

Supporting Information

Fabrication of white electroluminescent device based on bilayered yellow and blue quantum dots

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Synthesis of blue CdZnS/ZnS QDs: In a typical synthesis of alloyed CdZnS core QDs, 1 mmol of CdO, 10 mmol of ZnO, 7 ml of oleic acid (OA), and 15 ml of 1-octadecene (ODE) were loaded in 50 ml of three-neck flask, and heated to 150°C with N₂ flowing, and subsequently the temperature of the reaction mixture was raised to 310°C. And then, 2 ml of a sulfur (S) solution comprising 2 mmol of S dissolved in 3 ml of ODE was swiftly injected into the above cationic mixture at that temperature, and the reaction proceeded for 12 min for CdZnS core QD growth. Another S solution, consisting of 8 mmol of S dissolved in 5 ml of OA, for the successive ZnS shelling, was sequentially added in a dropwise way to the above hot CdZnS QD growth solution, and the shelling reaction was maintained at 310°C for 4 h. The resulting growth solution was cooled down to room temperature, diluted with an excess hexane, and repeatedly centrifuged (9000 rpm/10 min) to remove any undissolved species and by-products. And then, CdZnS/ZnS QDs were subjected to the repeated cycles of purification with a solvent combination of hexane–ethanol *via* centrifugation (9000 rpm/10 min), and finally dispersed in hexane for the spin-deposition of EML.

Synthesis of yellow CIS/ZnS QDs: For synthesizing CIS core QDs, 0.125 mmol of CuI, 0.5 mmol of In acetate, and 5 ml of ODE were placed in 50 ml of three-neck flask. The mixture was sequentially degassed during heating to 100°C, backfilled with N₂, and further heated to 230°C. And then, 3 ml of 1-octanethiol (OTT), which provides not only the passivating surface ligand but S source for both core and the following shell, was rapidly injected to the above mixture, and the growth reaction of CIS core was maintained for 5 min. For the consecutive ZnS shell overcoating, Zn solution, prepared by dissolving 4 mmol of Zn acetate dihydrate in 4 ml of OA and 2 ml of ODE, was added dropwisely into the hot CIS core growth solution, and the shelling reaction proceeded at 240°C for 1 h. Subsequently, another supplementary Zn solution (4 mmol

of Zn stearate, 4 ml of OA, and 2 ml of ODE), was added and reacted for 2 h. As-synthesized QDs were precipitated with an excess of ethanol, thoroughly purified with a solvent combination of hexane–ethanol *via* centrifugation (9000 rpm/10 min), and then dispersed in hexane for the spin-deposition of EML.

Synthesis of ZnO NPs: For a typical preparation of ZnO NPs, a clear mixture of 5 mmol of tetramethylammonium hydroxide (TMAH) in 10 ml of ethanol was added slowly at room temperature to a Zn solution, comprising of 3 mmol of Zn acetate dihydrate dissolved in 30 ml of dimethyl sulfoxide (DMSO), and then the reaction proceeded for 1 h. And then, ZnO NPs were precipitated with an excess of acetone and dispersed in ethanol for the spin-deposition of ETL.

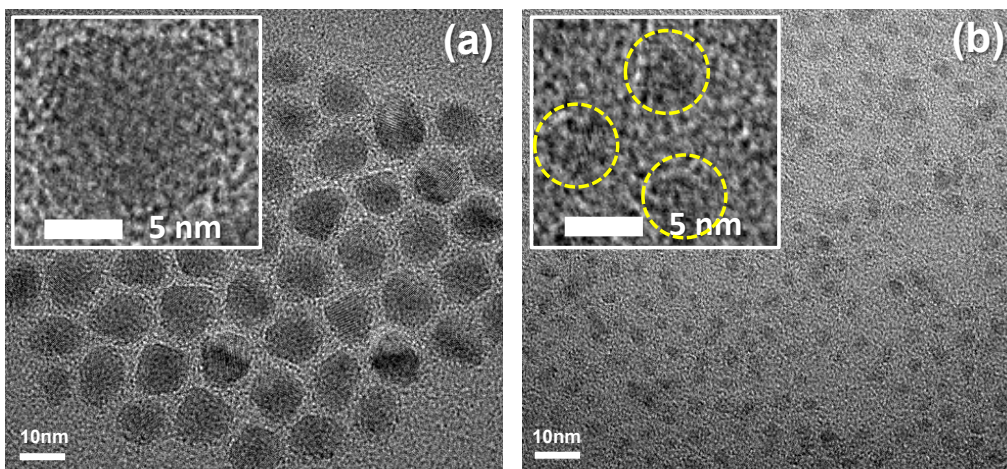


Fig. S1 TEM images of (a) CdZnS/ZnS and (b) CIS/ZnS QDs.

