Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C

Supplementary Information for

Improving the efficiency and reducing efficiency roll-off in quantum dot light emitting devices by utilizing plasmonic Au nanoparticles

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Synthesis and Characterization of Quantum Dots

Chemicals: Cadmium oxide (99.99%), sulfur (99.98%, powder), zinc oxide (99.99% powder), 1-octadecene (ODE, 90%), Oleic acid (OA, 90%), Tri-Octylphosphine (TOP), and Oleylamine (OAm) selenium powder (99.5%, 100 mesh), were purchased from Alfa.

Synthesis of CdSe core NCs: In a typical reaction, a mixture of 0.2mmol CdO powder, 0.5mmol of OA, 3ml ODE and 1ml OA were loaded into three-neck flask， then the reaction mixture was evacuated for 1 hour and heated to 280 °C under Ar-flow to form an optically clear solution. A solution containing 0.1mmol Se dissolved in 2.0 g of TOP was injected into the reaction flask. After the injection, the temperature was adjusted to 250 °C for 1 min. After this time the heating mantle was removed and cooled down to room temperature.

Preparation of the core/shell nanocrystals with different shells: The method of preparing core/shell nanocrystals was similar to that reported in litherature. A typical reaction for synthesis of CdSe/CdS/ZnS nanocruystals was performed as follows. 1.5×10^{-7} mol CdSe dissolved in hexane (0.2 ml), 3 ml ODE and 1 ml of OAm were loaded into a 50 ml reaction vessel, heated to 100 °C under vacuum for 1 hour Subsequently, the solution was heated to 245 °C where the shell growth was performed for growth of shell materials by SILAR method. The red CdSe QDs with an average diameter of 7.5 nm was prepared by growing 4 ML CdS and 2.5 ML ZnS shells on the surface of the large CdSe core with a diameter of 3.0 nm. The green CdSe QDs with an average diameter of 3.6 nm were obtained by growing 1 ML CdS and 2 ML ZnS shells on the surface of the small CdSe core with a diameter of 1.5 nm and an emission of 462 nm. Finally, the reaction solution was cooled down to room temperature. For purification 10 ml of hexane were added and by-products were

removed by successive methanol extraction until the methanol phase was clear. No defect-related emission below the band edge PL was observed in these QDs.

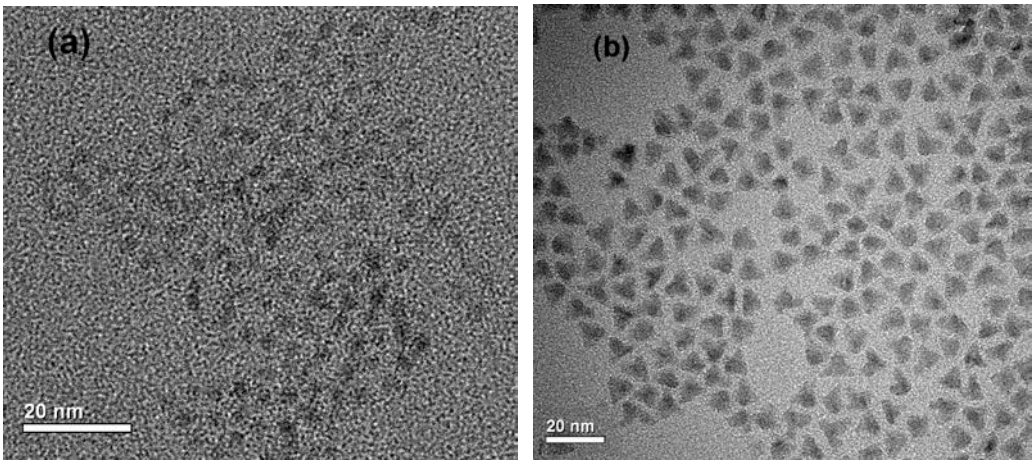

Figure S1. TEM images of green and red CdSe/CdS/ZnS core/multishell quantum dots with average diameter of 3.6 nm (a) and 7.5 nm (b), respectively.

