Improved luminous efficacy of hybrid tandem white OLEDs with a Li-doped charge generation layer

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The superior characteristics of organic light-emitting diodes (OLEDs), being ultra-thin, high flexibility, wide viewing angle, the vivid impression of a color and so on, give rise to a rapid growth in small-size display market. In addition, 55-inches TV products based on white organic light-emitting diodes (WOLEDs) was recently released and are expected to has a great potential for growth. A WOLED with RGB color filter scheme is regarded as a more pratical approach for large-size applications than a RGB-patterned scheme due to the technical issues of a fine metal mask. However, RGB color filters can cause efficiency loss in display, hence the development of efficienct WOLEDs is one of the important factor to fabricate a large-size display.

Tandem architecture is widely used to realize WOLEDs due to high efficiency, long lifetime, and color stability. In the tandem OLEDs, the suppressed voltage loss in a charge generation layer (CGL) is important for the development of low driving voltage and high luminous efficacy.[1,2] In this paper, we report high luminous efficacy tandem WOLEDs with optimal CGLs. Various electron transporting materials used as a nCGL with Li doping, resulting in similar turn-on voltage. However, they influences on the electrical propertis of tandem WOLEDs, especially an operating voltage. Depending on nCGL, the operating voltage at 5mA/cm^2 can be reduced by 0.8V as shown in Fig 1. With an optimization of CGL and each unit cells (fluorescent blue and phosphorescent yellowish-green) in hybrid tandem WOLEDs, we demonstrated power efficiency of 42.7lm/W and external quantum efficiency of 28.8% without any light extraction techniques. In addition, hybrid tamdem white OLEDs in this study exhibited a lifetime of over 40,000 hours at 1,000 nits. Finally, WOLEDs with light extraction techniques results will be discussed.

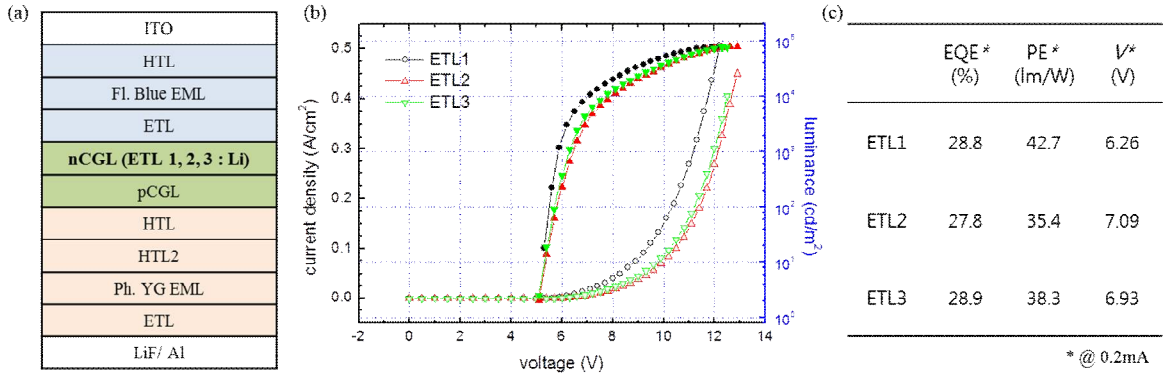

Fig. 1. (a) Device structure, (b) current density- voltage-luminance characteristics, and (c) efficiency table at 5mA/cm^2 of tandem WOLEDs

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References

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