Viscoplastic Modeling of Azopolymer Deformation: From Structured Light to Molecular Orientation and Flow

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A unique property of side-chain azopolymers is their ability to align backbone chains along the light polarization, converting structured irradiation into well-defined stress fields. Resulting directional deformations have been successfully described within the viscoplastic photoalignment (VPA) framework. Because photon absorption by azo-chromophores is inherently stochastic, the model does not incorporate the phase of the light field; instead, spatial distributions of intensity and polarization are directly mapped onto the stress field. This approach shows excellent agreement with experimentally observed reshaping of azopolymer micropillars. Recent results reveal that spiral surface patterns induced by helical beams do not arise from wavefront sensitivity of azopolymers, but from the three-dimensional polarization structure of strongly focused light itself. Current work aims to extend the VPA framework to model photodeformation under polychromatic irradiation.

Biography:

Marina Saphiannikova is polymer physicist who studies photodeformable azopolymers and magnetoactive elastomers. In 2007, she defended the habilitation thesis ‘‘Photoinduced Material Transport in Amorphous Azobenzene Polymer Films’’ at the Faculty of Science, University of Potsdam. In 2009, she became Associate Professor at the Faculty of Mechanical Science and Engineering, TU Dresden. Together with Vladimir Chigrinov and Hoi Sing Kwok she launched the first PhoSM2014 in Hong Kong. Since 2015 she leads the research area ‘‘Material Theory and Modeling’’ in the division Theory of Polymers at the Leibniz Institute of Polymer Research Dresden.