DEPOSITION AND CHARACTERIZATION OF CuO THIN FILMS BY USING CHEMICAL BATH DEPOSITION TECHNIQUE

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Abstract : *Chemical bath deposition (CBD) is a very simple technique for the deposition of thin films of semiconductor materials such as CuO. In the present work, CuO thin films on glass substrate were deposited at 80 ^0C by varying the deposition time. Optical and structural properties of the deposited CuO thin films were studied which revealed formation of CuO on the glass substrate. Such films are useful for gas sensing studies.*

Keywords: chemical deposition, thin film, semiconducting materials structural characterisations.

I. INTRODUCTION

Copper oxide (CuO) is one of the most important p-type semiconductors and has gained significant attention due to its excellent optical, electrical, physical and magnetic properties [1,2]. CuO possesses the narrow band gap of 1.4 eV. It is used in various applications such as catalysis, solar energy conversion, gas sensing, etc [3]. CuO thin films can be deposied using various techniques like sputtering, sol-gel, chemical bath deposition, etc [4,5]. Among these processes chemical bath deposition (CBD) method is a facile inexpensive, and is cost effective thin film deposition approach due to its ability of large area production and good yield [6]. Here, we present the work on deposition of thin film of copper oxide by CBD method on glass substrate at 80 0C by varying the deposition time using chemical bath deposition technique.

II. RESEARCH METHODOLOGY

Deposition of CuO thin films was carried out by simple CBD technique.

2.1 Materials

CuO thin film were prepared using copper acetate (CH3.COO)2.Cu.H2O as Cu precursor, triethanolamine (TEA) as complexing agent and sodium hydroxide (NaOH) as pH regulator.

2.2 Experimental Procedure

2.2.1 Preparation of glass substrate

Thin films were deposited on glass substrate (micro slides-75mm L×25mm wide), thickness 1.35 mm (+0.1 mm). The glass substrate were first cleaned by normal running tap water, soap solution, distilled water (2-3 times), subsequently soaking them in chromic acid for 24 hours in order to remove finger prints, precipitation and other invisible markings. Afterwards slides were thoroughly washed with distilled water several times , treated with distilled water in ultrasonicator and finally dried in air.

2.2.2 Deposition of CuO thin films

PREPARATION OF CuO THIN FILM :

CuO films were grown using a simple two process: 1. Seed layer or barrier layer on CuO seeds On the substrate and growth of films on the seeded substrate. The CuO seed was prepared by a modified dip and dry method. 0.2gm copper acetate and 5drops of NaOH were dissolved into 80ml methanol respectively. The beaker containing above solution kept in a ultra-sonicator for 5min. The solution were mixed rapidly .Dipped the substrate in the resultant solution for 10 second and dried on the hot plate for few second ,repeat this procedure for 18 times. Light brown colour substrate observed.

2.The CuO growth was carried out by suspending the above obtained substrate in the 250ml beaker filled with an aqueous solution of copper acetate 0.02M,0.7ml TEA and NaOH(pH=12) at *80 ^0C* for 2 hours. The pH was adjusted by NaOH, and TEA is used as complexing agent . Subsequently, the substrate was removed from solution ,rinsed with distilled water and dried in air at *80 ^0C*.

They were later annealed at temperature(400C)for 2hour.

2.3 Characterization

Structural characterisations of the films were carried out by studying X-ray diffraction (XRD) patterns. The optical properties of CuO thin film were studied via UV-Visible spectroscopy in the range of 400-900 nm.

III. RESULTS AND DISCUSSIONS

X-ray diffractograms of the CuO thin film samples are shown in Figure 3.1. X-ray diffractograms match with the JCPDS card no 80-1917. Broadened XRD peaks indicate the formation of nanocrystals in the deposited films. The optical properties of CuO thin film were studied using UV-Visible spectroscopy and the band gap value was calculated to be 1.5 to 1.8 eV by varying deposition time.

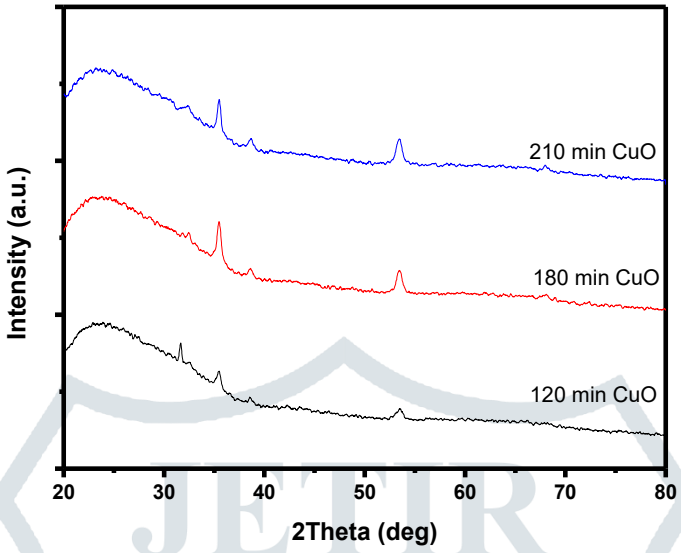

Figure 3.1- X-ray diffractograms of CuO thin film

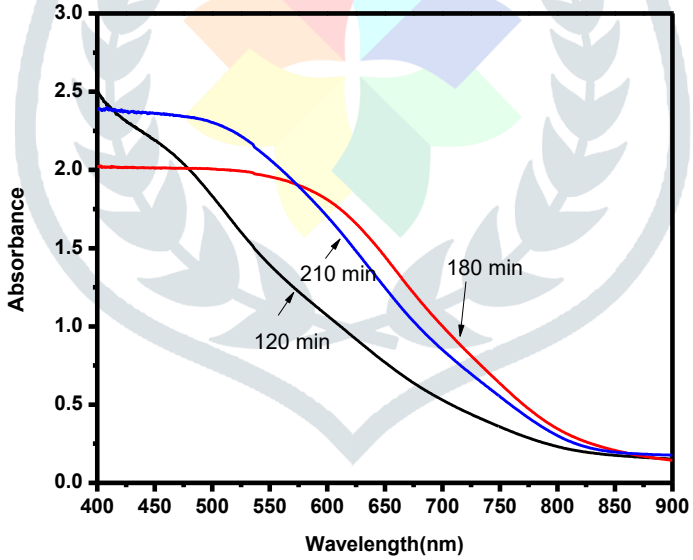

Figure 3.2- UV-visible spectra of CuO thin film

IV. CONCLUSIONS

Copper oxide thin films has been successfully obtained using convenient, environment friendly, inexpensive and efficient chemical bath deposition method.

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VI. REFERENCES

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