

Characterization of Morphological, Optical, and Electrophysical Properties of Cu₂O Thin Films Obtained by RF Sputtering**V. Suman^{1*}, V. Morari¹, D. Bragari¹, E. Monaico², L. Ghimpu¹, E. Rusu¹, E. V. Monaico²**¹Institute of Electronic Engineering and Nanotechnologies „D. Ghitu”, Technical University of Moldova, Academiei str. 3/3, Chisinau 2028, Republic of Moldova²National Center for Materials Study and Testing, Technical University of Moldova, Studenților str. 9/7, Chisinau 2012, Republic of Moldova***Email:** victor.suman@iien.utm.md

Abstract: Metal oxide semiconductors, owing to their versatile electronic properties, are essential materials for a wide range of applications, including photovoltaic and photoelectrochemical cells, photodetectors, and power electronic devices. Their functionality as selective charge transport layers or light absorbers is determined by their electrical conductivity, work function, and band gap. Copper oxide (Cu₂O), a p-type semiconductor with a band gap in the range of 1.9–2.6 eV, has attracted significant attention as a hole transport layer in perovskite solar cells due to its promising efficiency and stability. In this work, the electrophysical properties of Cu₂O thin films deposited by RF magnetron sputtering are reported. The optical properties and the effect of post-deposition thermal treatment on the morphological and electrical characteristics of the films were investigated. Atomic force microscopy (AFM) analysis revealed an increase in surface roughness with film thickness, from 100 nm to 500 nm. Post-deposition annealing at 400°C for 60 minutes under high vacuum conditions resulted in a significant increase in the contact angle from 102° to 120°, indicating enhanced hydrophobicity. Raman spectroscopy identified characteristic phonon modes at 218 cm⁻¹, 418 cm⁻¹, and 637 cm⁻¹, confirming the formation of the Cu₂O phase, in agreement with X-ray diffraction (XRD) results. Optimization of film thickness and structural and electronic properties, such as grain size and charge carrier mobility, is expected to significantly improve the performance of Cu₂O-based films.

Keywords: Cu₂O, RF magnetron, Raman Spectroscopy, XRD.

Acknowledgements. This work was supported by the institutional subprograms #02.02.01 no. 4/FI „Nanostructures and advanced materials for applications in spintronics, thermoelectricity and optoelectronics” and Stimulating Excellence in Research 2025–2026: #25.80012.5007.88SE – Tandem solar cells based on Cu₂O heterojunctions.