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Arrested Precipitation Technique for Synthesis of Chalcogenide and Oxide Thin Films

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Introduction

Interest in the use of photo electrochemical (PEC) solar cells for low cost energy conversion has led to an extensive research in the search for novel and suitable thin film semiconductor materials [1-5]. The techniques presently used for synthesis of mixed metal chalcogenide and oxide thin films are CBD, MOCVD, spin coating, electro deposition, spray pyrolysis, sputtering, crystal growth, and chemical bath deposition [6-12]. All these deposition techniques require specific sophisticated instrumentation. In this regard APT is more attractive and relatively inexpensive presently used by us for deposition of mixed metal chalcogenide and oxide thin thin films [13-15].

In the present investigation we attempt to prepare mixed metal chalcogenide and oxide thin films by arrested precipitation technique (APT). The purpose of work is to establish and optimize the growth condition to produce these thin films. The as grown films are then used for characterization studies like structural, surface composition, surface morphology, optical and electrical properties and PEC application.

Experimental setup for arrested precipitation synthesis

For the synthesis of any metal chalcogenide and oxide thin film, it is important to select most simple and economically convenient method. The various factors of technique are affect the deposition rate and quality of thin films.

Thin film synthesis assembly

This section deals with fabrication of thin film synthesis technique and associated accessories. Figure 1 shows the cross sectional view of synthesis assembly. It consists of an exhaust fan at the top of synthesis chamber to remove toxic gases, constant speed motor, metallic stand, temperature controller, reaction container, constant temperature bath etc. A thin film synthesis chamber was designed and fabricated in our laboratory having dimensions 1.8 × 0.8 × 1 m^3 to preserve clean ambient atmosphere necessary for the synthesis and to protect the synthesis system from the physical hazards.

Constant speed motor: This is a single-phase a. c. gear motor type [Remi Make Universal RU-56-24.1/8 HP (1.1 Amp)]. The motor fitted to a sturdy metallic stand. A metallic rotating shaft having diameter 0.5 cm and length 15 cm was attached to the motor. One end of the rod was attached to a constant speed a. c. gear motor while other end was fitted to a substrate holder as shown in Figure 1a. A dimmer stat cum regulator was also provided to control speed of motor. It is helped for varied speed from 30 rpm to 150 rpm.

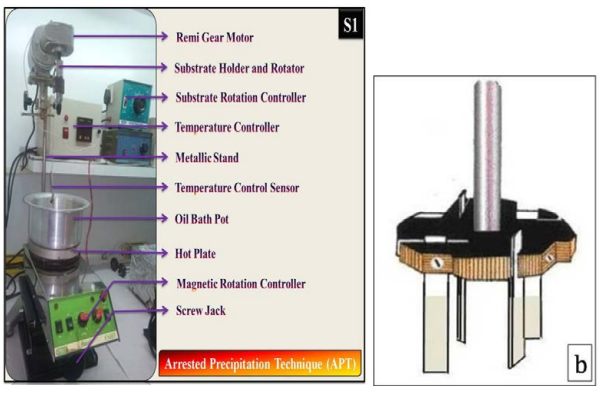

Figure 1: a) Cross sectional view of thin film synthesis assembly, b) Cross sectional view of substrate holder.

Substrate holder: Geometry of substrate holder acting significant role in uniformity and quality of the thin film prepared by arrested precipitation technique. The substrate holder was designed and fabricated in our laboratory. Cross sectional view of substrate holder is shown in Figure 1b. It is a circular disc and made from bakelite material having diameter 5 cm and thickness 1 cm with four slots which are perpendicular to each other. The substrates to be deposited were fitted in these slots with the help of screws in such a way that rotating substrates do not touch the wall of the solution container. The disc was grooved and attached to a shaft of the constant speed gear motor.

Constant temperature assembly: Reacting solutions were taken in glass container having capacity 150 cm^3. The reaction container was kept in cylindrical water pot of 20 cm in diameter and 10 cm in height. It was provided with controlled heater to heat water. A $1/10^{th}$°C thermometer was used to measure the temperature of the bath. A magnetic stirrer was used to stir the water to achieve uniform temperature throughout the water bath.