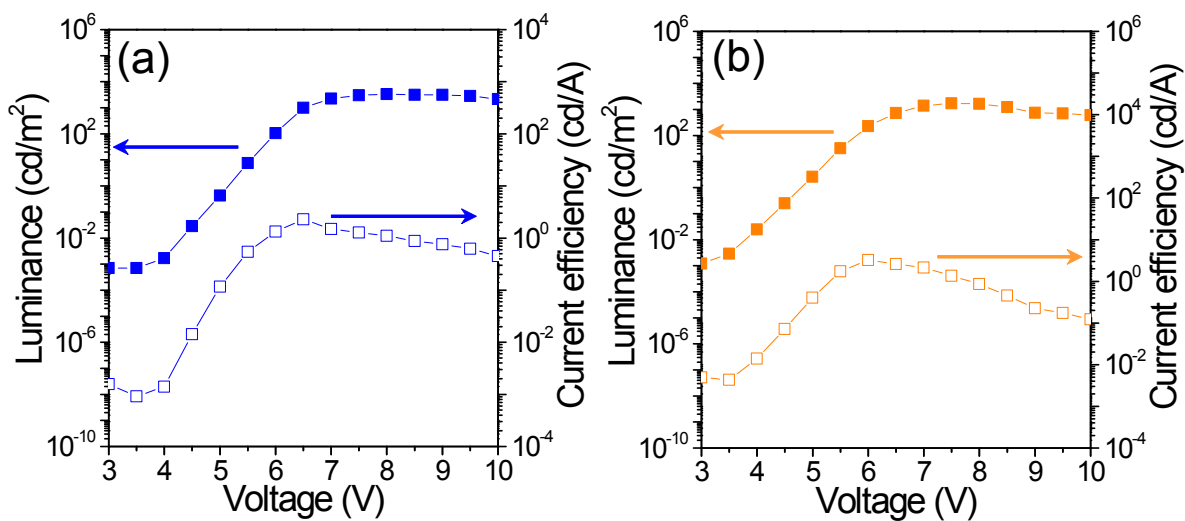


Fig. S2 Voltage-dependent luminance–CE variations of (a) blue CdZnS/ZnS and (b) yellow CIS/ZnS monochromatic QLEDs.

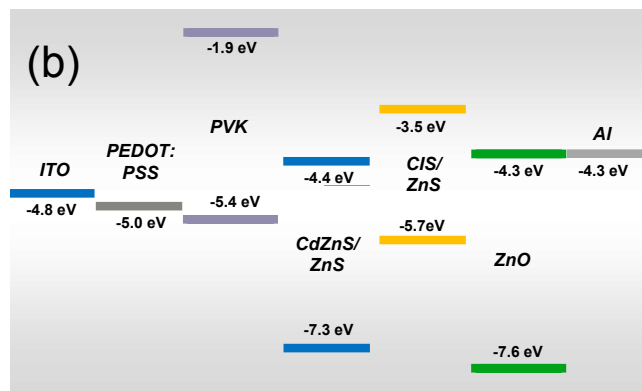
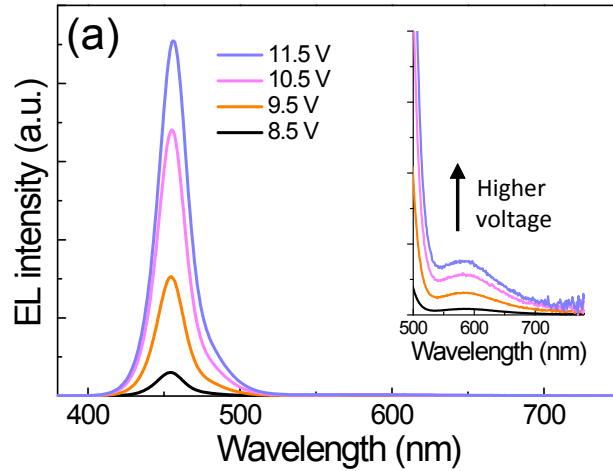


Fig. S3 (a) Voltage-dependent EL spectra along with their close-up spectral region (inset) and (b) energy band diagram of bilayered QD EML-based QLED with a stacking sequence of CdZnS/ZnS // CIS/ZnS QD.

