WPI MATERIALS SCIENCE & ENGINEERING

Lite Zhou

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Novel Nanostructured Metal Oxides for Efficient Solar Energy Conversion

Abstract

Metal oxide materials could offer earth-abundant, non-toxic alternatives to existing light-absorber materials in thin-film photovoltaic and photoelectrochemical cells. However, efficiency of these devices based on existing metal oxides is typically low due to poor material properties. In this research, novel Sb:SnO_2 nanorod and nanotube electron collectors have been synthesized, investigated and were used to improve the photo-conversion efficiency of top-performing $BiVO_4$ photoelectrochemical cell. The performance of Sb:SnO_2/$BiVO_4$ photoanode achieved a new record for the product of light absorption and charge separation efficiencies ($\eta_{abs} \times \eta_{sep}$) of ~ 57.3% and 58.5% under front- and back-side illumination at 0.6 V_{RHE} and Sb:SnO_2/$BiVO_4$ PV cell achieved 1.22% solar power conversion efficiency. In addition, a new promising metal oxide material ($CuBiW_2O_8$) has been synthesized and its optoelectronic properties have been investigated to make photovoltaic cell which has potential to achieve over 30% solar power conversion efficiency