Nematic Main-Chain LCEs Influence of the Crosslinker Topology on Order and Mechanics

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Main-Chain Liquid Crystalline Elastomers (MCLCEs), where the mesogens form part of the polymer backbone, show a large, reversible change in length up to 400% at the phase transition, making them interesting as actuators and artificial muscles (1). In the last years, the main focus has been on the development of easily accessible systems with moderate phase transition temperatures (2).
The mechanical properties and the thermoelastic effect of these networks are strongly influenced by the geometry and the concentration of the cross-linking agent (3). A thorough understanding of this influence is vital for further improvement of the properties of MCLCEs.

By copolymerisation of two different mesogens, we were able to obtain elastomers with purely nematic phases, and to tune our systems' clearing temperature.
We studied the influence of the crosslinker topology on the elastomers' order and mechanical properties by using both isotropic, siloxane-based crosslinkers and anisotropic, mesogen-like crosslinkers with flexible chains of different length. Remarkably, the mesogen-like cross-linking agents caused lower tensile moduli and phase-transition temperatures than the isotropic ones. In order to check our assumptions regarding the cause of this effect, a multifunctional, dichroitic dye based on perylene will be used to measure the orientation behaviour of the net points independently from that of the mesogens.

References

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