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CONTROLLING THE SIZE OF QUANTUM DOTS FOR EFFICIENT CdS QUANTUM DOT-SENSITIZED SOLAR CELLS

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Abstract

Quantum dots have attracted extensive attention in different applications including light emitting diodes, photodetectors, photovoltaic cells and spectrometers. Quantum dot-sensitized solar cells (QDSSCs) have gained more attention recently in the area of solar power conversion systems due to their less production cost and the excellent properties of quantum dots such as ability of multiple exciton generation (MEG), tuneable energy gap due to the quantum confinement effect and high molar extinction coefficients. The working principle and structure of QDSSC is similar to the dye-sensitized solar cell. Only difference between these solar cells is the sensitizer. CdS quantum dot is an II-VI type semiconductor with a bulk bandgap of 2.42 eV. CdS quantum dots are used for the QDSSC application due to its wide range absorption in the visible region. CdS quantum dot – sensitized solar cells are the low-cost photovoltaic cells. CdS quantum dots have been deposited on TiO_2 electrodes by using successive ionic layer adsorption and reaction (SILAR) technique. Optical and electrical characterizations of the electrodes and solar cells have been studied with different amounts and sizes of CdS quantum dots. In order to fabricate a better CdS quantum dot – sensitized solar cell, number of SILAR cycles has been optimized. CdS QDSSC fabricated with 7 SILAR cycles shows a better efficiency of 0.674% with a short circuit current density of 5.148 mA cm^{-2}.

Keywords: *quantum dot-sensitized solar cells, multiple exciton generation, SILAR, tuneable energy gap*