CHEMICAL BATH DEPOSITION OF CU DOPPED SERIES THIN FILMS PREPARATION AND CHARACTERIZATION"

Mr.Murugan.[1],Mr.A.Raja[2].,Mr.T.Ravi[3].,Mrs.R.Keerthana[4].

Assistant Professor Department of Physics ,DhanalakshmiSrininivasan College of Arts & Science For Women (Autonomous)

ABSTRACT

Copper thin films are provide through chemical bath deposition method (CBD). For this study iron pyrite thin films were prepared by using the chemical bath deposition method in aqueous solution. Deposition time constant at 60 minutes and pH of the solution at 2.0. Substrate is the surface is used to deposit thin film. The CDS (CU) thin film is deposited on the glass substrate by using chemical both deposition method at 800c in three hours. With the help of XRD analysis CDS (cu) thin film has hexagonal crystalline structure.

Keywords : XRD, UV, chemical bath deposition, CU thin films

INTRODUCTION

CDS thin film has drawn an outsized attention among researchers within the field of transistors [1], FET, LEDs [2], photons [3], photo catalysis [4], NIR-detectors [5], energy storage systems due to its high stability, excellent physical, chemical, and optical properties which are different from bulk. Among various metal sulfidechalcogenides, wide availability and simple preparation has made CDS thin films popular for future applications [6]. Recently, CDS thin films are used as a gas senses material [6]. It is also widely used as window layer in the thin film solar cells alongside different absorbers like CdTe [7], SNS [8], CdSe [9], CIGS and PBS [10]. The properties of CDS thin films are often precisely controlled by the doping process. It is documented that the conduction of pure CDS is attributed to the native defects or sulfur vacancies and cadmium interstitial [11]. Accordingly, it is feasible to control the conductivity of CDS by introducing a suitable dopant. Several efforts are made to organize metal sulfide thin films doped with transition metals or rare-earth element ions. The doping of CDS with metallic ions such as In3+ [12], Al3+ [13], Ni2+ [11], Cu2+ [14] and B3+can improve both the structural and electrical properties of CDS. Some authors have found that Cu2+ doping has an effect of deterioration of crystalline [6]. However, detail reports on Cu doped CDS thin films are very scarce.CdS thin films can be deposited by different techniques such as spray hydrolysis [15], chemical bath deposition (CBD) [16], successive ionic layer adsorption and reaction (Solar) [17] and spin coating [18] techniques. Chemical bath deposition method is used to deposit thin films and nanomaterials Now, one of the most inexpensive and scalable methods to prepare CDS thin films is chemical bath deposition (CBD), which uses a controlled reaction to grow thin films by precipitation. To achieve this, substrates are vertically immersed in an alkaline solution containing the chalcogenide source, 2 the metal ion and a completing agent. Many studies on the deposition of CDS using this technique employ a highly toxic material which is ammonia in the chemical bath as complexing agent and hydroxide source [19,20].

EXPERIMENTAL TECHNIQUES

SUBSTRATE

A substrate is typically the chemical species being observed duringreaction , which reacts with a reagent to urge a product. It also can ask a surface on which other chemical reactions are performed, or play a supporting role during a sort of spectroscopic and microscopic techniques. According to the physics SUBSTRATE is " A base material to which something is applied or adhered.

SUBSTRTE MATERIAL:

Thin-film substrates on polymer, ceramic, steel, glass, ferrite, etc .The nature and surface finish of the substrate materials said about has the maximum surface smoothness and is also optically plane .It is easily and cheaply available . GLASS is used as a substrate for this work.

Sample preparation

The CdS films were prepared by CBD technique . The bath solution comprised of 2M solutions of cadmium chloride [$CdCl_2 .H_2O$] (Qualigens Fine Chemicals Mumbai) and 1.5 M solution of thiourea ($(NH_2)_2CN$) (Merck , India) prepared in double distilled water. The pH of the solutions play major role in reaction. The pH of the bathtub solution during deposition was maintained at 10 by adding ammonia solution. Cleaned glass substrates were mounted vertically in the solution at room temperature for 10 minutes After the formations of the films the substrates were removed from the bath and rinsed several times in distilled water to remove any adherent particles and unreacted material. Samples were dried at room temperature. Adequate precaution was taken to protect the films from dust.

