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Effect of angle deposition γ on the structural, optical and electrical properties of copper oxide zigzag (+γ, - γ) nanostructures elaborated by glancing angle deposition

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Abstract

In this work, Cu_xO thin films were obtained by air annealing of copper thin films deposited on glass substrates using thermal evaporation method by Glancing Angle Deposition "GLAD" technique. The copper was sculptured into a zigzag shape, which presents two columns with inclined angles +γ and - γ where γ is the deposition angle between the incident flux and the substrate normal. Morphological, structural, optical and electrical properties of the obtained thin films were investigated using X-ray diffraction (XRD), UV-Vis-NIR Spectroscopy and electrical resistivity measurements. The XRD patterns revealed that thin films deposited at different incident angles are mainly crystallized in Cu_2O cubic phase characterized by the preferential orientation along (111) plane. The optical parameters were calculated from the analysis of the transmittance and reflectance spectra in the wavelength range 300-1800 nm. The absorption coefficient exceeds 10^5 cm^{-1} in the visible and NIR spectral ranges. Direct band gap energy increases from 2 to 2.54 eV with deposition angle. The in-plane birefringence and the anisotropic resistivity of the Cu_2O films were also studied. Their maxima were obtained at incident flux angle of $\gamma = \pm 60°$. Therefore, the GLAD technique is a promising way to create zigzag nanostructures with enhanced anisotropic properties.

Keywords