The Effect of Reactive Mesogen Distribution on the Response times of Fringe Field Switching Mode

Tae-Hoon Kim[1], Youngsik Kim[1,3], Dong-Ha Kim[2], You-Jin Lee[2], Chang-Jae Yu[1,2], and Jae-Hoon Kim[1,2,*]

1 Department of Information Display Engineering, Hanyang University, Seoul, Korea
2 Department of Electronic and Computer Engineering, Hanyang University, Seoul, Korea
3 LG Display co. Ltd., Gumi, Korea

[Contact E-mail: jhoon@hanyang.ac.kr]

In the liquid crystal displays (LCDs), various LC alignment methods have been investigated such as rubbing method of polyimide (PI) [1], evaporation of silicon oxide (SiOx) [2], ultraviolet (UV) exposure of photopolymers [3]. Among them, mechanical rubbing of the PI layer is the most promising method because of its simplicity and thermal stability. Especially, the surface morphology of the rubbed PI layer is one of the most important parameters governing the electro-optical performances such as response time, view angle, and contrast ratio. Recently, introducing reactive mesogen (RM) to the PI layer, the azimuthal anchoring energy was significantly enhanced and thus the response time was improved [4].

In this paper, we reported the effect of the polymerized RM distribution on the anchoring energy and the resultant response time in a fringe-field switching (FFS) mode [5]. Topological characteristics of the polymerized RMs on the rubbed PI layer were observed by an atomic force microscopic (AFM). The surface morphology of the rubbed alignment layer mixed with the RM was strongly correlated to the anchoring energy and the response time. In the alignment layer with a randomly aggregated RM surface, no remarkable enhancement of the anchoring energy was observed. In the alignment layer with a uniformly aggregated RM surface, however, the azimuthal anchoring energy was 1.2 times stronger than that in the randomly aggregated RM surface. This means that the polymerized RM distribution affects the interaction between the LC and PI molecules. In the FFS cells, the response times were observed in both RM-mixed alignment layers. As a result, both falling and rising times of FFS cell with the uniformly aggregated RM surface were faster than that with the randomly aggregated RM surface.

Acknowledgment:
This research was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MEST, No. 2012005379) and LG Display Co. Ltd.

References

[1] K.-Y. Han et al., *J. Soc. Inf. Disp.*, **2**(1), 15 (1995).
[2] J. L. Janning, *Appl. Phys. Lett.*, **21**(4), 173 (1972).
[3] M. Schadt et al., *Jpn. J. Appl. Phys*, **31**, 2155 (1992).
[4] Y. K. Moon et al., International Display Workshop, 23 (2010)