Chemical deposition technique includes the following methods:

i) Chemical Vapour Deposition (CVD):

CVD may be a chemical change during which the gaseous precursors are used. Precursor gases are moved into a chamber with the substrate. The chemical reaction between the substrate and the precursor is continued at high temperature till the desired thickness of the film is obtained.

ii) Plasma Enhanced CVD (PECVD) Method:

InPECVD, plasma is formed in a reaction chamber that transforms the gaseous precursors into reactive radicals, ions, neutral atoms and molecules. These atomic and molecular fragments interact with a substrate and this reaction cause to develop a solid layer on the surface at the substrate . In PECVD, lower temperatures (300~350 degrees centigrade) are used for skinny film deposition while in CVD high temperatures (600~90 degrees centigrade) are used to develop thin films.

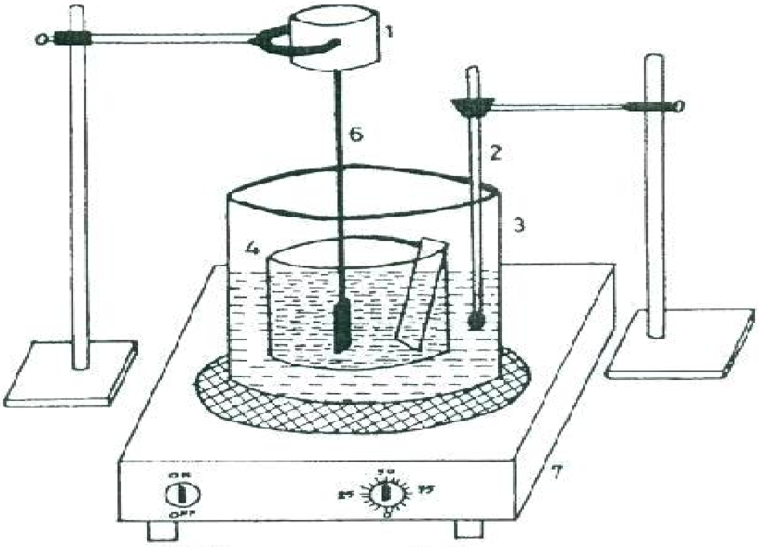
iii) Atomic Layer Deposition (ALD) Method:

In Atomic layer deposition, two or more gaseous precursors are wont to react with the substrate sequentially one at a time. The thin films obtained by this process are conformal. The process of ALD is split into two half reactions. These reactions include deposition of precursor and evacuation of the reaction chamber that run in sequence and repeated for each precursor. This reaction occurs on the substrate leading to the formation of desired film thickness. ALD is a stepwise procedure; therefore it is slower one but can run even on lower temperature.

CONCLUSION

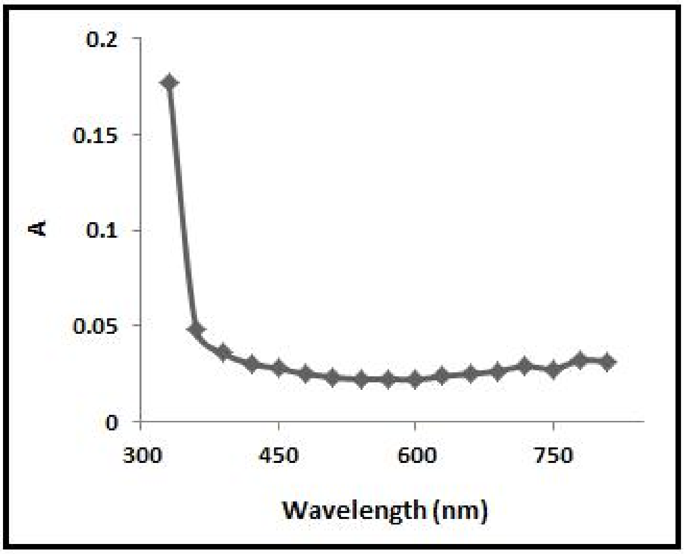
Synthesization of CDS CU thin film has done by using glass substrate by chemical bath method [CBD]. By this method temperature is kept at 800C throughout the deposition process of 3 hours. The linear nature of absorption indicates that Cd SCU is a direct band gap material with the band gap energy equal to 1.50 eV. The XRD image of the CDS CU thin film shows the crystalline structure prepared thin film. It confirms that the film has hexagonal crystalline structure. & it is amorphous.

