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## Auxiliary anode on large-area organic light-emitting diode lighting

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Organic light-emitting diodes (OLEDs) have been made for full color displays. However, many issues are involved in the fabrication of large-area OLED panels such as a short circuit, low luminous intensity, non-uniformity of light emission, etc. The non-uniform light distribution is attributed to the limiting conductivity of ITO. Therefore, an auxiliary metal electrode as grid patterned on ITO has been used. In this work, we investigate the feasibility to control the auxiliary metal electrode effects in OLEDs by introducing a striped Ag and Au metal layer between ITO/HTL layers. To provide guidelines for design optimization of large-area OLED panels such as the space and thickness of the patterned metal lines and the OLED layer thickness are investigated. We have first fabricated the small-area (3x3 cm<sup>2</sup>) OLED device without auxiliary electrode in structure of ITO/CuPc (10 nm)/NPB (40 nm)/Alq<sub>3</sub> (60 nm)/LiF (0.8 nm)/Al (150 nm). The result shows the luminance, current efficiency and driving voltage of 764 cd/m<sup>2</sup>, 3.82 cd/A and 9.25 V, respectively, at 20 mA/cm<sup>2</sup>. Then, to obtain homogeneous light, we have deposited auxiliary Ag or Au on ITO, patterned Ag or Au in the form of a grid with a grid space of 2, 4, and 6 mm in device structure of ITO/Ag or Au (15 nm)/CuPc (10 nm)/NPB (40 nm)/Alq<sub>3</sub>(60 nm)/LiF (0.8 nm)/Al (150 nm). It was seen that the optimal auxiliary electrode material and line space of Au in line space 6 mm were obtained. The result shows the luminance, current efficiency and driving voltage of 690 cd/m<sup>2</sup>, 3.45 cd/A and 7.49 V, respectively, at 20 mA/cm<sup>2</sup>. The snapshot light emission of the 3x3 cm<sup>2</sup> OLED of Au line space 6 mm metal grids were investigated. The average luminance of 420.9 cd/m<sup>2</sup> and uniform luminance of 95% at 10 mA/cm<sup>2</sup> were achieved. This uniform luminance is higher than that of without metal grids about 9.8 %. Finally, the auxiliary electrode of Ag and Au grid were applied to the area of 6x6 cm<sup>2</sup> OLED device. The Au in line space 6 nm device shows high the luminance, current efficiency and low driving voltage is 203 cd/m<sup>2</sup>, 2.03cd/A and 9.5 V at current density of 20 mA/cm<sup>2</sup>, respectively. While the Ag in line space 4 nm device shows high uniform luminance of 94%. This indicates that the grid metal layers are expected to be helpful in reducing the sheet resistance of the transparent electrode; we expected that our approach can be easily integrated with existing OLED architectures, in particular, large-area device.

### Biography

Apisit Chittawanij was born in Chiang Mai, Thailand on May 7, 1982. He received the BS degree and MS degree from Thammasat University, Pathumthani, Thailand in 2007 and 2011. Recently, he is studying Doctoral program in Institute of Electro-Optical and Materials Science, National Formosa University, Taiwan. His research interest in organic light - emitting diodes includes materials, high efficiency, encapsulation, and long life time and solution process of OLEDs.

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