DOI: 10.3969/j.issn.1003-501X.2017.03.012

Green OLED based on double metallic mirrors in microcavity structures and double light-emitting structure

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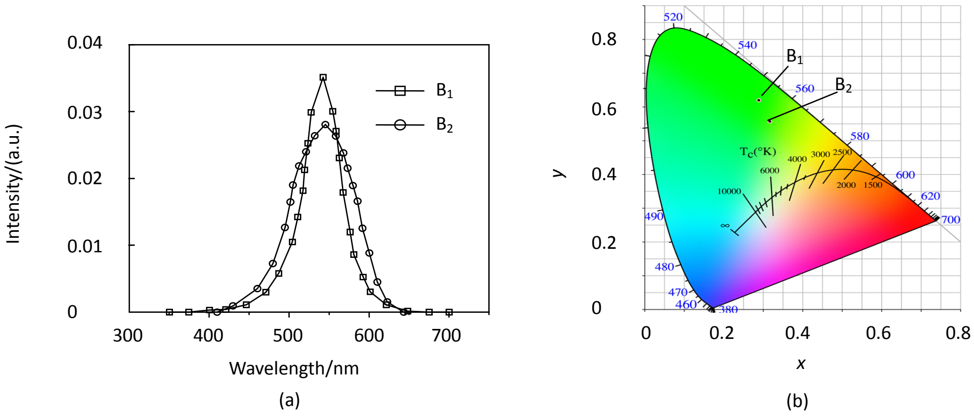

Comparison of B_1 and B_2.

Abstract: Organic light emitting devices (OLEDs) have some performances, such as low power consumption, ultra-light, fast response speed, high-definition, self-luminous and viewing angle, etc, which are expected to become a mainstream of the next generation of display devices. It is found that the microcavity structure can narrow the luminescence spectrum of the thin film and improve the luminescence color purity of the device effectively. We prepared a light-emitting device by using high vacuum deposition process and high-precision film thickness detector. This paper designed and prepared the green OLED devices based on double metallic mirrors in microcavity structures, of which the process was by vacuum evaporation and double metallic mirrors of devices: Al/MO_3 as device of anode and hole injection layer, and LiF/Al as device cathode and electron injection layers. Organic material C545T was as green microcavity device of light-emitting materials. The device structure is Al(20 nm)/MoO_3(4 nm)/2T-NATA(10 nm)/NPB(15 nm)/NPB:C545T(x%, 20 nm)/Alq_3: C545T (4%, 20 nm)/Bphen (35 nm)/LiF(1 nm)/Al(200 nm), where x is the doping concentration, denoted as device B_1. In order to analyze the microcavity effect, another preparation was made based on the ITO reference device B_2. The microcavity effect of the device was analyzed by comparing the device's luminous brightness, luminous efficiency and luminescent color purity. The experimental results show that the device has the best optical and electrical properties when the doping concentration of device B_1 is 3%. We found B_1 and B_2 color coordinates, (0.289, 0.620) and (0.317, 0.557), respectively. It can be judged that the luminescent color of the microcavity device B_1 is purer. Then, microcavity device for microcavity effects could improve forward direction luminance intensity and luminance efficiency. At 100 mA/cm^2, the brightness of devices B_1 and B_2 are 5076 cd/m^{2}and 4818 cd/m^2, and the maximum brightness of the both devices are 9277.7 cd/m^2 and 10440 cd/m^2. At 100 mA/cm^2, luminance efficiencies of devices B_1 and B_2 are 6.0 cd/A and 5.61 cd/A, and the maximum luminance efficiencies of the both devices were 8.6 cd/A and 7.97 cd/A. We can conclude that, compared with the reference device, the green microcavity device has better luminous efficiency and color purity than the reference device under the effect of the microcavity, and the photoelectric performance of the device is best when the C545T doping concentration is 3% and the thickness is 20 nm.

Keywords: OLED; green microcavity device; C545T; Al/MoO_3; double light-emitting layer structure; double metallic mirrors; device research

Citation: An Tao, Wu Junyu, Li Peng, *et al*. Green OLED based on double metallic mirrors in microcavity structures and double light-emitting structure [J]. *Opto-Electronic Engineering*, 2017, **44**(3): 356-361.

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