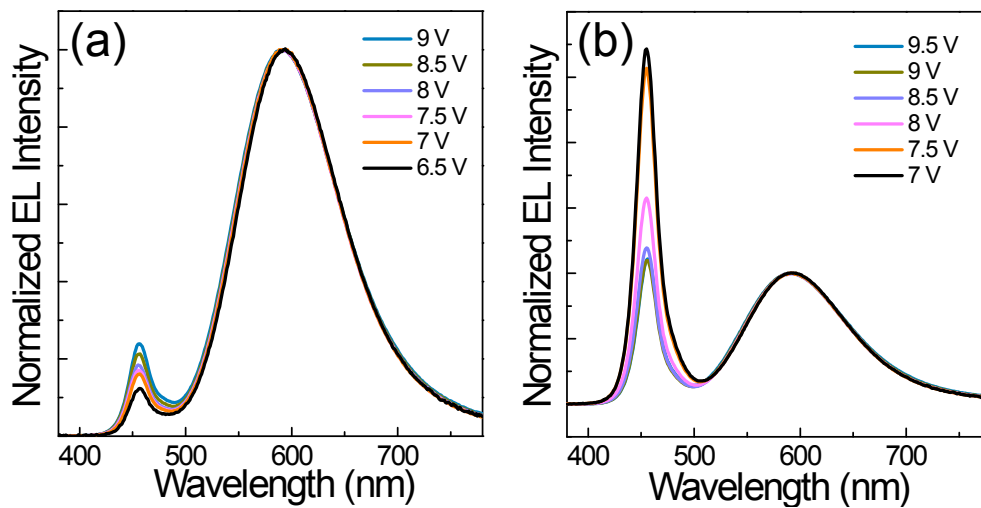


Fig. S4 Normalized EL spectra of (a) device B2 and (b) device B3 as a function of applied voltage.

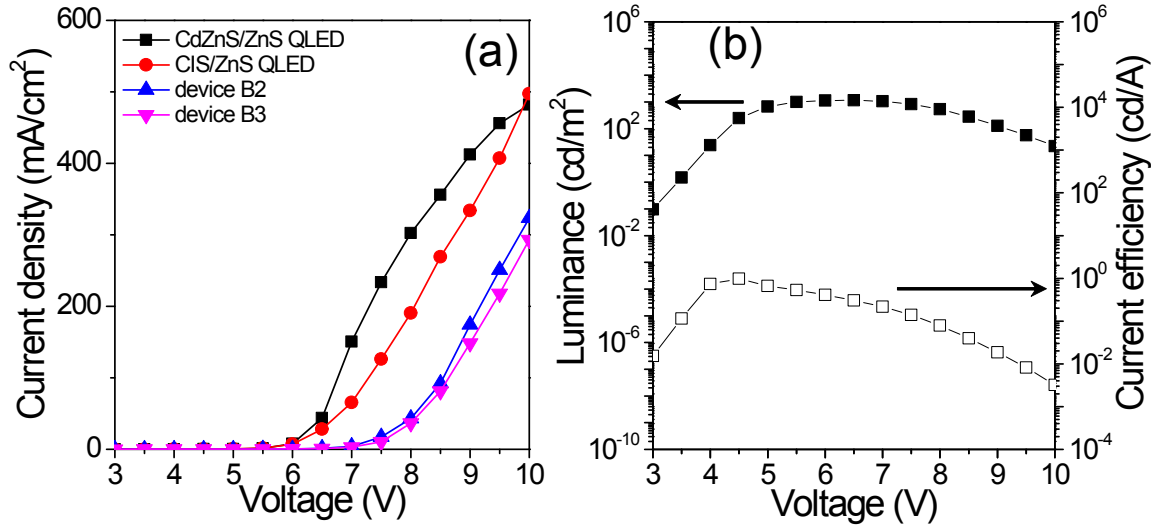


Fig. S5 (a) Voltage-dependent variations of current density of monochromatic QLEDs of CdZnS/ZnS and CIS/ZnS and bicolored white QLEDs of device B2 and B3. (b) Voltage-dependent luminance–CE variations of CIS/ZnS QLED fabricated through 150°C-EML baking.