Flickering behavior in low-frequency driven FFS liquid crystal mode

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The portable devices such as smart phone and tablet have required high transmittance with low power consumption. Fringe field switching (FFS) liquid crystal (LC) mode has been considered as a suitable solution for these requirements the past several years [1]. In addition, low-frequency operating has been adopted for low power consumption due to its linear proportionality to the operating frequency. However, the FFS LC mode driven at low frequency has serious flickering behavior because of the flexoelectric (FE) effect in positive dielectric LC (p-type LC) and low voltage holding ratio (VHR) in negative dielectric LC (n-type LC) [2,3]. These are obstacles for using the low frequency driving in many applications. We will present analysis on the origins of flickering problems caused by the FE effect in FFS using p-type LC dividing into static and dynamic perspectives, and propose their solutions. In FFS using n-type LC, the FE effect was enough small not to affect the image flicker. However, the discharging problem takes place over the entire pixel area. Thus, the brightness decay within a frame (i.e., low VHR) was larger than that of p-type LC, commonly. Because it would be another origin of flickering in FFS using n-type LC, we also analyzed the causes of discharging and the design parameter in FFS using n-type LC. The origins of image flicker according to the LC type in FFS and their solutions are summarized in Fig. 1.

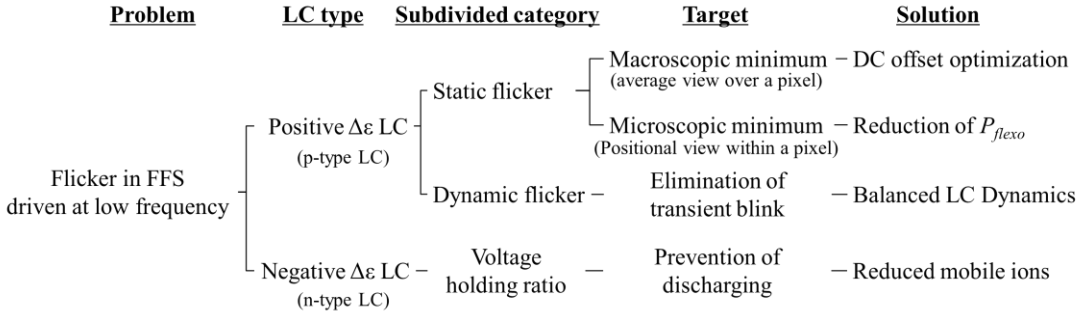

Fig. 1. Classification of flickering problems and solutions of FFS LC mode in low frequency driving.

References

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Speaker Biography

Hak-Rin Kim received his BS, MS, and PhD degrees in electronic engineering from Seoul National University, South Korea, in 1998, 2000, and 2005, respectively. In 2007, he joined the faculty of the School of Electronics Engineering, Kyungpook National University, South Korea, where he is currently working as an associate professor in the Display/Organic Electronics Laboratory. Prof. Kim has actively served as a LCT program committee in international meeting on information (IMID) from 2008. He also served as an organizing committee in ACLC 2015. He is the author of more than 60 papers in international journals. His current research interests include liquid crystal displays, organic-based electro-optic devices, optics for 3D imaging and 3D displays, and novel fabrication processes for flexible printed electronics.