Photovoltaic Properties of Bi2S3 and CdS Quantum Dot Sensitized TiO2 Solar Cells

Diego Esparzaa, Isaac Zarazúaa, Tzarara López-Lukea, Ramón Carrilesa, Alejandro Torres-Castrob, Elder De la Rosa

Electrochimica Acta. Volume 180, 20 October 2015, Pages 486–492

Abstract.

Bismuth sulfide (Bi2S3) is an attractive potential replacement for lead sulfide (PbS) due to its low toxicity and near infrared absorption spectrum. In this work, we report the photovoltaic characteristics of cadmium sulfide (CdS) and Bi2S3 quantum dots (QDs) sensitized solar cells. The QDs were grown by the successive ionic layer adsorption and reaction (SILAR) method. The number of cycles was varied in order to optimize the photoconversion efficiency. Using a photovoltaic device with the structure TiO2/CdS/ZnS as our reference, we obtained increments in the short circuit current (Jsc) from 7.9 to 9.3 mA/cm2, the fill factor (FF) from 41.9 to 53.7%, and the photoconversion efficiency (η) from 1.7% to 2.52% for the configuration TiO2/CdS/Bi2S3/ZnS. This enhancement is explained by an augmented absorption spectral range and a favorable energy level diagram. Electrochemical impedance measurements were performed to better understand the carrier recombination and transport processes.

Keywords

Bismuth sulfide; cadmium sulfide; TiO2; quantum dot solar cells.