

Polymer Dispersed Liquid Crystals Based on Poly Vinyl Alcohol Boric Acid Matrix

Authors : Daniela Ailincăi, Bogdan C. Simionescu, Luminita Marin

Abstract : Polymer dispersed liquid crystals (PDLC) represent an interesting class of materials which combine the ability of polymers to form films and their mechanical strength with the opto-electronic properties of liquid crystals. The proper choice of the two components - the liquid crystal and the polymeric matrix - leads to materials suitable for a large area of applications, from electronics to biomedical devices. The objective of our work was to obtain PDLC films with potential applications in the biomedical field, using poly vinyl alcohol boric acid (PVAB) as a polymeric matrix for the first time. Presenting all the tremendous properties of poly vinyl alcohol (such as: biocompatibility, biodegradability, water solubility, good chemical stability and film forming ability), PVAB brings the advantage of containing the electron deficient boron atom, and due to this, it should promote the liquid crystal anchoring and a narrow liquid crystal droplets polydispersity. Two different PDLC systems have been obtained, by the use of two liquid crystals, a nematic commercial one: 4-cyano-4'-penthylbiphenyl (5CB) and a new smectic liquid crystal, synthesized by us: buthyl-p-[p'-n-octyloxy benzoxy] benzoate (BBO). The PDLC composites have been obtained by the encapsulation method, working with four different ratios between the polymeric matrix and the liquid crystal, from 60:40 to 90:10. In all cases, the composites were able to form free standing, flexible films. Polarized light microscopy, scanning electron microscopy, differential scanning calorimetry, RAMAN- spectroscopy and the contact angle measurements have been performed, in order to characterize the new composites. The new smectic liquid crystal has been characterized using ¹H-NMR and single crystal X-ray diffraction and its thermotropic behavior has been established using differential scanning calorimetry and polarized light microscopy. The polarized light microscopy evidenced the formation of round birefringent droplets, anchored homeotropic in the first case and planar in the second, with a narrow dimensional polydispersity, especially for the PDLC containing the largest amount of liquid crystal, fact evidenced by SEM, also. The obtained values for the water to air contact angle showed that the composites have a proper hydrophilic-hydrophobic balance, making them potential candidates for bioapplications. More than this, our studies demonstrated that the water to air contact angle varies as a function of PVAB matrix crystallinity degree, which can be controlled as a function of time. This fact allowed us to conclude that the use of PVAB as matrix for PDLCs obtaining offers the possibility to modulate their properties for specific applications.

Keywords : 4-cyano-4'-penthylbiphenyl, buthyl-p-[p'-n-octyloxy benzoxy] benzoate, contact angle, polymer dispersed liquid crystals, poly vinyl alcohol boric acid

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