experimental observations are supported by the viscoplastic photoalignment model, linking polarization-controlled molecular reorientation to anisotropic photomechanical stresses and macroscopic material transport. The ability to reversibly reshape and reprogram surface structures establishes a flexible platform for adaptive optics, structured surfaces, microfluidics, and dynamically reconfigurable soft matter systems.

Biography:

Svetlana Santer is Professor of Experimental Physics at the University of Potsdam, Germany, where she has led the Smart Soft Matter group since 2009. Her research focuses on photoresponsive polymers, soft matter physics, colloidal systems, active matter, and light-driven transport phenomena. She received a Master's degree in Biophysics from St. Petersburg State University, Russia, a PhD in Macromolecular Chemistry from the University of Ulm, Germany, and her habilitation in Microsystems Engineering from the University of Freiburg, Germany.