ABSTRACT

INFLUENCE OF THE PARTICLE SIZE OF $CaCO_3$ COATING LAYER ON THE EFFICIENCY ENHANCEMENT OF SnO_2-BASED DYE SENSITIZED SOLAR CELLS

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Dye sensitized solar cells (DSSCs) have received much attention in the recent past over conventional silicon solar cells due to their low cost and easy fabrication. Even though TiO_2 is considered to be the best high band gap semiconductor for DSSC, other materials such as ZnO and SnO_2 having similar band gap positions and higher electron mobilities are under investigation. SnO_2-based DSSCs show low photovoltaic performance due to higher recombination rates. However, there have been various attempts to reduce recombination in this system in order to harness its other positive electronic properties to achieve higher DSSC efficiencies. One such method is to use a very thing insulating $CaCO_3$ coating layer on SnO_2 nanoparticles. This study is focused on the effect of particle size (diameter of the spherical particle) of the $CaCO_3$ coating layer on the efficiency enhancement of $SnO_2/CaCO_3$ composite DSSCs. $CaCO_3$ nanoparticles of 15 nm, 20 nm, 30 nm and 50 nm were prepared in the laboratory and used in the coating layer to fabricate SnO_2-based DSSCs while keeping SnO_2:$CaCO_3$ molar ratio at 50:1 in order to control the thickness of the coating layer and to change the effective surface area. A maximum photoconversion efficiency of 6.13% was obtained for 15 nm $CaCO_3$ nanoparticles. There is clear experimental evidence that the increase in efficiency enhancement is due to the increase in the overall surface area for smaller particle sizes of $CaCO_3$.