Study of Structural Parameters in Electrohydrodynamic Instability for Patterned Retarder

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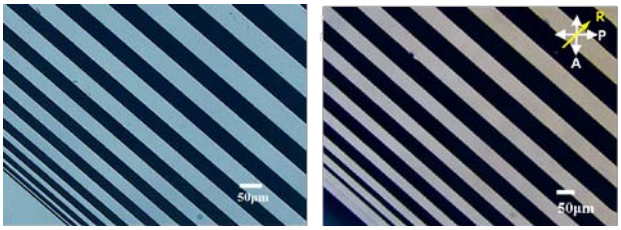
Film-type patterned retarder (FPR) has been of great interest due to apply micro-retarder for 3D display [1]. Liquid crystalline polymers (LCPs) have attracted much attention in FPR materials because of large optical anisotropy and excellent processability [2]. Generally, patterned retarders have been created by a thermal patterning method or a solvent washing method. Conversely, those techniques have technical challenges such as the generation of clear pattern-shapes with no decrease in phase retardation. Recently, a simple electrostatic technique was developed that uses electrohydrodynamic instability (EHDI) to create patterned retarders [3]. To obtain patterned retarders, the distorted electric field by pattered electrodes supplies a net force to form an anisotropic flow toward the high electric field regions. This method can lead to control the phase retardation by changing the cell gap. Therefore, EHD-driven instabilities were employed to replicate a pattern electrode [3]. However, the relationship between effective electric field and variable pattern electrode, essential for creating pattern retarder, has rarely been investigated so for.

In this work, we report a study of the formation of the patterned retarder induced by EHD-driven instabilities using variable patterned electrode. The width (w) and interval (l) of patterns in the binary photo-mask were changed from 2.5 to 70 μm, respectively. For the FPR, the LCP with the thickness (h) of 1.3 μm were coated onto the electrode-sputtered substrate without patterns. To introduce the EHD-driven instability, the LCP-coated substrate and the electrode-patterned substrate were assembled with maintaining the cell-gap (d) of 2.0 μm. In our cell conditions, it was found that the EHD-driven instabilities using variable patterned electrode lead to form the patterns with higher than 10 μm in width. Figure 1 shows the binary patterned photo-mask with variable periods and the fabricated LCP patterns with the photo-mask. Based on an analysis of the electric field distribution in the patterned electrode, we investigated and discussed the structural parameters (such as w, l, h, and d) for the FPR formation using the EHD-driven instability.



(a) (b)

Figure 1. POM images of (a) photo-mask and (b) variable patterned retarder observed under crossed polarizers.

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References:

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