Structural Design of Colloidal Quantum Dots for High Performance Optoelectronic Devices

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Unique optical properties of colloidal quantum dots (QDs) (e.g., broadband absorption but narrow emission, high quantum yield, and band gap tunability) have led to widespread research from fundamental study and manipulation of carrier dynamics in confined space to novel QD-based applications utilizing their emissive property such as full-color displays, lightings, or luminescent solar concentrators. Focused on the electroluminescence devices that generate photons from QDs through direct charge injection and recombination, herein, we discuss about the structural design of core/shell heterostructures for high performance quantum dot light emitting diodes. To alleviate nonradiative Auger decay of excitons originating from imperfect charge injection balance, we have developed finely-tuned interfacial structures of core/shell colloidal QDs that directly tackle Auger-involving electronic transition. Close correlation of suppressed Auger decay with device characteristics suggests that various detrimental phenomena occurring in devices can be mitigated by tailored QD heterostructures.