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Molecular dynamics of some liquid crystal glass-formers

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The phase situation and molecular motions of some cyanobiphenyl compounds with different terminal chains were studied in our group using various experimental methods [1-4]. Rich phase polymorphism was found for chiral isomers.

The main topic of this lecture will be two of the liquid crystal glass-formers of this group: (S)-4-(2-methylbutyl)-4'-cyanobiphenyl (5CB) and (S)-4-(1-methylheptyloxy)-4'-cyanobiphenyl (8OCB). Their phase situation obtained by adiabatic calorimetry and the results of the inelastic and quasi-elastic neutron scattering experiments will be discussed.

The quasi-elastic neutron scattering experiments were performed for isotropic liquid phase of 5CB and 8OCB for various temperatures and scattering angles. The spectra were described by a model consisting of two stochastic movements: reorientation of the whole molecule around the long molecular axis and diffusive motions of the protons in the terminal chains of the molecule.

The inelastic neutron scattering experiments were performed for phase I, glass of phase II and glass of cholesteric phase for 5CB and phase II, glass of phase I and glass of isotropic liquid for 8OCB. The boson peak was observed for most of the experiments. The quasi-elastic broadening of the elastic line was observed as well. The tunnel splitting suggested for temperatures lower than 1 K by relaxation calorimetry experiment was not observed.

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[4] A. Inaba, M. Massalska-Arodz, H. Suzuki, J. Krawczyk, Molecular Crystals and Liquid Crystals, 540 (2011) 102.

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