Vertical Alignment and Stabilization of Director Pre-tilt of Nematic Liquid Crystal Doped by Surface Modified Silica Nano-Particles

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We report a vertical alignment and pretilt control of nematic liquid crystals (NLC) doped by surface modified spherical silica nanoparticles (SNPs). The SNPs have been modified by photoreactive 3-(trimethoxysilyl) propyl methacrylate and homogenously dispersed in NLCs with negative dieleteric anisotropy. The surface modification has been accomplished through the silane coupling reaction to hydroxyl groups on the surface of SNPs [1]. The homogeneous mixture has been prepared by controlling dispersion rate, sonication conditions and processing temperature. The electro-optic (E.O.) cells have been fabricated by using fishbone-patterned pixel electrode. No pretreatment has been performed for the alignment of LC molecules.

The E.O. cells, with no pretreatment for LC alignment, exhibit spontaneous vertical alignment of liquid crystal [2]. The optical and electro-optical behaviors are similar to the conventional *"vertically aligned"* (VA) NLCs. No evidence for director pretilt has been observed. However, the stabilization of director tilt to a predetermined direction has been accomplished by exposing UV-light under applied electric field. As a result, the reorientation direction of LC, responding to the external field, is well-defined and consequently leads to enhanced electro-optic characteristics such as faster switching and enhanced brightness [3-4]. The polar anchoring energy has been found in the order of 10^{-5} J/m^2.

In our study, the spontaneous vertical alignment has been obtained by the adsorption SNPs at the inner surface of substrate. The stabilization of direct tilt has been accomplished by the polymerization of photo-reactive methacrylate group, modifying the surface of SNPs, under the predetermined multi-domain director tilt facilitated by the fishbone-patterned electrode and applied electric field.

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References

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