Quantitative analysis of image flickering in negative fringe-field-switching liquid crystal display: effect of flexoelectric polarization and impurity charge

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We quantitatively analyzed the image flickering in the negative fringe-field-switching (nFFS) liquid crystal (LC) display during low frequency driving. When the FFS mode is driven with a low frequency electric field, the image flickering occurs by the flexoelectric polarization and impurity charge in the LC layer [1]. However, a clear answer has not been reported to the question ; which effect is more significant to the image flicker effect of nFFS ? According to the Meyer's notation, the flexoelectric polarization is given by $P_f = e_s\vec{n}(\nabla \cdot \vec{n}) - e_b\vec{n} \times (\nabla \times \vec{n})$ where $\vec{n}$ is LC director and e_s and e_b are the splay and the bend flexoelectric coefficients, respectively [2]. We measured both e_s and e_b [3-4] and tried to elucidate the exact origin of the image flicker of the nFFS. First, we experimentally measured the image flicker of three kinds of commercial LC mixture with a negative dielectric anisotropy [Fig. 1]. Second, we separately measured e_s and e_b, and then simulated the optical response using the continuum theory [4]. By comparing the expeirmental results with the theoretical calculation, we found that the image flicker in nFFS was more affected by the impurity charge than the flexoelectric polarization.

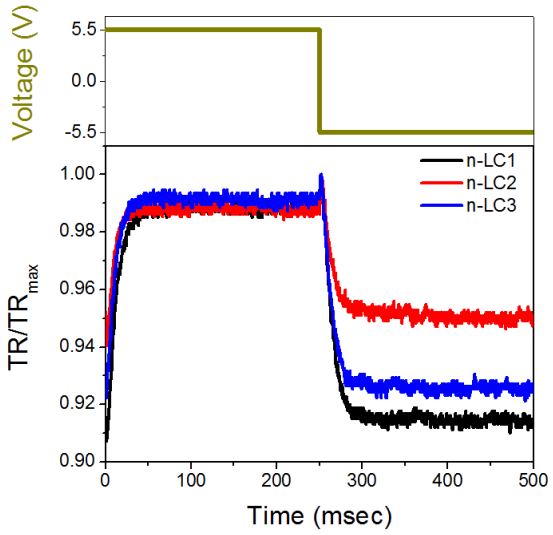

Fig. 1. Optical response of the negative LC mixtures in the presence of the 2 Hz square voltage.

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