The Investigation on the Reflective Properties for the Robust Flexible Cholesteric LCDs with Polymer Wall Structure

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Polymer wall formation using polymerization induced phase separation between liquid crystal (LC) and polymer in LC layer was known as an effective method to achieve the good mechanical stability in flexible LCDs. Lots of research on the cholesteric liquid crystal (Ch-LC) cells with the polymer wall structure were carried out since J. West group reported. [1] Recently our group achieved well configured and solid polymer wall formation, shown in figure (a), by the optimization of material and process parameters for the flexible Ch-LCDs. [2]

The LC layers in the polymer wall type Ch-LC cells in general have multi-domain structure as compared to the single domain structure of pure Ch-LC cells, so that the reflective properties depending on viewing angle are quite different with each other. The multi-domain texture is formed depending on the various material and process parameters, one of which is the amount of remaining polymer existing inside LC-rich region. The remaining polymer quantity decreases as the phase separation degree increases as well. In this paper, we investigated the reflective properties of the multi-domain Ch-LCs with well separated polymer walls, particularly focused on the viewing angle dependence of reflectance with the phase separation degree.

The Ch-LCs used in our system was CH100-550 (Slichem Co.). LC cells were prepared by using Indium Zinc Oxide deposited polycarbonate plastic substrates. The cell gap was set 5µm. No alignment layer was used. The acrylate-based monomer mixtures with photo-initiator and cross-linking agent were used. Figure (a) shows the polarizing optical microscopic (POM) image of the Ch-LCs at planar state after polymer wall formation. The walls were clearly formed and very small micro-domains were formed by the influence of little remaining polymer. Figure (b) is the SEM image that implies little amount of remaining polymer. Figure (c) shows one result of the reflective properties of the Ch-LC cell, showing the peak reflective wavelength versus viewing angle. The peak wavelength shift was much smaller than that of typical pure Ch-LC cell, which was resulted by the influence of micro-scale LC multi-domains. In this presentation, the details of reflective properties of the Ch-LC cells are discussed.

POM (a) and SEM (b) images of the Ch-LC cell after polymer wall formation; Peak reflected wavelength vs. viewing angle of the Ch-LC cell

References:

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