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Field-driven orientation ordering in nematic liquid-crystal films

M.M. Krupa, A.M. Korostil

Department of Physics of Meso- and Nanocrystalline Magnetic Structures, Institute of Magnetism, Nati. Acad. of Sci. and Min. Ed..Sci. of Ukraine. Prospect Vernadsky, 36b, Kiev-03142, Ukraine.
E-mail: amand@rambler.ru

The problem of field-driven changes of the long-range orientation ordering of anisotropy molecules with the absent their translation order in the nematic liquid crystals (LC) has both fundamental scientific significance in the condense matter physics and wide applied interest [1, 2]. The scientific interest in LC materials is caused by the diverse application potentials that these materials offered, especially for tunable optical devices such as LC based displays [2]. Over the last years, liquid crystals have emerged as a promising candidate for functionalized smart materials for controlled self-assembly, high response electro-optic devices, biological and biotechnological applications and polymer sciences.

The one of the significant problem of the liquid crystal physics constitutes in ultimate decreasing the time and domains of the field-induced reorientation, the enhancement of a stability of the orientation ordering states and their field sensitivity. Its solving provides to consider both microscopic anisotropic properties of molecules and collective effects of their interaction between itself and with different defects and boundary surfaces. This anisotropy determines tensor physical properties (specifically, optical properties) of the LC films.

Therefore, the more valid study of the induced-orientation ordering in the LC layers based on the generalized to inhomogeneous systems molecular Onsager's model in terms of quadruple Q-tensor operators for orientation ordering [3]. This permitted to characterize the distortion of the orientation ordering, caused both by heterogeneities of different natures (including impurities, bounding surfaces) and external electric and magnetic fields. It is shown, that the magnetic nanoparticles in the nematic LC films result in the considerable enhancement its magnetic sensitivity due to the spin interaction between nanoparticles and molecules.

1. *De Gennes P.G.* The Physics of liquid crystals (Clarendon Press, 1974).
2. *D.K. Yang, S.T. Wu,* Fundamentals of Liquid Crystal Devices (Wiley, West Sussex, 2006).
3. *Hang J., Luo Yi., Wang W., Zhang V.* From Macroscopic Theory to Macroscopic Theory: a System Study on Modelling for Liquid Crystals //Arch. Rational Mech. Anal.-**2015**.-P. 741-809.