Effect of Different Sensitization Technique on the Photoconversion Efficiency of CdS Quantum Dot and CdSe Quantum Rod Sensitized TiO2 Solar Cells

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Abstract

The procedure employed for the sensitization of mesoporous photoanodes affects strongly the final performance of sensitized devices, especially when semiconductor quantum dots and quantum rods are used as sensitizers. In this work the effect of three different sensitizing methods in the final cell performance was analyzed. The TiO2 films were sensitized with CdS QDs grown by successive ionic layer adsorption and reaction, SILAR, and with CdSe quantum rods deposited by electrophoretic and pipetting methods. Several configurations of the sensitizers and combinations of sensitization methods were tested. 4% photoconversion efficiencies were obtained for TiO2 electrodes sensitized with CdS and CdSe by electrophoretic and pipetting respectively, while for the sensitizer with both techniques the efficiency was 4.7%. This high efficiency is mainly due to the high fill factor (60%) and the photocurrents (13.1 mA/cm2) obtained by the correct combination of near-infrared and visible light photoabsorption, the better CdSe QRs distribution in the TiO2 film and a passivation of the TiO2 nanocrystals. Electrochemical impedance measurements has been analyzed and discussed in detail providing a detailed analysis of recombination resistance and charge transport processes. These parameters have been correlated with the cell performance.