Reflective 3D Displays using Cholesteric Liquid Crystals

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The cholesteric liquid crystals (Ch-LCs) have been widely applied in reflective displays. A circularly polarized light is reflected by optical characteristics of chiral dopants which make nematic LCs twisted structures in its cell [1]. Also reflective Ch-LCD is very well known that it does not require any additional color filter (CF) layers, polarizers, and alignment layers. That is why Ch-LCs are widely considered as one of the feasible solutions for reflective type displays.

In this paper, we propose a novel method which fabricates reflective three dimensional (3D) display panel using a unique bottom structure and inkjet printing techniques with Ch-LCs. First of all, micro-scale wall structures which patterned in bottom substrate were embedded for single-layer Ch-LCD panel. Then Ch-LCs materials were injected in every other pixel by inkjet printing. Left-handed and right-handed Ch-LCs were filled in odd pixels and even pixels respectively (Fig. 1a). The assembled panel sequentially reflects left and right circularly polarized light at each pixel. The reflected circularly polarized light constructs stereoscopic 3D images in observer's brain (Fig. 1b). In addition, those processes don't need any kinds of optical components such as patterned retarders [2], and additional polarized films.

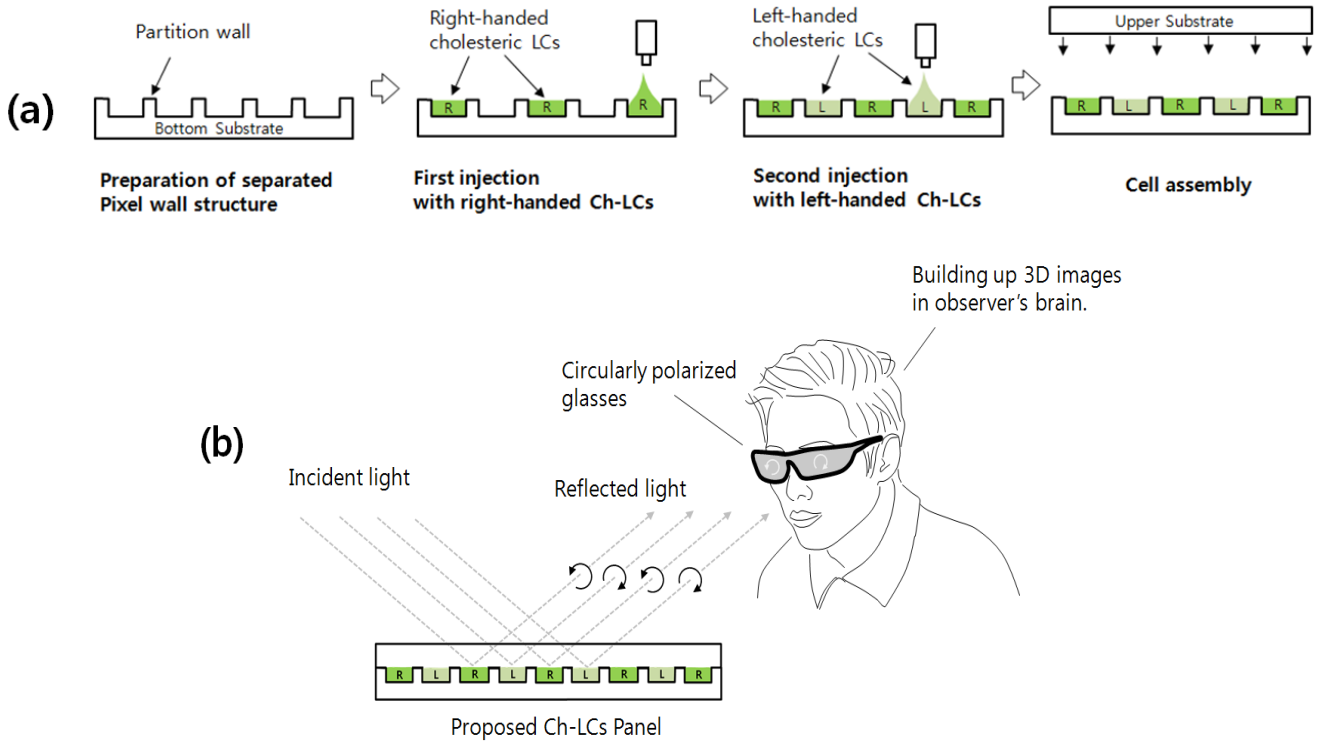

Fig.1 Schematic representations of (a) the reflective 3D display fabricating process using Ch-LCs materials, and (b) building up stereoscopic 3D images in observer's brain.

References

[1] D. K. Yang, Z. J. Lu, Switching Mechanism of Bistable Reflective Cholesteric Displays, *SID Symposium Digest*, pp. 351 (1995).

[2] Kwang-soo Bae, Reflective three-dimensional displays using the cholesteric liquid crystal with an inner patterned retarder, *Optics Express, Vol. 20, Issue 7,* pp. 6927-6931 (2012).