Study of light out-coupling efficiency and image quality improvement of OLED with conical micro-lens array film

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Organic light emitting diode (OLED) is considered as the next generation display, however, due to its multi-layered structures and total internal reflection, most of the light is confined within the OLED structure, causing low light out-coupling efficiency. Applying conical micro-lens array film (CMLAF) to OLED can be a good method for solving this problem. Besides, CMLAF is advantageous for its better out-coupling efficiency enhancement ratio and easier manufacturing process as compared to other geometric micro-structures.

In this study, the base diameter of CMLAF is 10μm and the gap between two conical micro-lenses is 1μm. Under the premise, we analyze the out-coupling efficiency enhancement ratio of OLED with CMLAF for different base angles and heights of the conical micro-lens as illustrated in Fig. 1. Regardless of what base angle is, out-coupling efficiency enhancement ratio can be high while the height of conical micro-lens is 5μm. In other words, out-coupling efficiency enhancement ratio is better while the height is a half of the diameter of conical micro-lens. The out-coupling efficiency enhancement ratio can be reached to 42.16% while the base angle is 70°.

Fig. 2 (a) and (b) show the mutual interference of pixels for base angles of 45° and 70° of CMLAF of 5 μm in conical micro-lens height and 0° in viewing angle. We discover the overlap between two pixels can be decreased for larger base angles of conical micro-lens under such condition.

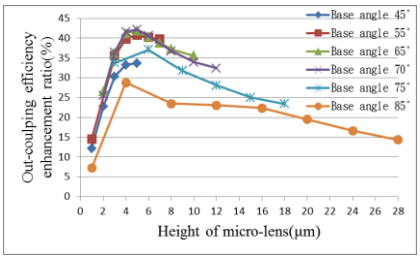

Fig. 1 Enhancement ratio

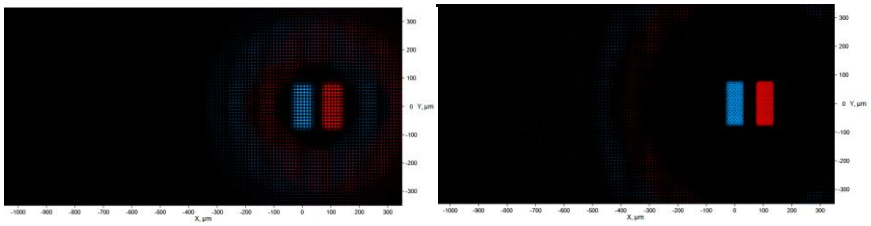

Fig. 2. Luminance for base angles of 45° and 70°

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