

Investigations on photo-reactive liquid crystal systems

Andreas Hoischen

In this work the photo-chemical reactions of polymerizable monomers based on acrylates were studied. These systems are useful e. g. for optical storages, electro-optical displays or switchable optical elements. The reaction behaviour is of great interest for the optimization and development of new compounds and systems. Due to the change of the reaction enthalpy during the photo-polymerization, a calorimetric investigation method was used. A photo-DSC was constructed to study the heat and kinetics of the polymerization reaction. The modifications allow computer control, as well as electronic data recording and processing.

Following systems were investigated:

1. Highly crosslinked cholesteric liquid crystals for optical storage:

The selective reflection wavelength becomes temperature independent due to the photo-polymerization. Surprisingly, for this effect a double-bond conversion of nearly 35% is sufficient.

2. Liquid crystalline gels:

The polymerization kinetics is of great interest in context of studying polymer-stabilization in dynamic systems. These systems consist of an inert compound and a monomer with a maximum fraction of 10 wt.-%. The calorimetric setup allows the detection of very small amounts of reaction heat. Here, this facility is particular important because of the low reaction enthalpy of these systems.

3. Polymer dispersed liquid crystals:

The holographic technique allows the optical structuring of the samples. It is possible to inscribe switchable diffraction gratings. The conditions of the reaction have a strong influence on the kinetics, the morphology of the sample, and the electro-optical switching behaviour.