

Improvement of Light Out-coupling Efficiency in Organic Light-emitting Diodes with Micro-Lens Array

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This paper reports how a micro-lenses array can affect OLEDs for enhancing out-coupling efficiency. The OLED is manufactured with micro-lens emits more light than the OLED without the micro-lens. To form micro-lens array, the front side of the glass will be hydrophobic treatment, and a micro-lens is formed on the hydrophobic surface.

High efficiency OLEDs are required for display and solid state lighting applications, as mentioned above. Devices with nearly 100% internal quantum efficiency have been achieved by using phosphorescent emitting materials.

However, due to the mismatch of the refractive index between air and the organic light-emitting device, most of the generated light is lost through total internal reflection (TIR) into the waveguiding modes in glass substrate, ITO and organic layer, and self absorption. The typical out-coupling efficiency is as low as ~20%. This low coupling efficiency becomes the limitation to high efficiency.

In order to overcome the limitation of efficiency, various methods have been proposed to increase the out-coupling efficiency. Peng et al reported OLED on micro-lens array substrate. In this report, over 65% light is extracted from the OLED on the micro-lens array substrate as compared with the conventional device, but this device is require to complex structure by multiple process.

Therefore, we propose OLEDs on micro-lens array based on simply fabrication method. The backside of ITO glass is coated with a hydrophobic material. Then, micro-lens array with 100 μm size is formed on the hydrophobic surface by screen printing method without complex process such as photolithography, RIE etc. Through this simple process, its efficiency is over 26% than not micro-lens formed OLED.

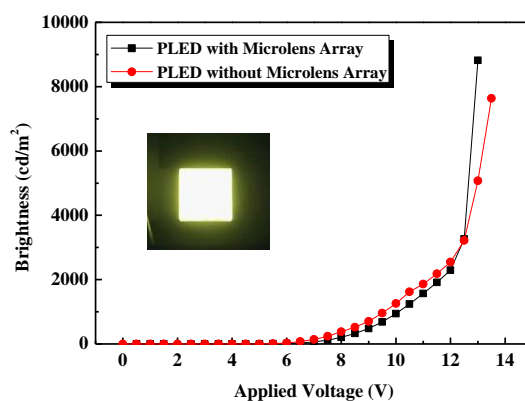


Fig. 1. Efficiency of PLEDs with and without the micro-lens array.

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