Polymer Stabilized Vertical Alignment Flexible Display

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More recently, such FPDs are requested to have more functional displays with free form factors and flexibility such as curved, bendable, foldable, circular shape displays [1]. Present commercialized LCDs use a fluid liquid crystal (LC) and in addition, the LC molecules are uniformly aligned like a single crystal having either homogeneous or vertical alignment by two substrates holding LCs. Therefore, bending or curving of the display will give a mechanical stress to the substrate and more worse situation arises from different stresses at two substrates, leading to misalignment between two substrates, and also will cause distortion of cell gap and uniform LC orientation associated with fluidity of LC molecules. In this paper, we report LC device more suitable to flexible display. Recently, we reported electro-optic characteristics of vertical alignment mode driven by in-plane electric field (VA-IPS) using the bulk polymer network [2,3], in which the polymer network are formed in three dimensions so that the device shows no pooling mura even under an external mechanical pressure. However, polymer network in the VA-IPS device has a high driving voltage because the bulk polymer network disturbs the reorientation of the LCs and in addition, VA-IPS requires relatively high operation voltage to reorient LCs as the LC directors are aligned perpendicular to the substrate in an initial state. As one of the solutions to overcome this problem, modified VA-IPS in which additional counter electrode is formed on top substrate so called Transverse Bend Alignment (TBA) mode [4] which reorients LC directors by in-plane and oblique electric field is tested with polymer network formation in a bulk LC layer. And also plastic LCD with polymer-stabilized mode is fabricated to test its image quality change at bending stress. The proposed device showed a very fast response time(2ms; rise+decay time) and relatively low operating voltage(38V) even with use of a LC with low magnitude of dielectric anisotropy, and also no pooling mura at all even though external pressure is applied to the device and kept a uniform bright state even if the plastic LCD is bent, opening a possibility for the device to be applicable in flexible displays.

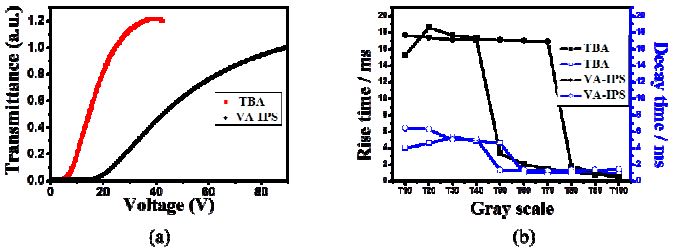

Fig. 1. Measured (a) V-T curve and (b) response time of VA-IPS device and TBA device with 3 dimensional polymer network

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