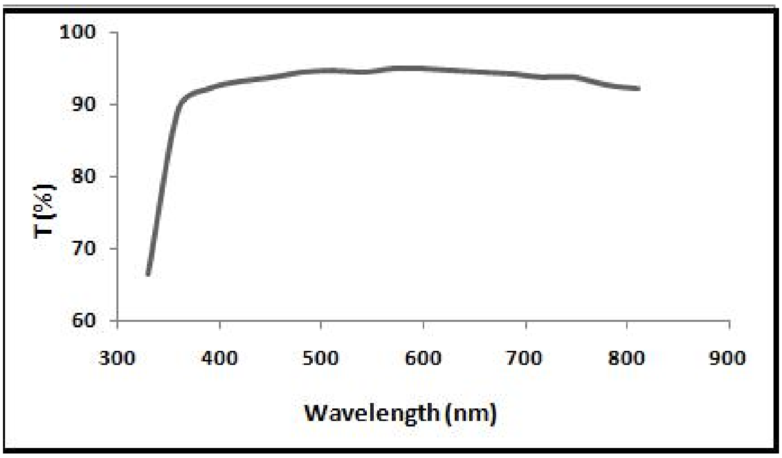
List of figures



1. Motor
3. Water bath
5. Glass slide
7. Heater

2. Thermometer
4. Glass beaker
6. Stirrer


0.2
0.15
0.1
0.05
0
A
300
450
600
750
Wavelength (nm)


100
90
80
70
60
T (%)
300
400
500
600
700
800
900
Wavelength (nm)

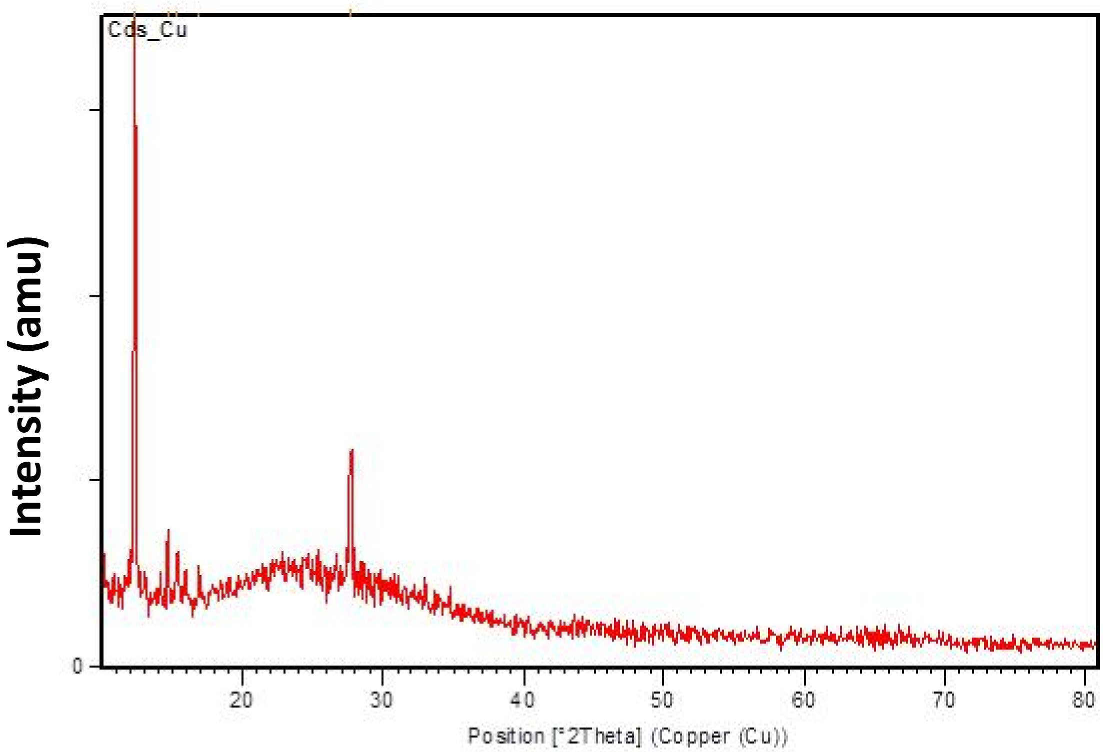

Cds_Cu
Intensity (amu)
0
20
30
40
50
60
70
80
Position [°2Theta] (Copper (Cu))

Table-1

WAVE LENGTH	TRANSMITTANCE
330	66.3
360	89.4
390	92.2
420	93.2
450	93.8
480	94.5
510	94.8
540	94.5
570	94.9
600	94.9
630	94.6
660	94.5
690	94.2
720	93.8
750	93.8
780	92.7
810	92.3

Table:2

WAVE LENGTH	ABSORBANCE
330	0.177
360	0.048
390	0.0358
420	0.0303
450	0.0279
480	0.025
510	0.0233
540	0.0223
570	0.0225
600	0.022
630	0.0239
660	0.025

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