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Transition Moment Orientational Analysis on Liquid Crystalline Elastomers

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A novel method is suggested for unravelling the mean orientation and the molecular order parameter in IR-transparent materials, such as polymer films. It is based on the analysis of IR transmission spectra as a function of polarization *and* an intentional inclination of the sample. Compared to other structural techniques, like X-ray scattering and NMR, this method has the advantage that it can give group-specific 3D structural information for samples under varying external conditions.
The application of this method to liquid crystalline elastomers forming a nematic or smectic mesophase gives information separately about the director and the elastomeric matrix under external strain. It is shown, that, depending on the crosslinking conditions, the samples are biaxially oriented. Strain or shear has a minimal effect on the orientation of the director in systems with liquid crystalline side-chains, but it can change dramatically the mechanical and piezoelectric properties of main-chain liquid crystals.