

Electro-Optic Parameters of Ferroelectric Particles- Liquid Crystal Composites

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Abstract : Influence of barium titanate particles on electro-optic properties of liquid crystal 4-cyano-4'-pentylbiphenyl (5CB) with positive dielectric anisotropy and the liquid crystalline (LC) mixture H-37 consisting of 4-methoxybenzylidene-4'-butylaniline and 4-ethoxybenzylidene-4'-butylaniline with negative dielectric anisotropy was investigated. It was shown that a presence of particles inside 5CB and H-37 decreased the clearing temperature from 35.2 °C to 32.5°C and from 61.2 oC to 60.1oC, correspondingly. The threshold voltage of the Fredericksz effect became 0.3 V for the BaTiO₃-5CB colloid while the beginning of this effect of the pure 5CB was observed at 2.1 V. Threshold voltage of the Fredericksz effect increased from 2.8 V to up 3.1 V at additive of particles into H-37. A rise time of the BaTiO₃-5CB colloid improved while a decay time worsened in comparison with the pure 5CB at all applied voltages. The inverse trends were observed for the H-37 matrix, namely, a rise time worsened and a decay time improved. Among other things, the effect of fast light modulation was studied at application of the rectangular impulse with direct bias to an electro-optical cell with the BaTiO₃ particles+5CB and the pure 5CB. At this case, a rise time of the composite worsened, a decay time improved in comparison with the pure 5CB. The peculiarities of electrohydrodynamic instability (EHDI) formation was also investigated into the composite with the H-37 matrix. It was found that the voltage of the EHDI formation decreased, a rise time increased and a decay time decreased in comparison with the pure H-37. First of all, experimental results are explained by appearance of local electric fields near the polarized ferroelectric particles at application of external electric field and an existence of the additional obstacles (particles) for movement of ions.

Keywords : liquid crystal, ferroelectric particles, composite, electro-optics

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