

Mikhail Osipov (Strathclyde)

Molecular models for biaxial nematic liquid crystals

A molecular-statistical theory of biaxial ordering and phase transitions in nematic liquid crystals is discussed in detail including the relation between tensor order parameters and molecular symmetry. In particular, the symmetry of the constituent molecules of the two recently discovered biaxial materials is considered. A molecular model of the biaxial and uniaxial nematic phases, composed of tetrapod-shaped molecules is developed using a simple model of a tetrapode composed of four mesogenic groups rigidly linked to the same centre. The coefficients of the effective interaction potential, used in the existing theory of biaxial nematics, are calculated numerically as functions of molecular model parameters by expansion of the total interaction potential for tetrapodes. Order parameters of the uniaxial and biaxial nematic phases are evaluated by direct minimization of the free energy at different temperatures, and the phase diagrams are obtained which enables one to study the dependence of the stability regions of all phases on the model parameters of a tetrapode molecule. A particular origin of the stability of the biaxial ordering in the nematic phase composed of tetrapode molecules, which has recently been discovered experimentally, is discussed in detail.

Joint work with M.V.Gorkunov