

Orientational structures of cholesteric layers with tangential-conical boundary conditions

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The physical properties (optical, electrical, etc.) of liquid crystal (LC) systems depend on the director configuration specified mainly by the anchoring of LC molecules at the interface. Commonly, the tangential (LC director lies parallel to the surface) or normal (LC director lies perpendicular to the surface) boundary conditions (surface anchoring) are formed. Recently the conical surface anchoring was investigated in the polymer dispersed nematic liquid crystal [1-3]. In this case, LC director is tilted to the interface and its azimuthal direction is degenerated. It has been revealed that the value of threshold electric field of director reorientation was less than that one for analogous composite materials containing LC droplets with tangential or normal surface anchoring. The present work is devoted to the investigation of orientational structures of cholesteric liquid crystal (CLC) layers in the sandwich-like LC cells with tangential-conical boundary conditions.

The cells consisting of two glass substrates with ITO electrodes and the cholesteric layer between them were considered. The nematic mixture LN-396 (Belarusian State Technological University) doped with the chiral additive cholesterylacetate was used as CLC. One of the substrates was preliminarily coated by the polyvinyl alcohol providing the tangential surface anchoring. Poly(isobutyl methacrylate) specifying conical boundary conditions with 40° tilt angle for used cholesteric was deposited on another substrate. The samples were examined by polarizing microscopy.

It has been revealed the optical textures of cholesteric layer depend on the ratio of CLC layer thickness d to the intrinsic helix pitch p . The optical textures were a uniform bright area in the cells when the confinement ratios d/p less than 0.4 (fig. 1a). The stripe patterns were formed at the higher values of confinement ratio (fig. 1b). The period of observed stripe structure was about $2p$. The director configurations and their transformation under the action of electric field have been studied.

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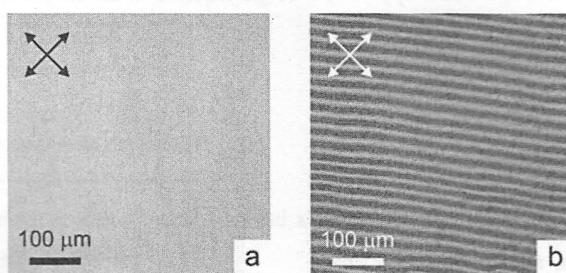


Fig. 1. Optical textures of cholesteric layer with different confinement ratios observed in crossed polarizers: (a) $d = 5.9 \mu\text{m}$, $d/p = 0.28$; (b) $d = 6.3 \mu\text{m}$, $d/p = 0.60$. The polarizer's directions are marked by the double arrows.

References

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