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Molecular dynamics in succinodinitrile plastic crystal studied by means of sub-picosecond Optical Kerr Effect (OKE).

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Succinodinitrile at room temperature is a plastic crystal characterized by orientational and conformational (trans-gouche) disorder. Several methods have been proposed and used to characterize the plastic phase. NMR and Rayleigh scattering experiments have evidenced that at least two decay mechanisms are responsible for the line broadening with correlation times ranging between 20 and 60 psec. More recently time resolved OKE has been utilized to measure directly in the time domain the effects of molecular reorientation. In this method a strong polarized pulse induces an anisotropy that disappears because of the reorientational motions of the molecules. A second weak pulse probes at different delays the amount of anisotropy. It has been demonstrated that the decay times obtained with this method are the same measured using Rayleigh scattering. In the case of time resolved OKE it is possible to distinguish more precisely different decay times.

We have measured time resolved OKE in succinodinitrile as a function of temperature. The instrumental set-up used in the experiment has a time-resolution of 300 fs. A second much shorter decay (4 ps at room temperature) was thus observed. Our results, together with those of previous experiments, are discussed in terms of rotational and torsional dynamics of the molecules, and of cooperative motions related to the intermolecular interactions.