Reorientation Properties and Piezoelectricity of Liquid Crystalline Main-Chain Elastomers

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Chiral smectic C (SmC*) liquid crystals have attracted both scientific and industrial attention due to their outstanding features such as ferroelectricity and second harmonic generation. Liquid crystalline elastomers (LCE) combine the anisotropic properties of a liquid crystal and the elastic properties of conventional rubber. In SmC*-LCE, the properties of the chiral liquid crystalline phase can be addressed by numerous external stimuli such as electrical/ magnetic fields, temperature or mechanical fields. (1-3) Hence, chiral LCE add another promising path to the construction of soft actuators. Also, as the polymer network prevents macroscopic flow, chiral LCE provide new access routes to the study of the SmC* phase.

On this poster, we present studies on the reorientation behavior and piezoelectricity of SmC*-LCE. External mechanical shear and uniaxial stress in various geometries were applied to investigate the formation of SmC*-monodomains and charge formation in these samples (see figure). The microscopic processes were analyzed by small-angle X-ray scattering. Such monodomain samples exhibit a macroscopic polarization and therefore a piezoelectric effect. Dynamic electromechanical analysis allowed to measure the increasing piezoelectric effect while monodomain formation took place.

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