Influence of the Crosslinker Topology on Order and Mechanics

F. Zander, H. Finkelmann

Albert-Ludwigs-Universität, Institut für Makromolekulare Chemie,
79104 Freiburg im Breisgau, Germany

The mechanical properties and the thermoelastic effect of Main-Chain Liquid Crystalline Elastomers (MCLCEs) [1] are strongly influenced by the geometry and the concentration of the crosslinker used [2,3]. A thorough understanding of this influence is vital for further improvement of the properties of MCLCEs.
A new nematic main-chain system was synthesised by copolymerisation of two different mesogens. The clearing temperature of the mesophase can be tuned easily by varying the mesogens' ratio On a suitable system obtained by this method, we investigated the influence of the crosslinker topology on the elastomers' order and on their mechanical properties. Isotropic, siloxane-based crosslinkers and anisotropic, mesogen-like crosslinkers with flexible chains of different length were used. Remarkably, only a medium-sized isotropic crosslinker seems to stabilise the nematic phase, whereas both small and large isotropic crosslinkers cause lower tensile moduli and phase transformation temperatures. Rigid crosslinkers, despite their similarity to the matrix, affect the network in a similar way.
In order to measure the order and the orientation behaviour of the net points independently from those of the elastomer matrix, multifunctional, dichroitic dyes based on perylene were added to the networks as co-crosslinkers, and were investigated by polarised light spectroscopy.

References

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