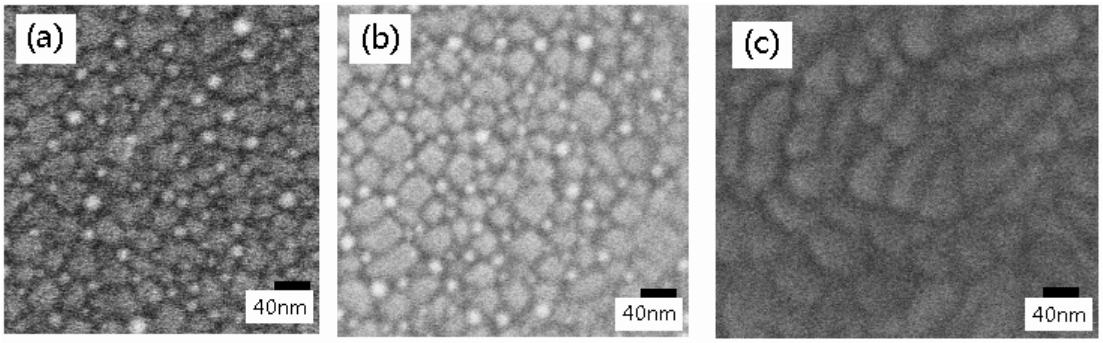

Figure S2. The scanning electron microscope (SEM) images for the substrates of (a) with Au NPs before heating, (b) with Au NPs after heating under 350 ºC for 30 min, and (c) bare substrate.

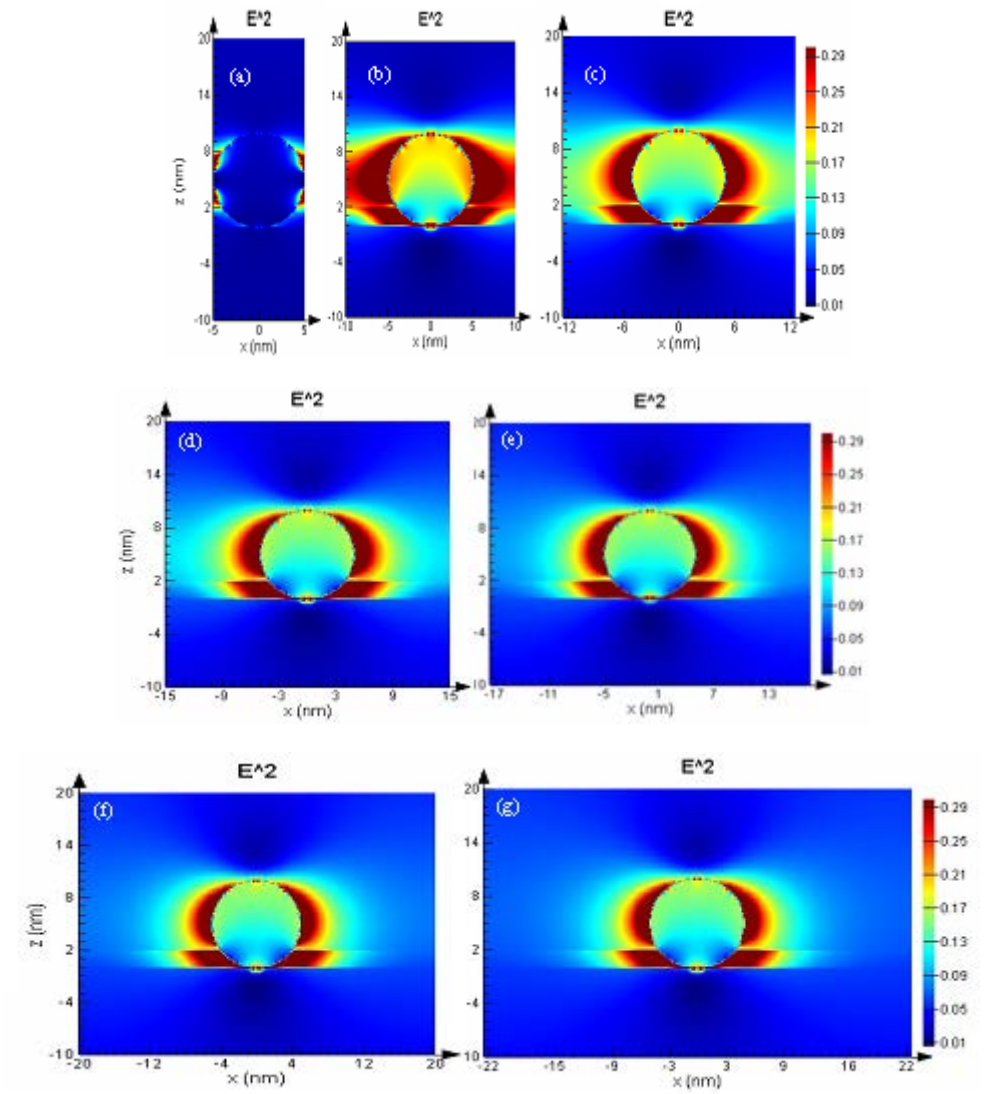

Figure S3. Simulated electric field profiles of devices with Au NPs at the wavelength 540 nm for TM illuminations. Here, z is defined as the light incident direction, and x is the polarization direction. Z direction is perpendicular to ITO surface. The NPs is placed on the ITO substrate and the interface of Au NPs and ITO is the zero of z direction. The structure in this model has the same configuration to the sample S-c.

