Hybrid Ligand Passivation for Efficient and Stable Blue-Emitting Quantum Dots

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ZnTeSe-based blue-emitting quantum dots (QDs) have become essential emissive materials in future display technology based on electroluminescence devices. While their full potential was recently demonstrated elsewhere, vulnerability arisen from minimal electron confinement makes it difficult to handle the ZnTeSe-based QDs in synthesis, purification and device fabrication processes. Here, we demonstrate hybrid ligand passivation for ZnTeSe/ZnSe/ZnS QDs. As synthesized QDs suffer from degradation of photoluminescence quantum yield (PL QY) for repeating purification process, possibly due to the desorption of surface ligands and the oxidative degradation of shell. When we introduced zinc halide as well as alkylthiol, we found that their PL QY and photophysical stability of as-synthesized QDs are considerably improved. Moreover, they became robust against repeating purification process. We believe that our strategy can be generalized to other QDs demanding better photophysical and chemical stability against stressful processing condition faced in various applications like solubility control, QD-polymer composites or light-emitting diodes.