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Electro-optical properties of the polymer dispersed liquid crystal films with conical boundary conditions

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Polymer dispersed liquid crystals (PDLC) are the polymer film containing liquid crystal droplets. Optical properties of such films are determined by the orientational structure in the droplets and can be controlled by the electric field [1]. The axial-bipolar orientational structure is formed in the droplets under the conical boundary conditions with the director tilt angle of 40° to the surface normal [2]. In present work, the electro-optical properties of PDLC films with the axial-bipolar droplets have been investigated.

An electric field causes a reorientation of the bipolar axes along the field due to the positive dielectric anisotropy of used LC. If the electric field is applied perpendicular to the film, the composite material is switched from the opaque state into the transparent one. The typical dependences of light transmission on the applied voltage for PDLC films under study are shown in Fig. 1. The conical anchoring determining the axial-bipolar configuration results in a decrease of the driving voltage and an increase of the contrast ratio. For the composite film of 30 μm thickness, the threshold voltage, the saturation voltage, and contrast ratio are 8 V, 12 V, and 4235, respectively.

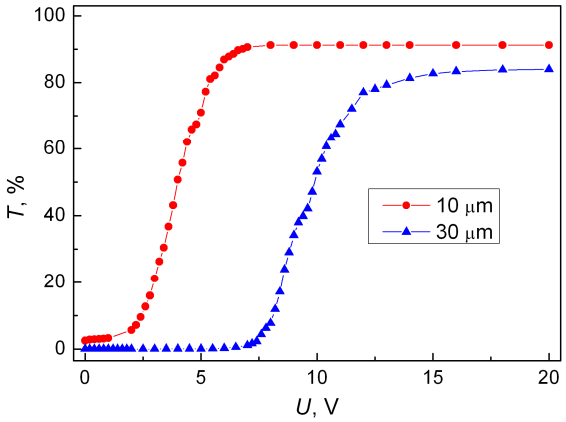

Figure 1 – Dependences of light transmission on the applied voltage for PDLC films of 10 and 30 μm thickness.

Moreover, these PDLC films with axial-bipolar droplets can operate as electrically controllable polarizer when the electric field is applied along the film plane [2]. Such polarizer is characterized by the high extinction ratio, low driving field strength, and high value of transmittance for the light polarized perpendicular to the applied electric field.

References:

[1] P.S. Drzaic, *Liquid crystal dispersions*, (World Scientific, 1995), pp. 429.

[2] M.N. Krakhalev, et al., *Optical Materials*, **89**, 1 (2019).

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