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CADMIUM SULPHIDE (CDS) QUANTUM DOTS (QD) ON VERTICALLY ALIGNED ZINC OXIDE (ZNO) NANORODS FOR PHOTOVOLTAIC APPLICATION

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ABSTRACT

Nanostructured metal oxides are promising candidate for cost efficient solar cells. A key advantage of using metal oxides as electron acceptors is the capability to produce rigid, nanocrystalline structures that present a direct and ordered path for photo-generated electrons to the collecting electrode. This may be done using templated porous structures, tetrapods, or vertically aligned nanorods. In this work, ZnO nanorods were synthesized via a low temperature hydrothermal process on a ZnO thin film coated FTO substrate. CdS quantum dots (QD) were then deposited on ZnO nanorods by chemical bath deposition. Fabricated ZnO nanorods and CdS QD coated ZnO nanorods were characterized using Field emission scanning electron microscopy (FESEM), Transmission electron microscopy (TEM), X-ray diffraction (XRD), and UV-Vis spectroscopy techniques. FESEM micrographs confirm that the nanorods were vertically oriented and well-aligned over the substrate. The length of the ZnO nanorods was determined as 500 nm with diameters ranging from 25 to 50 nm. An XRD diffraction pattern indicates the presence of ZnO and CdS phases adopting the typical hexagonal wurtzite and cubic zinc blende structure, respectively. TEM image shows the average size of fabricated CdS quantum dots was about 5 nm. The strong absorption peak over the near infra-red region in UV-Vis-NIR spectra also ensured the presence of crystalline CdS on the ZnO nanorods array. Quantum dots sensitized solar cell (QDSSC) was successfully fabricated using CdS QDs and vertically aligned ZnO nanorods. The cell yields a short circuit current density over 1 mAcm^{-2} and resulting an overall power conversion efficiency over 0.3 % under AM 1.5 irradiation (80 mW/cm^2).

Keywords: *ZnO, CdS, nanorods, quantum dots, QDSSC*