Fabrication of Micron-Size Lens Arrays to Enhance Light Extraction Efficiency of Organic Light Emitting Devices

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Conventional organic light emitting devices (OLED) are deposited on flat glass substrate. The light escaping cone from inside the device is limited by the critical angle at the glass/air interface. Thus, the light extraction efficiency (ηout) of OLED is only ~20%. The purpose of this project is to fabricate microlens arrays on substrate surface of organic light emitting devices (OLED) to redirect high-angle rays to within the escape cone, so that light extraction efficiency can be enhanced (Figure 1). The microlenses were fabricated by Nanoimprint lithography, following (Figure 2): 1) Hexagonal arrays of small openings (1μm dia) are patterned on photoresist on a glass mold; 2) Mold etched in BOE to achieve hemispherical shape; 3) After photoresist removal, mold is pressed against PMMA layer at 200ºC and 240 PSI; and 4) Mold released after cool-down. Figure 3 shows the SEM image of the fabricated microlens arrays on the substrate surface. Figure 4 shows the quantum and power efficiencies of OLED with microlens arrays (solid) are enhanced by (49±4)% compared to those of conventional OLED (open). This project is supported by the Department of Energy and by Universal Display Corporation under contract number UDC 2006.

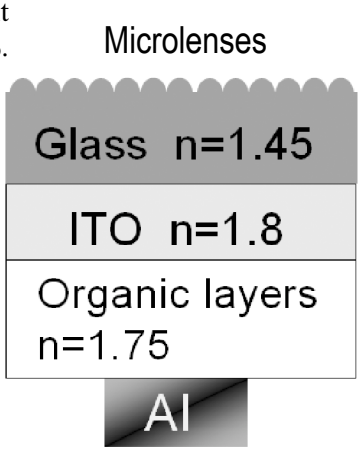

Figure 1

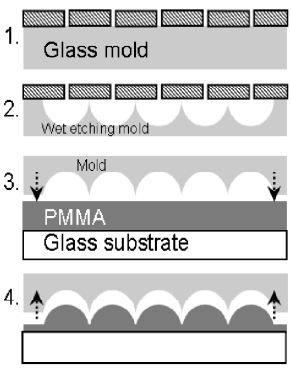

Figure 2

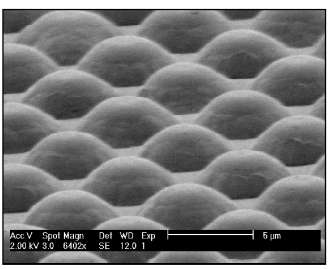

Figure 3

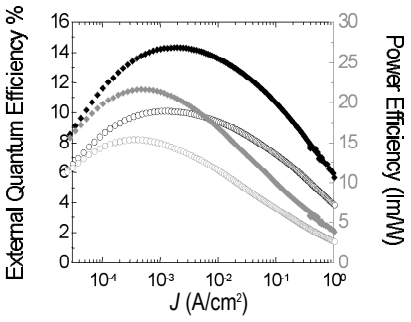

Figure 4