

Potentiostatic Electrodeposition of Cu₂O Films as P-Type Electrode at Room Temperature

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Abstract : Single phase Cu₂O films have been prepared via an electrodeposition technique onto ITO glass substrates at room temperature. Likewise, Cu₂O films were deposited using a potentiostatic process from an alkaline electrolyte containing copper (II) nitrate and 1M sodium citrate. Single phase Cu₂O films were electrodeposited at a cathodic deposition potential of 500mV for a reaction period of 90 min, and pH of 12 to yield a film thickness of 0.49 μm. The mechanism for nucleation of Cu₂O films was found to vary with deposition potential. Applying the Scharifker and Hills model at -500 and -600 mV to describe the mechanism of nucleation for the electrochemical reaction, the nucleation mechanism consisted of a mix between instantaneous and progressive growth mechanisms at -500 mV, while above -600 mV the growth mechanism was instantaneous. Using deposition times from 30 to 90 min at -500 mV deposition potential, pure Cu₂O films with different microstructures were electrodeposited. Changing the deposition time from 30 to 90 min varied the microstructure from cubic to more complex polyhedra. The transmittance of electrodeposited Cu₂O films ranged from 20-70% in visible range, and samples exhibited a 2.4 eV band gap. The electrical resistivity for electrodeposited Cu₂O films was found to decrease with increasing deposition time from 0.854 x 10⁵ Ω-cm at 30 min to 0.221 x 10⁵ Ω-cm at 90 min without any thermal treatment following the electrodeposition process.

Keywords : Cu₂O, electrodeposition, film thickness, characterization, optical properties

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