The twist elasticity coefficient in a chiral smectic C* liquid crystal

W. Kuczynski, D. Dardas and K. Nowicka

Institute of Molecular Physics, Polish Academy of Sciences,
Smoluchowskiego 17, 60179 Poznan, Poland

Liquid crystal (LC) technology has attracted considerable attention for use in electro-optical devices such as displays [1]. In a LC display, the quality of the picture are primarily dependent on the LC material parameters and on molecular alignment in the cell. The sensitivity of the liquid crystal cell on various external factors and the value of the switching threshold depend on elastic coefficients, first of all on the twist elastic constant for the **c** director B_3 [2,3]. Therefore the determination of this parameter is of large technical value [4].

In order to measure any elastic coefficient one has to apply an appropriate stress to the properly oriented sample and measure the deformation caused by this stress. Both the stress and the deformation have to be small to fulfill the condition of proportionality between deformation and stress. Due to the ferroelectric polarization of smectic layers in SmC* phase, the simplest way to introduce a deformation is by applying an electric field parallel to the smectic layers.

We proposed a method for determination of the twist elastic coefficient B_3 for the smectic **c** director. This method fulfills the condition of small deformation. The elastic constant is determined with indirect method, needing three different experiments. In a first step, spontaneous polarization was measured with the Diamant-Pepinsky bridge [5]. The temperature of the sample was controlled by the Mettler FP5 temperature controller with in ±0.1K. The orientation of the sample was checked with the polarizing microscope. In a second step the pitch of the helix was measured in homeotropically aligned samples using two methods: the spectroscopic one and the Cano method in a wedged sample. In the next step we measured the amplitude of optical axis inclination caused by DC or low frequency electric field and the tilt angle. The measurements were performed in 4-methylbutyloxy phenyl-4-octyloxy-benzoate (C8). The method applied to the material C8 gave reasonable results. The critical temperature dependence of the measured coefficients was observed. The relation between the measured parameter and the smectic C order parameter is presented.

References

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