Efficiency improvement of CdS and CdSe quantum dot-sensitized solar cells by TiO₂ surface treatment

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CdS and CdSe quantum dots (QDs) have been synthesized via successive ionic layer adsorption and reaction for the fabrication of quantum dot-sensitized solar cells (QDSSCs). In this work, several approaches such as incorporation of ZnS passivation layer, scattering layer, treatment with TiCl₄, and increasing the TiO₂ layer thickness have been applied on TiO₂ layer in order to improve the solar cell performance. By passivating the QD-sensitized TiO₂ layer with ZnS, the performance of the cells increased due to reduction of charge recombination at the photoanode/electrolyte interface. With a thicker TiO₂ layer thickness of 26 μm, further enhancement was observed. The efficiency of the CdS and CdSe QDSSCs improved from 1.06% to 1.48% and from 1.41% to 3.05%, respectively. On the other hand, scattering layer and treatment with TiCl₄ did not bring much improvement to the cells. © 2014 AIP Publishing LLC. [http://dx.doi.org/10.1063/1.4870996]

I. INTRODUCTION

Alternative energy sources have been gaining momentum in recent years due to concern on global warming caused by green house gas emission. Of all the alternative energy sources, solar cell is the preferred choice due to its easy-to-use device, lower installation or setup cost and no emission of carbon dioxide. Third generation photovoltaic technology such as quantum dot-sensitized solar cell (QDSSC) is gaining popularity lately. However, the performance of the