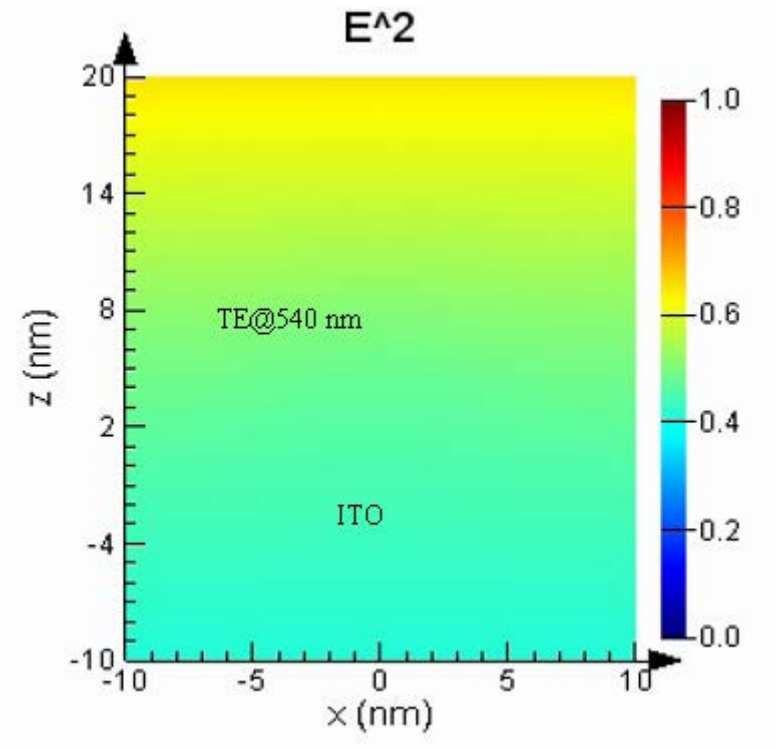

Figure S4. The electric field distribution of the transverse electric (TE) for the sample of S-c.

