Optical Modeling of a Top-Emitting Organic Light Emitting Composite Cathode Device using a High Refractive Index Metal

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It is widely recognized that the development and optimization of organic light emitting (OLED) stacks could be speeded up using electrical and optical modeling of their behavior [1] [2]. And it is much easier to obtain accurate optical performance of OLED device for optical modeling only considering the refractive index (n) and absorption coefficient (k).In addition, the color shift of view angular in top-emitting organic light emitting (TEOLED) became serious because of the cavity effect.

In this paper, the optical modelings of TEOLED composite cathode device using a high refractive index metal MC07 was built to find the optimal combination of cathode and couping layer (CPL). First of all, the basic OLED device structure of Ag/ITO/HIL/HTL/EML/ETL/cathode/CPL was designed, and by changing the thickness of cathode, inserting MC07 and optimizing the thickness of CPL based on the color coordinate of 0°view angle, the various optical model was generated, and the detail device structure and number is shown in table 1. After comparing the vertical viewing angle of these different structure device, the color coordinate tend to be deep blue (fig. 1a) when the device use thicker Ag and composite cathode structure of Ag/MC07 (5nm)/Ag (5nm). Fig. 1b show the color shift at different viewing angles, and the best composite cathode structure for minimum color shift is Ag (12nm)/MC07 (5nm)/Ag (5nm)/CPL (36nm) of D14.

Building optical model of TEOLED and using composite cathode which consist of thick Ag and MC07 and optimizing CPL, the best optical performance especially color coordinate and shift of view angular has been achieved. And thicker Ag, composite cathode and optimizing CPL become the three key factors for deep blue and minimum color shift. These results suggest that such factors have good potential applications in practical flat panel displays.

Table 1. The detail device structure and number

Device	A01	A12	A03	A14	B01	B12	B03	B14	C01	C12	C03	C14	D01	D12	D03	D14
Ag (nm)	25	25	25	25	20	20	20	20	15	15	15	15	12	12	12	12
MC07 (5nm) /Ag (5nm)	×	○	×	○	×	○	×	○	×	○	×	○	×	○	×	○
CPL (nm)	0	0	43	36	0	0	43	33	0	0	44	35	0	0	46	36

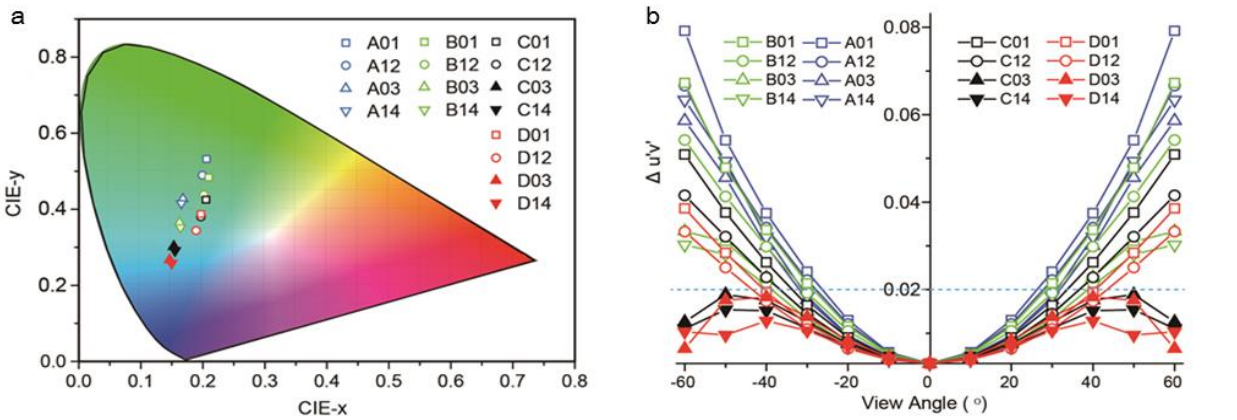

Fig. 1. (a) CIE1931 color coordinate of 0° viewing angle; (b) The color shift of viewing angle

References

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