Enhancement of photovoltage of dye-sensitized solid-state solar cells by introducing high-band-gap oxide layers

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Abstract

Electrodes constructed using nanocrystalline TiO_2 particulates for dye-sensitized solid-state solar cells (SS-DSSCs) showed open-circuit voltage (V_{oc}) in the 500–600 mV range, which is less than the theoretical expected value. Incorporation of high-band-gap semiconducting oxides with a flatband potential higher than TiO_2, such as $SrTiO_3$ or ZnO, results in a dramatic increase in V_{oc} of SS-DSSC as compared to porous TiO_2 nanocrystalline films. The observed photovoltage difference could be correlated to the difference in the flatband potential values of the respective oxides and shift of the flatband potentials of the oxide films. Hence, this method could be used to enhance the V_{oc} and overall cell performance of SS-DSSC.

Keywords: Dye sensitization; Solid-state solar cell; TiO_2; $SrTiO_3$; ZnO; SnO_2