

Structural and Electronic Properties of Cu-doped ZnO Thin Films by RF Sputtering Method

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The epitaxial Cu-doped ZnO and pure ZnO thin films were grown on Al₂O₃ (0001) substrates by RF sputtering method. The structures and crystallographic orientations were investigated using X-ray diffraction (XRD) and X-ray absorption spectroscopy. From the XRD pattern, it is observed that peak positions shift towards higher 2θ value with Cu doping. The ω -scan measurements at the (0002) diffraction peak for these samples reveal that the full-widths at half-maxima (FWHMs) are about 0.017-0.019°, which indicate a good c-axis orientation of the Zn_{1-x}Cu_xO films. From phi-scan, all of the Zn_{1-x}Cu_xO films were epitaxially grown. EXAFS measurements also demonstrated that Cu incorporated into a Zn-atom position substitutionally. All the results confirmed that copper ion were well incorporated into the ZnO lattices by substituting Zn sites without changing the wurtzite structure and no secondary phase existed in Cu-doped ZnO thin films.

Keywords: ZnO, XRD, XANES, EXAFS, Epitaxial thin film, RF sputter