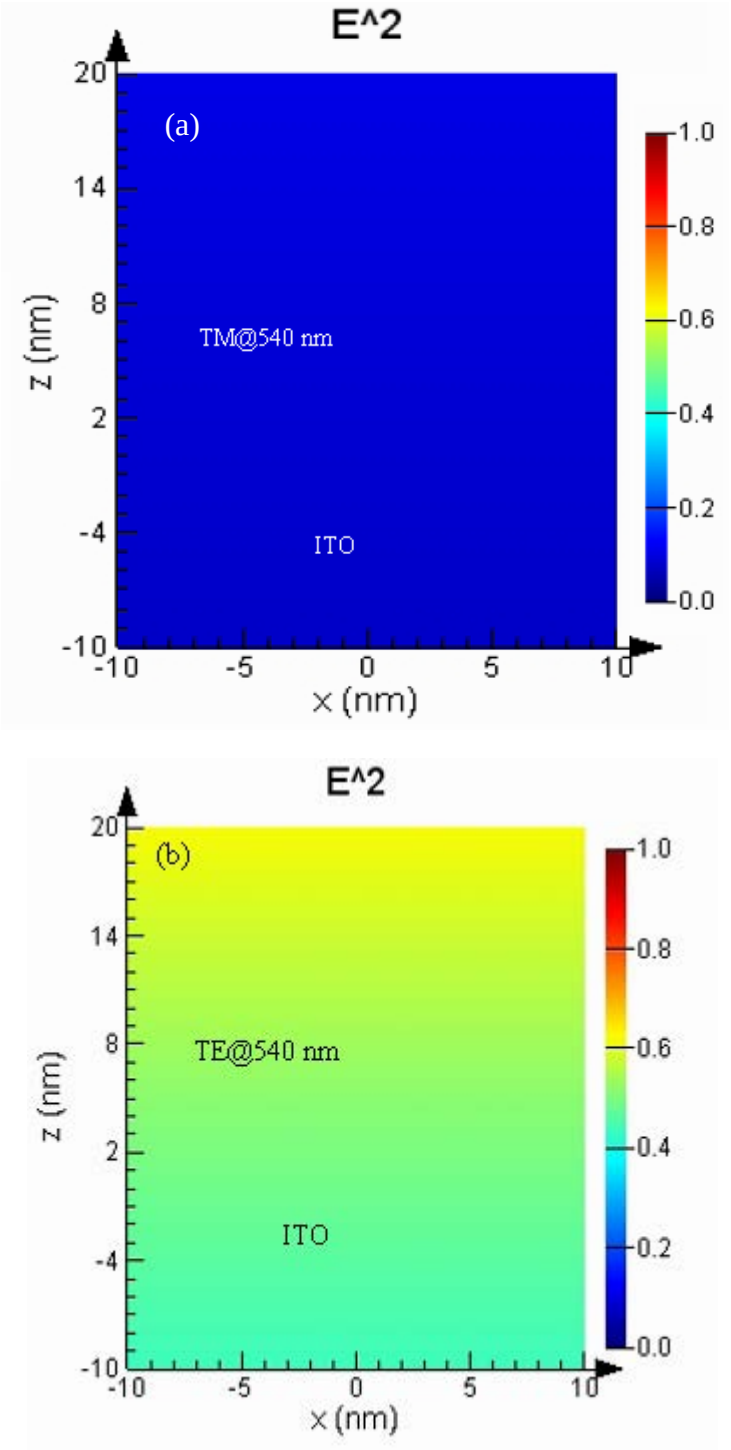

Figure S5. The electric field distribution: (a) the transverse magnetic (TM) and (b) transverse electric (TE) for the structure without Au NPs (sample S-b).

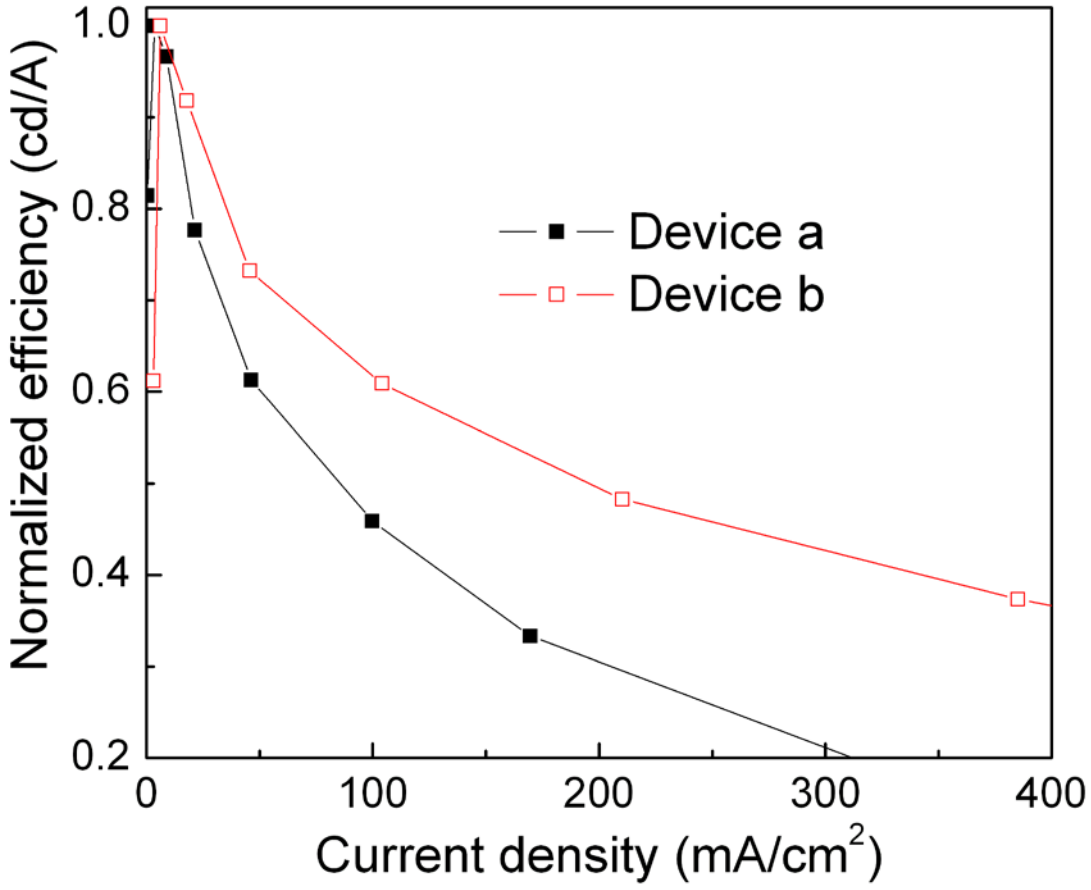

Figure S6. The normalized efficiency of devices a and b.