

Substrate type $\langle 111 \rangle$ -Cu₂O/ $\langle 0001 \rangle$ -ZnO photovoltaic device prepared by photo-assisted electrodeposition

Abstract

The substrate-type $\langle 0001 \rangle$ ZnO/ $\langle 111 \rangle$ Cu₂O photovoltaic (PV) device has been constructed by electrodeposition of a $\langle 111 \rangle$ -p-Cu₂O layer on an Au(111)/Siwafer substrate followed by stacking the n-ZnO layer by electrodeposition during light irradiation in aqueous solutions. The PV device was fabricated by stacking the Al:ZnO-window by sputtering and the top Al electrode by vacuum evaporation. The $\langle 0001 \rangle$ -ZnO layer was composed of aggregates of hexagonal columnar grains grown in the direction normal to the surface, and pores could be observed between the ZnO grains at the deposition time last 1800 s. The $\langle 0001 \rangle$ -ZnO/ $\langle 111 \rangle$ -Cu₂O PV device showed a photovoltaic performance under AM1.5 illumination, and showed the improved short-circuit current density of 5.87 mA cm⁻² by stacking the AZO-TCO due to the increase in the diffusion length of the carrier.

Keywords; Aldoped ZnO; Cuprous oxide; Growth mechanism; Photo-assisted electrodeposition; Solar cells; Thin film; Zinc oxide; ZnO/Cu₂O heterojunction