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Dependence of deposition bath temperature for p-electrodeposited-Cu_2O onto n-TiO_2/ZnO bilayer thin films

Abstract

The synthesis of semiconductor materials is crucial to produce the best properties of heterojunction thin films solar cell. Titanium dioxide (TiO2) is coupled with zinc oxide (ZnO) to promote high transmittance due to low utilization of the solar spectrum. In this project, p-Cu2O as absorbing layer was deposited onto n-TiO2/ZnO bilayer thin film which acts as window layer in order to complete the device. Several bath temperatures of 30, 40, 50 and 60 °C were manipulated during Linear Sweep Voltammetry (LSV) measurement and electrodeposition process for p-Cu2O thin film. The LSV measurement was employed to determine the potential value and electrochemical properties of p-Cu2O thin film. Based on findings, the suitable deposition potential chosen is − 0.4 V vs Ag/AgCl. The p-Cu2O thin film deposited at bath temperature of 40 °C exhibited the highest diffraction peak intensity in the (111)-preferred plane orientation showing high crystallinity. The surface morphology of homogeneous and well-defined triangular shape with thickness of 4.93μm was observed. The estimated bandgap energy of 1.92 eV acquired indicated to p-Cu2O thin film. The n-TiO2/ZnO bilayer/p-Cu2O heterojunction thin film was successfully fabricated and showed significant electrical rectification properties. Here in, bath temperature influenced to the enhancement of heterointerface growth development in several properties. © 2023

Keywords

Bath temperature; Electrodeposition; N-TiO2/ZnO bilayer thin film; P-Cu2O thin film; P-n heterojunction; Sol-gel spin coating