High-transmittance fast-in-plane-switching negative-LC cell with double-sided patterned electrodes

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Among various LCD technologies, the in-plane switching (IPS) mode is one of the mainstream technologies developed for wide viewing angle. The IPS mode exhibits excellent viewing angle characteristics because the LCs are rotated in a plane parallel with the glass substrates [1]. However the IPS mode has low transmittance because the transmittance above the patterned electrodes is low.

To enhance the transmittance of IPS mode, the fringe-field switching (FFS) mode was proposed [2, 3]. The FFS mode exhibits higher transmittance than IPS mode. Especially, the FFS mode using negative dielectric anisotropic LCs (n-LCs) shows higher transmittance than FFS mode using positive dielectric anisotropic LCs (p-LCs). However, the transmittance above the electrode and between the electrodes of the FFS mode using n-LCs still low. Moreover, the response time of n-LCs is slower than that of p-LCs because of the higher viscosity of the former.

In this paper, we propose high transmittance and fast response time of n-LCs using double-sided patterned electrodes. Figure 1 shows the proposed structure, transmittance distribution, potential profile, and LC director distribution. The proposed structure shows higher transmittance than the conventional FFS mode using n-LCs because the proposed structure does not have weak point of transmittance. In addition, the proposed structure shows faster response time than conventional FFS mode using n-LCs. Because in the proposed structure, the electric field is applied between top and bottom patterned electrodes so that the LC molecules of all regions are rotated. Since the thickness of the LC layer showing maximum transmittance become smaller than the conventional FFS mode using n-LCs, the proposed structure has faster response time than conventional FFS mode using n-LCs.

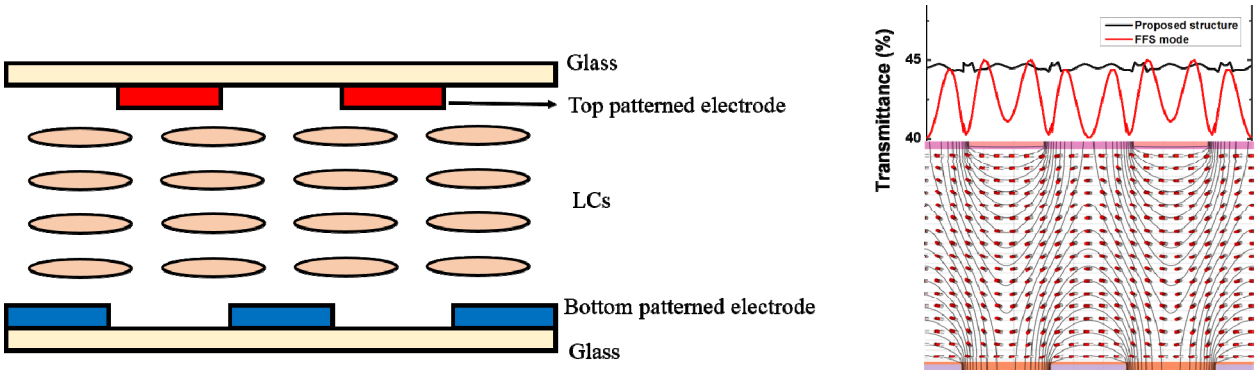

Fig. 1. (a) The proposed structure and (b) its transmittance distribution, potential profile, and LC director distribution.

Acknowledgment

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIP) (No. 2014R1A2A1A01004943).

References

1. M. Oh-e and K. Kondo, Appl. Phys. Lett. 67(26), 3895 (1995).
2. S. H. Lee, S. L. Lee, and H. Y. Kim, Appl. Phys. Lett. 73(20), 2881 (1998).
3. S. H. Lee, S. M. Lee, H. Y. Kim, J. M. Kim, S. H. Hong, Y. H. Jeong, C. H. Park, Y. J. Choi, J. Y. Lee, J. W. Koh, and H. S. Park, *SID'05 Technical Digest*, vol. 32, p. 485 (2001).