Switchable Aperture of Liquid Crystal Lens Array Fabricated with a Hole-Array Patterned Metal Foil Spacer

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Recently, numerous technological development of three dimensional (3D) have been focused on the usage of LC lenses/lens array [1, 2]. For example, integral imaging (InIm) system possesses high potential to provide very good autostereoscopy with full parallax [3], in which a very important optical component of lens array is needed. Comparing with traditional lens array, LC lens arrays possess more capabilities for operations in InIm system including tunable focal length, lens ON/OFF, and so on.

The fabricated liquid crystal lens array (LCLA) has a metal foil spacer (copper, type C1020, 50 μm thickness) with a hole-array (2 mm in diameter for each hole) as shown in Fig. 1, which is sandwiched between two ITO glass substrates. The ITO films on glass substrates are outside the LC cell. The cell was filled with LCs (E7, Merck) to form a 90 degree twisted nematic LC cell by means of coated/rubbed polyimide on glass substrates. Figure 2 shows a cross-section of LC orientations are with respect to two types (type A and type B) of electric operation. Simultaneously, the interference patterns observed with a pair of crossed polarizers are shown in Fig.3 when individually applying voltages of 40 and 180 V rms for two types of electric operation as same types as in Fig. 2. Obviously, switchable aperture of lens array is shown when applying various electric operation. However, disclination lines also appear in lens units.

We demonstrate a LCLA with a metal foil spacer to switch lens apertures when applying two different electric operation on hole-array metal foil. The advantage of the dual-aperture LC lens array is that the aperture is switchable between type A and type B, and focal length tunable by electrically controllable. The parameters of LCLA are necessary to be optimized by simulator, which can improve the focusing function of it. The optimized LCLA can be used to InIm system.

References:

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