Foldable Nano-Phase-Separated LCDs with 2.5 mm Radius of Curvature using Polymerization Inhibitor

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Sheet-type liquid crystal displays (LCDs) [1-2] using plastic substrates have many advantages such as ultra-thin, light-weight and unbreakable. These features enable layered displays that improve an optical performance and functionality of display devices such as the high-contrast dual-layered LCDs and the viewing angle controllable LCDs. In addition, sheet-type LCDs can achieve an extremely narrow borders less than 0.3 mm by folding the edge of display panel. For these reasons, sheet-type LCDs are attracting significant interest for new applications, including curved automotive displays, large digital signages, high contrast rollable screen televisions, foldable and wearable devices.

We have developed the foldable LCDs using nano-phase-separated (NPS) LCs [3-4]. By introducing the nano-size polymer network into the LCs and controlling the viscoelasticity of LC materials, we successfully suppressed the flow of LCs and improved the luminance uniformity in the bending state.

In addition, we established the control method of the structure of polymer spacers by using the polymerization inhibitors [5]. By controlling the polymerization stopping period with the inhibitor concentration and the UV irradiation time, the polymerization in the vicinity of the polymer spacer was suppressed and the low driving voltage was realized. The foldable nano-phase-separated LCD has high contrast ratio over 1300:1 and 2.5 mm radius of curvature with 80 μm polycarbonate substrate, therefore, it is promising for future flexible LCD applications.

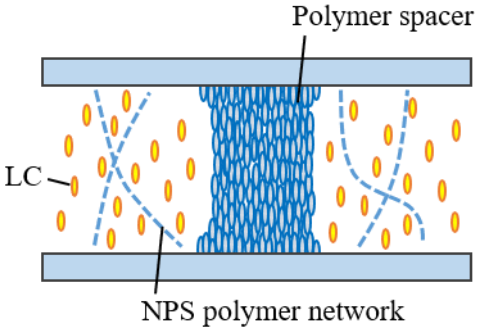

Fig. 1. Flexible NPS-LCD with polymer spacers.

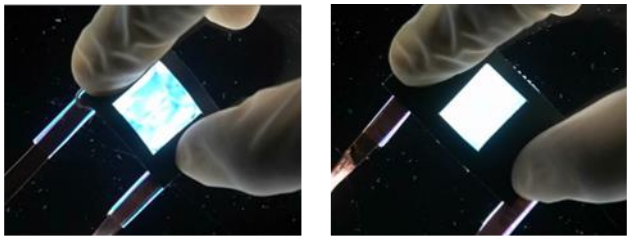

Fig. 2. Comparison of LC cells in the bending state.

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