Spectroscopic Observation on Heteroepitaxy of InP/ZnSeS Colloidal Quantum Dots and Implication to Efficient and Color-Pure Emitters

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InP colloidal quantum dots (QDs) have recently risen as one of the novel emitters for next generation displays due to their color purity and high photoluminescence quantum yield (PL QY). Ceaseless studies made over two decades have significantly improved emission bandwidth down to ca. 40 nm as well as PL QY over 80% through InP/ZnSeS core/shell heterostructures. Despite such dazzling achievements, there are some unveiled issues in the synthesis of InP/ZnSeS QDs, for instance, imbalanced valency and corresponding atomic structure at core-shell interface, atomistic shell growth behavior, and corresponding morphology development. Herein, we investigate the shell growth behavior of colloidal InP/ZnSeS core/shell QDs based on static and transient spectroscopic probes (e.g., absorption and static/time-resolved PL). Temporal emergence of bimodal PL spectra implies the non-uniform epitaxy of ZnSeS layers on InP surface. We found that reaction condition enabling uniform ZnSeS shell growth at the early reaction stage is critical for achieving high PL QY and color-pure InP/ZnSeS QDs.