Effect of Triplet Harvesting on Efficiency and Lifetime of Hybrid Blue and White Organic Light-Emitting Diodes

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White organic light-emitting diodes (WOLEDs) have drawn tremendous attention as solid-state lighting due to their merits of thinness, light weight, and environmental friendliness. Generally, WOLEDs are designed with the emissive materials by combining three phosphorescent emitters for the colors; blue, green, and red.[1] However, there is no perfect blue phosphorescent emitter in terms of lifetime and color stability up till now, limiting the development of all-phosphor-doped devices.[2] To solve the problem of blue and white phosphor-doped OLEDs, the device combining fluorescent and phosphorescent emitters in emitting layer (EML), which promises higher device stability were suggested.

In this work, the device architecture, triplet harvesting (TH) system as EML, was developed for the transfer of the triplet excitons from fluorescent emitter to phosphorescent emitter, where they can decay in radiation. This concept of the TH is to transfer the non-radiative triplet excitons from fluorescence to radiative triplet excitons in phosphorescence.[3] The TH for the hybrid blue and white OLEDs, which combines a fluorescent with a phosphorescent emitter, has achieved advanced efficiency and reduced efficiency roll-off. Figure 1 shows the changes in both external quantum efficiency (EQE) roll-off and lifetime at 80% of 1,000 cd/m^2 with the respect of fluorescent doping concentrate in hybrid WOLEDs. The EQE roll-off and CIE coordinate values (see Fig. 1 inset) between 1,000 and 10,000 cd/m^2 for hybrid white devices are stabled. The TH system with fluorescent and phosphorescent within EML may be useful to fabricate stabilized device and enhance the lifetime for future OLED display.

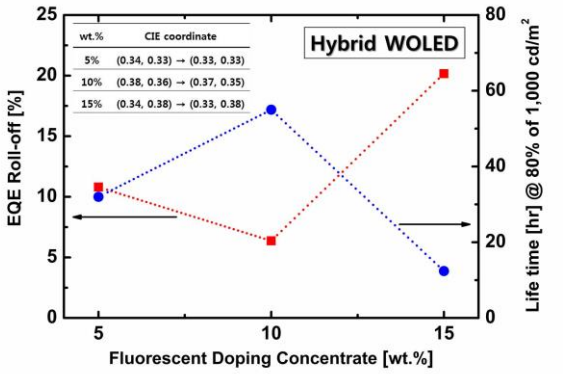

Fig. 1. EQE roll-off and lifetime at 80% of 1,000 cd/m^2 versus fluorescent doping concentrate.

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