Structural Analysis of Nanocrystalline Cu₂O Prepared by Electrodeposition at Different Temperatures

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The results of structural and phase analyses of Cu₂O films electrodeposited at different temperatures are reported in this paper. The electrodeposition temperature was varied to obtain a single-phase Cu₂O film. Structural information and the phase composition were extracted from X-ray diffraction patterns using a general structure analysis system (GSAS) to perform Rietveld refinement. Increasing the deposition temperature decreased the crystallite size and increased the lattice strain in the films. A preferential orientation was found at relatively high deposition temperatures. The Cu₂O phase began to form above room temperature, and a single phase of nanocrystalline Cu₂O with a fine crystallite size of 34 nm was grown at a deposition temperature of 75°C. This pure Cu₂O film had a uniform surface morphology with a direct bandgap energy of 2.18 eV. These results show how temperature controls the structure and phase composition of electrodeposited Cu₂O.

Keywords: Structural and phase analysis, single-phase Cu₂O, electrodeposition temperature, general structure analysis system

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