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Synthesis and Structural Analysis of CuO Thin Films by Spray Pyrolysis

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Abstract- Copper oxide (CuO) thin films were synthesized using the spray pyrolysis technique to investigate their structural properties. The formation of the CuO phase was confirmed using Xray diffraction (XRD) analysis. The results reveal the successful deposition of polycrystalline CuO thin films with a monoclinic crystal structure, demonstrating the effectiveness of spray pyrolysis for fabricating metal oxide thin films

Keywords- - CuO thin films ,Spray pyrolysis, Spray-deposited CuO,Chemical spray pyrolysis Ultrasonic spray pyrolysis (USP)

I. INTRODUCTION

Copper oxide (CuO), a p-type semiconductor with a narrow band gap (~1.2 - 1.9 eV), has attracted considerable interest for applications in photovoltaics, gas sensing, and catalysis. Among the different fabrication techniques, spray pyrolysis is widely employed due to its simplicity, cost-effectiveness, and ability to produce uniform thin films over large areas. This study focuses on the synthesis of CuO thin films via spray pyrolysis and confirms film formation using X-ray diffraction analysis.

II. EXPERIMENTAL DETAILS

High-purity copper nitrate trihydrate [Cu(NO3)2 · 3H2O] was used as the precursor material. The aqueous precursor solution was prepared by dissolving an appropriate amount of copper nitrate in distilled water. Fluorine-doped tin oxide (FTO) glass substrates were ultrasonically cleaned with acetone, ethanol, and distilled water successively before deposition. The spray pyrolysis was carried out at a substrate temperature of 400 °C. The solution flow rate, nozzleto-substrate distance, and carrier gas pressure were optimized to obtain uniform coatings. Post-deposition, the films were cooled to room temperature.

III. RESULTS AND DISCUSSION

The structural properties of the deposited CuO thin films were characterized using X-ray diffraction (XRD). The XRD patterns showed prominent diffraction peaks corresponding to the monoclinic phase of CuO (JCPDS card no. 80-1917), confirming the successful formation of CuO thin films. The crystallite size was estimated using the Scherrer equation, indicating nanocrystalline nature. The absence of impurity peaks further confirmed the phase purity of the films.

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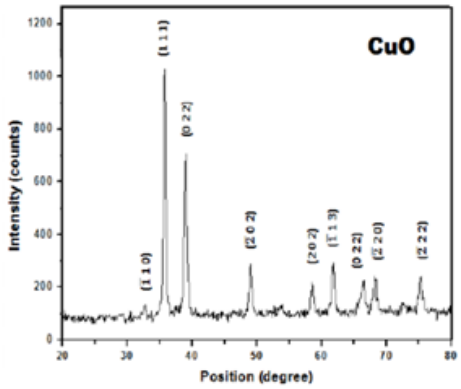

IV. CONCLUSION

CuO thin films were successfully synthesized using the spray pyrolysis technique. XRD analysis confirmed the formation of monoclinic CuO with good crystallinity and phase purity. The study validates spray pyrolysis as an effective and simple method for the fabrication of CuO thin films for potential optoelectronic and sensing applications.

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