The influence of the dimensions of $CdSe/Cd_{1-X}Zn_XS$ core/shell type-I heterostructured quantum dots on the performances of light-emitting devices

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We have investigated the relationship between the dimensions of core/shell heterostructured quantum dots (QDs) with the performances oflight-emitting diodes (LEDs). For comparative study, we have synthesized a series of $CdSe/Zn_{1-X}Cd_XS$ core/shell type-I heterostructured QDs having similar optical properties (e.g., photoluminescence energy, full width at half maximum, photoluminescence quantum yield, single exciton lifetime) but varying shell thicknesses (core radius: 2.0 nm, 2.5 nm<= shell thickness <= 6.3 nm). Upon the inverted device architecture, thick-shell QDs have shown higher efficiency andoperational stabilityalong the current sweep within the actual devices.Spectroscopic analysis reveals thatthe suppression of energy transfer and QD charging in thick-shell QDs is indeed responsible for the improved device performances. As an ultimate achievement, deep-red QD-LEDs (λ_{max} = 630 nm)exhibitingpeak external quantum efficiency of 7.4 % and record-high brightnessabove 100,000 cd/m^2could be realized based on the type-I giant QDs (core radius: 2.0 nm, shell thickness: 6.3 nm).