Enhancement of Light Extraction in Organic Light Emitting Diodes with porous polymer film for viewing angle dependency

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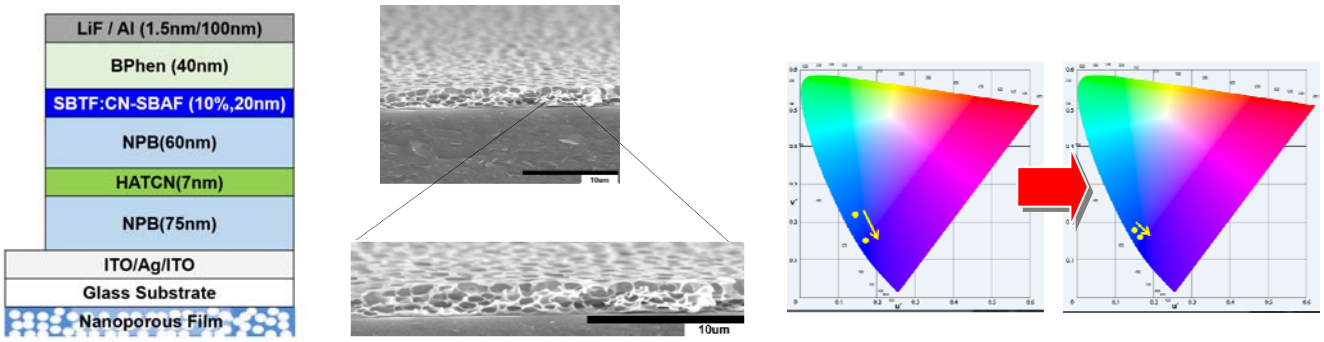
The fraction of outcoupled photons into the forward viewing space from an organic light emitting diode(OLED) fabricated on planar glass is typically ~20% due to lots of loss originated from the substrate mode, waveguide mode, and surface plasmon mode, etc. The light extraction improvement techniques in OLED is essential to advance large area OLED displays in terms of power consumption and lifetime. There have been lots of methods to improve the outcoupled light emission as follows: i) micro-cavity structure, ii) photonic crystals, iii) nanoparticles, iv) nano-structuring including corrugated structures and ii) gradient refractive index structure to extract surface plasmon mode, etc. Although they could be used as a commercial applications such as OLED lightings and displays, it is very difficult to apply them because they normally requires complicated processes which may result in high production cost.

In this study, we report simple method to apply a porous polymer film which can be obtained by very simple spin-coating process during continuous supply of water droplets. And, we found that it is very effective to improve a viewing angle dependency of blue OLED with strong microcavity characteristics. We used 2nd-order microcavity conditions with a thick hole transport layer (HTL), as the total thickness of the 1st-order cavity device is too thin to cover the dust from the anode side. In other words, we found that nano-porous polymer film could effectively reduce the viewing angle dependency of the microcavity OLEDs.



(a) **(b)** **(c)**

Fig. 1. (a) Device structure of microcavity OLED with randomly distributed nanoporous film as a nanoscatter layer (b) SEM image of porous film (c) color coordinate by CIE 1976 system (left: microcavity device, right: microcavity device with porous film)

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