Conclusion

Arrested precipitation technique is useful method to synthesize mixed metal chalcogenide and oxide thin films. This novel technique is simple low cost, convenient and reliable.

References

1. Mane RM, Mane SR, Kharade RR, Bhosale PN (2010) Synthesis and characterization of new quaternary MoBi2Se5 mixed metal chalcogenide thin films. Journal of Alloys and Compounds 491: 321-324.
2. Mane SR, Mane RM, Kharade RR, Gawale SN, Patil SM, et al. (2011) Influence of Tl+ Doping on Opto-Structural and Electrical Properties of Chemically Grown Tungsten Heteropolyoxometalate Thin Films. Digest Journal of Nanomaterials and Biostructures 6: 451-466.
3. Kharade RR, Mane RM, Mane SR, Patil PS, Bhosale PN (2010) Synthesis and characterization of chemically grown electrochromic tungsten oxide. Journal of Sol-Gel Science and Technology 56: 177-183.

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4. Salunkhe MM, Mane RM, Mali SS, Patil PS, Bhosale PN (2012) Photoelectrochemical Cell Performance Of Chemically Deposited $MoBi_2Te_5$ Thin Films. Journal of Advanced Materials Letters 3: 71-76.

5. Khot KV, Mali SS, Pawar NB, Kharade RR, Mane RM et al. (2014) Development of nanocoral-like Cd(SSe) thin films using an arrested precipitation technique and their application. New J Chem 38: 5964-5974.

6. Chavan S, Sharma R (2006) Growth, structural and optical properties of non-stoichiometric $CuIn(S1{-}xSex)_2$ thin films deposited by solution growth technique for photovoltaic application. J Phys Chem Solids 67: 767-773.

7. Kuranouchi S, Nakazawa T (1998) Study of one-step electrodeposition condition for preparation of $CuIn(Se,S)_2$ thin films. Sol Ener Mat Sol Cells 50: 31-36.

8. Adurodija FO, Song J, Asia IO, Yoon KH (1999) Formation of $CuIn(S,Se)_2$ thin film by thermal diffusion of sulfur and selenium vapours into Cu–In alloy within a closed graphite container. Sol Ener Mat Sol Cells 58: 287-297.

9. Kamoun N, Bouzouita H, Rezig BJ (2007) Fabrication and characterization of Cu_2ZnSnS_4 thin films deposited by spray pyrolysis technique. Thin Solid Films 515: 5949-5952.

10. Liu JP, Zhang BS, Wu M, Li DB, Zhang JC, et al. (2004) Structural and optical properties of quaternary AlInGaN epilayers grown by MOCVD with various TMGa flows. J of crystal growth 260: 388-393.

11. Abd Raof NH, Abu Hassan H, Mohd Bakhori SK, Ng SS (2009) World Academy of Science, Engineering and Technology, 55.

12. Ajalkar BD, Burungale SH, Bhange DS, Bhosale PN (2004) Chemical synthesis and compositional analysis of mixed [Mo (S1 − x Se x)$_2$] semiconductor thin films. J Mater Sci 39: 1659-1664.

13. Mane RM, Ghanwat VB, Kondalkar VV, Khot KV, Mane SR, et al. (2014) Nanocrystalline $MoBi_2Se_5$ Ternary Mixed Metal Chalcogenide Thin-films for Solar Cell Applications. Journal of Procedia Materials Science 6: 1285-1291.

14. Kharade RR, Mane RM, Bhosale PN (2011) Synthesis and electrochromic application of surfactants tailored WO_3 nanostructures. Journal of Optical Materials 34: 322-326.

15. Patil SV, Mane RM, Pawar NB, Kharade SD, Mali SS, et al. (2013) Opto-structural and electrical properties of chemically grown Ga doped $MoBi_2Se_5$ thin films. Journal of Material Science: Material Electronics 24: 4669-4676.