Electro-optical response of PDLC films with conical boundary conditions

M.N. Krakhaev[1,2], O.O. Prishchepa[1,2], K.A. Feyzer[2], V.S. Sutormin[1,2], V.A. Loiko[3], A.V. Konkolovich[3], A.A. Miskevich[3], V.Ya. Zyryanov[1]

[1]Kirensky Institute of Physics, Federal Research Center KSC SB RAS, Krasnoyarsk, Russia
[2]Institute of Engineering Physics and Radio Electronics, Siberian Federal University, Russia
[3]Stepanov Institute of Physics of the NASB, Minsk, Belarus

1. Introduction

Polymer dispersed liquid crystals (PDLC) are the liquid crystal (LC) droplets dispersed in polymer matrix. Optical properties of such composite materials depend on the orientational structure inside droplets which, in turn, depends on the boundary conditions at LC-polymer interface. For instance, the bipolar director configuration with two point defects at the opposite droplet's poles is formed within droplets at tangential surface anchoring. An electric field applied to this PDLC film causes the transformation of orientational structure and reorientation of bipolar droplet axis along the field. In the result, PDLC film can be switched from a light-scattering state to transparent one [1].

At the conical boundary conditions with $\theta = 40°$ angle between the director and the normal to surface, the axial-bipolar structure is formed with two point defects at the opposite poles and the ring surface defect at equator [2]. Under applied electric field, this structure is oriented by a bipolar axis along the field. In this case the control voltage required to reorient the structure are less in several times than for bipolar droplets [3].

2. Results and Discussions

In this paper; the electro-optical response of PDLC films with the axial-bipolar structure has been studied. These droplets manifest essential distinction in scattering properties depending on the orientation of the bipolar axis relative to the light polarization direction. So, the light polarized along the bipolar droplet axis is scattered intensively while the light polarized perpendicular to the bipolar axis passes almost without scattering. In initial state, the bipolar droplet axes within PDLC film are oriented randomly. An electric field applied in the film plane tends reorienting the droplets by the bipolar axes along the field so that a transmittance of PDLC film under voltage will depend on the polarization of incident radiation (Fig. 1). Low control voltages, a high transmittance of light polarized perpendicular to the applied field $T_\perp$ and a large value of $T_\perp/T_\parallel$ ratio are characteristic for these PDLC films.

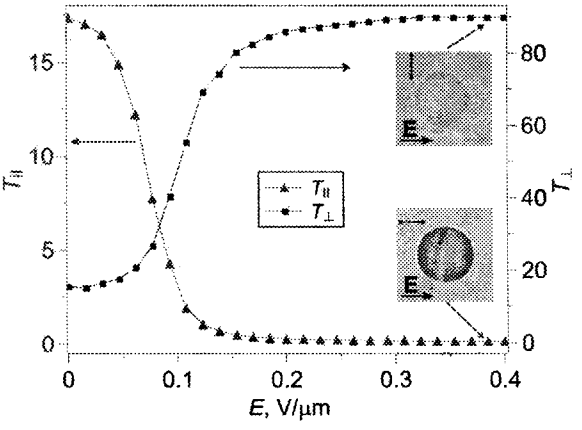

Figure 1: Transmittances $T\|,\perp$ of the polarized components of laser radiation depending on the applied electric field E. The microphotos of axial-bipolar droplet in the polarized light are presented on the insertions. The polarizer direction indicated by the double arrow

3. Acknowledgements

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4. References

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