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Colloidal Thick-Shell Pyramidal Quantum Dots for Efficient Hydrogen

Production

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Abstract

Colloidal semiconductor quantum dots (QDs) have attracted a great attention for their potential applications in optoelectronic devices, such as water splitting, luminescent solar concentrators and solar cells, because of their size/shape/composition-dependent optoelectronic properties. However, the fast electron-hole (e-h) recombination and slow charge separation of QDs limit their applications as light absorber in high efficiency optoelectronic devices. Here, we synthesized thick-shell CdSe/CdSe_xS_{1-x}/CdS QDs with pyramidal shape, which exhibit a quantum yield of ~15%, with a long radiative lifetime up to ~100 ns due to the spatial separation of the e/h wavefunction and significantly broadened light absorption toward the 500-700 nm range, compared to CdSe/CdS unalloyed QDs. As a proof-of-concept, the pyramidal QDs are applied as light absorbers in a photoelectrochemical (PEC) system, leading to

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