Wide Color Gamut Top-Emitting White Organic Light-Emitting Diodes for High Quality Display Application

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The organic light-emitting diodes (OLEDs) have been widely investigated for the lighting and flat panel display application [1,2]. For the high resolution display, active matrix OLEDs (AMOLEDs) using thin film transistors (TFTs) are promising technology. The top-emitting OLEDs (TEOLEDs) have many advantages compared with the conventional bottom-emitting OLEDs (BEOLEDs) in active matrix driving because of high aperture ratio of pixels, broad applicability of various substrates and easy control of color purity using microcavity effects [3,4]. For large area full-color display application, combining color filters with white OLEDs is the most promising candidate due to reduced shadow mask chaging process, which decrease production yield [5]. However, white BEOLEDs usually emit broad electroluminescence spectra which match poorly with the transmission spectra of color filters. The RGB color filtered from BEOLEDs usually are less saturated and have narrow color gamut [6]. From this point of view, white TEOLEDs have great potential to demonstrate wide color gamut in display application.

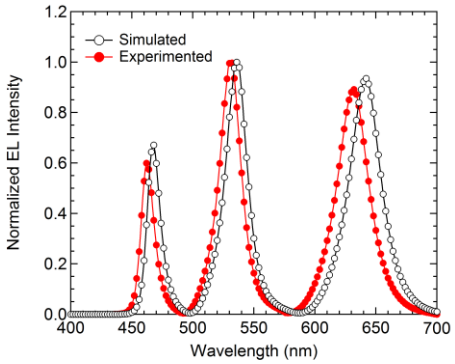

Fig. 1. The emission spectra of the fabricated white TEOLEDs and simulated in the normal direction.

In this paper, we fabricated multimode white TEOLEDs having narrow three peaks by modulating charge transporting layer thickness to control cavity length. Moreover, the used tandem architecture is beneficial for emitter position optimization and reducing color shift by changing applied voltages. The white TEOLEDs exhibit improved color purity and wide color gamut, even wider than NTSC color gamut. The current efficiency of TEOLED reach 29.4 cd/A at 1000 cd/m^2. We believe that the white TEOLEDs with microcavity effect can be applicable for high-quality wide color gamut display application.

Acknowledgment

This work was supported by the Industrial Strategic Technology Development Program (no. 10042412) funded by the Ministry of Trade, Industry and Energy of Korea.

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