

Electronic Supplementary Information (ESI) for RSC Advances.

The recombination zone adjusted by gradient doping of TPA-DCPP for efficient and stable deep red organic light emitting diodes

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We prepared devices B with the same structure as devices A except the different location of Ir(ppy)₃ in the EML with 10 periods. The series EML of B devices were prepared:

B1: CBP(3nm)/Ir(ppy)₃(1.2nm)/[CBP(3nm)/TPA-DCPP(1.2nm)]₉

B2:[CBP(3nm)/TPA-DCPP(1.2nm)]₂/CBP(3nm)/Ir(ppy)₃(1.2nm)/[CBP(3nm)/TPA-DCPP(1.2nm)]₇

B3:[CBP(3nm)/TPA-DCPP(1.2nm)]₄/CBP(3nm)/Ir(ppy)₃(1.2nm)/[CBP(3nm)/TPA-DCPP(1.2nm)]₅

B4:[CBP(3nm)/TPA-DCPP(1.2nm)]₆/CBP(3nm)/Ir(ppy)₃(1.2nm)/[CBP(3nm)/TPA-DCPP(1.2nm)]₃

B5: [CBP(3nm)/TPA-DCPP(1.2nm)]₈/CBP(3nm)/Ir(ppy)₃(1.2nm)/[CBP(3nm)/TPA-DCPP(1.2nm)]

B6: [CBP(3nm)/TPA-DCPP(1.2nm)]₉/CBP(3nm)/Ir(ppy)₃(1.2nm)

A5: [CBP(3nm)/TPA-DCPP(1.2nm)]₁₀

The electroluminescence spectra of all devices are as follows:

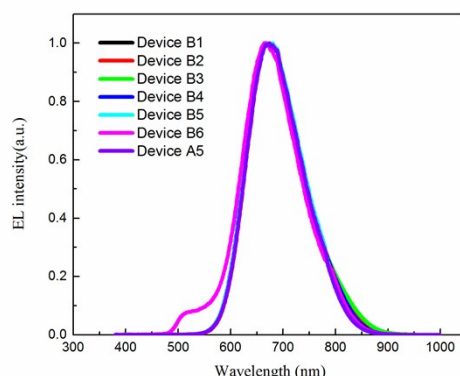


Fig.S1 Under 10V voltage, the normalized electroluminescence spectrum of the device with the sensing layer at different positions

Experiment

In this paper, ITO is purchased from South China Xiangcheng Technology Co.Ltd., the size is 19.4 *19.4 *1.1 mm, square resistance $\leq 15 \Omega$, transmittance over 86%,

The specific process is as follows.

1. The ITO substrate was soaked in the cleaning solution and then treated by ultrasonic for 30 minutes.
2. The ITO substrate was immersed in deionized water, and then treated by ultrasonic for 30 minutes. The process was repeated twice.
3. The ITO substrate was immersed in alcohol, and then treated by ultrasonic for 30 minutes. The process was repeated twice.
4. The ITO surface was dried with nitrogen (purity $\geq 99.5\%$), and then put it into the plasma processor for 90 s plasma treatment.
5. The treated ITO substrate was placed in the evaporation chamber (under a pressure of below 1×10^{-4} Pa) for the preparation of organic films. Organic materials such as NPB and CBP were deposited in a quartz boat at a rate of 0.3-0.5 Å/ S. Inorganic materials such as MoO₃ and LiF need to be heated in a molybdenum boat, and the evaporation rate is 0.05 Å/ S. The film thickness and evaporation rate

were monitored by quartz crystal. In the device, the thickness of MoO₃ is 5 nm, the thickness of NPB is 33 nm, the total thickness of CBP is 30 nm, and the total thickness of TPA-DCPP is 12 nm, the thickness of Bphen is 45 nm, the thickness of LiF is 0.5 nm and the thickness of Al is 100 nm.

6. Then the electrode was evaporated by strip mask, the evaporation rate of Al cathode is 1-2 Å/S. This is the end of sample preparation.