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Light Scattering in the Stretched Film of Polymer Dispersed Liquid Crystal Doped with Surfactant

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Uniaxially stretched films of polymer dispersed liquid crystals (PDLC) can effectively polarize transmitted light in the visible and infrared ranges owing to the strong anisotropy of light scattering by the uniaxially aligned LC droplets of elongated ellipsoidal form [1,2]. Until now the polymer-nematic compositions with rigid tangential anchoring of LC molecules at the polymer walls were generally considered. In this case the bipolar configuration with two topological defects-boojums is formed initially inside LC droplets and this structure remains after the stretching of film. A drawback of such PDLC polarizers is a light scattering at stored boojums, causing the suppression of orthogonal light component transmittance. In this investigation we remove the obstacle by means of doping the nematic with surfactant. PDLC film is composed of polyvinyl alcohol (PVA) specifying tangential alignment, nematic liquid crystal 5CB and surface-active substance (surfactant) cethyltrimethylammonium bromide (CTAB) that initiates a homeotropic anchoring of nematic with polymer surface. Light transmission components of the PDLC film have been measured depending on the elongation factor. It has been shown that the uniaxially stretching of composite film results in the abrupt increase both of the orthogonally polarized component of passed forward light and, consequently, the polarization degree, which are saturated at the double film elongation. This feature of change of macroscopic optical properties of the film can be explained by the orientation-structural transition of initial radial director configuration to the homogeneous one within deformed nematic droplets owing to the addition of homeotropic surfactant CTAB. That allows switching off the parasitic scattering at the boojums and improving considerably the optical properties of light polarizers based on such composite media.

References:
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