White Quantum Dot Light-Emitting Diodes with Improved Performance Using Conjugated Polyelectrolyte

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Quantum dot light-emitting diodes (QLEDs) are promising lighting sources for display applications because they have very high color purity and wide color gamut, compared to LCD and organic light-emitting diode (OLED) displays. Also, white QLEDs have simple device architecture with one mixed emission layer compared with white OLEDs, that have stacked tandem structure, due to restricted energy transfer between quantum dots (QDs) when the thickness of QDs is sufficiently thick [1]. Because the efficiency of the blue QLED is much lower than the green and red ones, the relative concentration of blue QDs in the mixed emission layer should be higher than the other color QDs to obtain balanced white emission. In addition, the larger bandgap of blue QDs can cause inefficient charge injection from charge transport layer to QDs. Thus, the optoelectronic characteristics of the white QLED are determined by the performance of blue QLEDs [2]. We demonstrate bright and color stable white QLEDs by inserting thin conjugated polyelectrolyte (CPE) layer between electron transport layer (ETL) and QDs. We found that the device with CPE layer exhibits significantly increased current density and luminance. Also, the CIE coordinates of the device with CPE layer shows less variation along with the increase of luminance compared to the device without CPE layer. The improved device performance of white QLEDs can be originated from the reduced electron injection barrier between ETL and blue QDs.

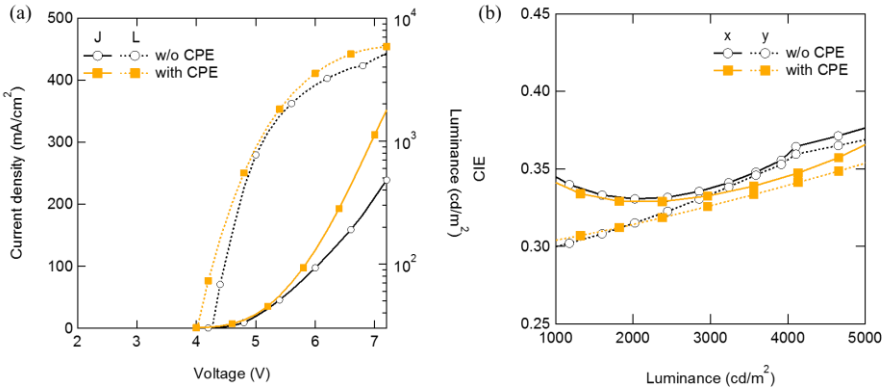

Fig. 1. (a) The current density-voltage-luminance and (b) CIE coordinate-luminance characteristics of white QLEDs with and without CPE layer

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References

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