MASTER'S THESIS

White light organic light emitting device

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ABSTRACT

White light organic light-emitting devices (WOLEDs) which are available as distributed sources rather than point sources of light can be contributed to solid-state lighting and backlight applications. Fabricating an efficient doped WOLED with high stability as well as cheerful colour quality would be the main concern in this paper.

By studying the recombination and transport processes in multilayer OLEDs, the simplest white light emitting structure found is device composed of only Alq_3 and MADN as emitters (*WAM2)*. The overall efficiency of 6.8 cd/A and 3 lm/W at 7.2 V corresponding to 1360 cd/m^2at 20mA/cm^2. Device fabricated by host-dopant system with additional dye thin film (*WRdRb)*, the CRI reaches 80 with CCT at 5400 and CIE coordinates (0.33, 0.34).

Another disable colour quantity is obtained in white device composed of DCJTB doped in Alq_3 as red emitter (*WDcA2)*, which has 81 in CRI with 4701 in CCT and CIE coordinates (0.36, 0.38). Moreover, the luminance yield and brightness of device *WDcA2* enhance 1.5 times to 10 cd/A and 2043 cd/m^2 with power efficiency 30% more than devices *WAM2* and *WRdRb*.

The luminance and yield of device fabricated by DCJTB doped in NPB as red emitter (*WDcN2)* is 2957 cd/m^2 and 14.8 cd/A respectively corresponding to 7.4 V, which doubled the performance in device *WAM2* and *WRdRb*. Furthermore, the device reached a half-decay $t_{1/2}$ life time over 8,000 h and 57, 000 h at an initial luminance of 1000cd/m^2 and 300 cd/m^2 respectively. This result is among the best records of fluorescent white light OLED.

This work shows that by optimizing the matching in dyes and hosts, and also minimizing the number of materials being used in WOLED. We have designed through studying their recombination and transport mechanism new WOLED with higher efficiency.

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