Tuning Photoresponse with CdSSe Quantum Dots. Towards the Design of Rainbow Solar Cell

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Highly luminescent ternary chalcogenide quantum dots (QDs) with gradient composition have been prepared to tune the absorption properties of in the visible. Sequential electrophoretic deposition of crystalline CdSeS nanoparticles enables layered structures within the mesoscopic TiO_2 film and thus maximizes light harvesting capability of quantum dot solar cell (QDSC). The sequential layering of higher bandgap CdSeS QDs followed by lower bandgap QDs provides a better synergy for harvesting incident photons across the visible spectrum. Power conversion efficiencies of 3.2 % and 3.0% obtained for the QDSC with two-layer QDs and three-layer QDs represent a synergetic effect during the operation of tandem layered QDSC. This maiden concept of utilizing ternary metal chalcogenides for designing tandem layered quantum dot solar cells paves the way to design new strategies for improving the efficiency of solar cells.

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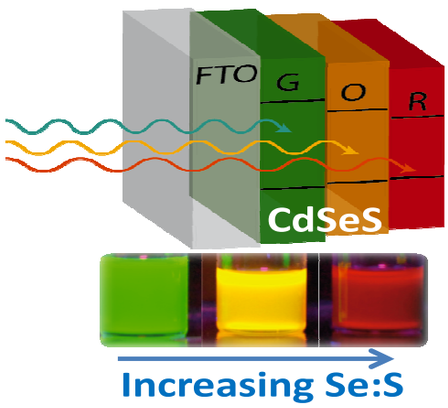

Schematic design of layered structure of CdSeS to achieve tandem layers of QDs ito achieve better photon management in solar cells.