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Research Article

SYNTHESIS AND STRUCTURAL PROPERTIES OF In_2S_3NANO-LAYERS BY CBD METHOD

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ABSTRACT
Indium Sulfide thin layers were produced by chemical bath deposition method on glass substrates at three different deposition temperature 35 ºC ,50 ºC and 70 ºC.Aqueous solution heated for 45 minutes and kept at 2-3 pH. Crystalline structures were investigated by XRD and SEM analysis. By increasing deposition temperature In_2S_3 grains and clusters produced and then resorption happened.

Keywords: *Indium Sulfide ,StructuralProperties,SEM, XRD*

INTRODUCTION
Indium sulfide is one of the potential materials for various device applications. This includes development of photovoltaic (Burrell *et al.,* 1999; Thomas and Mccubbin, 2003), photo electrochemical solar cells (Bellantone *et al.,* 2000), electronic (Gristina, 1987), optical (Hussain *et al.,* 2012) and acoustic (Pawar *et al.,* 2012) dry cells (Pendry, 2000) which are displayed as photo catalysts for dye degradation and water splitting. Amorphous In_2S_3 films on glass substrates have also been obtained by had been used to prepare this compound in thin film form such as organometallic chemical vapor deposition (Perdew *et al.,* 1998), spray pyrolysis (Blaha and Schwarz, 2009), thermal evaporation (Kim *et al.,* 2010) and rf sputtering. The aim of this work is to produce In2S3 thin layer in different deposition temperatures and investigates about their structure and crystalline properties by SEM and XRD analysis.

Experimental Details
The samples prepared by CBD were grown from solution containing Thioacetamide (TA) and Indium Chloride (InCl3) as sources of S^{2-} and In^{3+} respectively, acetic acid was used as complex agent of the In^{3+}. The resulting solution was diluted to 100mL with water distillated. Deposition parameters were: [InCl3]=25mM; [TA]=350mM; Acid acetic=300mM. During the deposition the bath temperature was changed at 35,50and 70. The solution pH kept in 2-3. In_2S_3thin films were characterised by crystalline structure, SEM and XRD analysis.

RESULTS AND DISCUSSION
In_2S_3 thin layers were produced by CBD method at different depositions temperatures.

Figure 1-3 show scanning electron microscopy of In_2S_3on glass thin layers produced by CBD method at 35 ºC , 50 ºC and 70 ºC , respectively.

As it can be seen from figure 1, In_2S_3 grains configure on glass substrate and Nucleation process happens. Surface is full of tiny grains along with voids between them.

Figure 2, shows scanning electron microscopy of In_2S_3on glass thin layers produced by CBD method at 50 ºC.

As it can be seen grains are growing on layer and surface is full of big and tiny In_2S_3 grains with voids between them.

At 70 ºC deposition temperature, as it can be seen from figure 3, substrate surface is full of In_2S_3 grains and coalescence also happened. 70 ºC is the best deposition condition for producing In2S3 layers by CBD method (Thomas and Mccubbin, 2003). This condition is clear in our work.

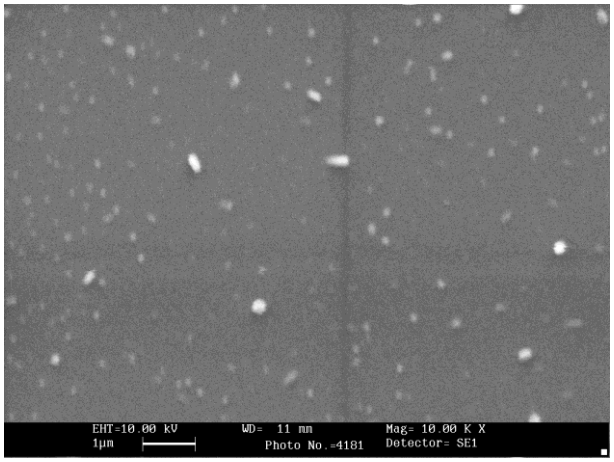

Figure1: Scanning electron microscopy of In_2S_3on glass thin layers produced by CBD method at 35 ºC

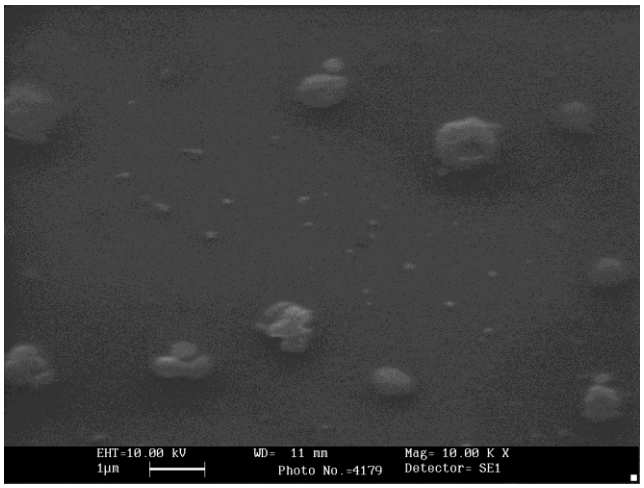

Figure 2: Scanning electron microscopy of In_2S_3on glass thin layers produced by CBD method at 50ºC

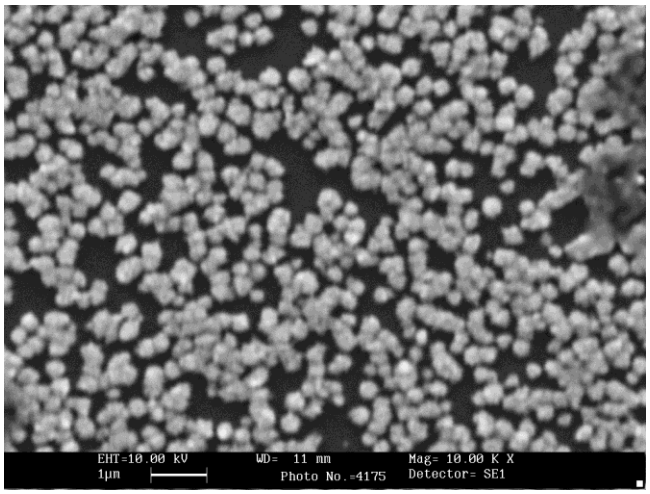

Figure 3: Scanning electron microscopy of In_2S_3on glass thin layers produced by CBD method at 70 ºC

Figure 4, a-c , show the XRD patterns of the In_2S_3thin layers produced by CBD method at 35 ºC , 50 ºC and70 ºC , respectively. The broad background is due to the amorphous glass substrate and also possibly due to the amorphous phase in In_2S_3 thin layer. The entire resultant product displayed the characteristic XRD peaks corresponding to amorphous nature of films.

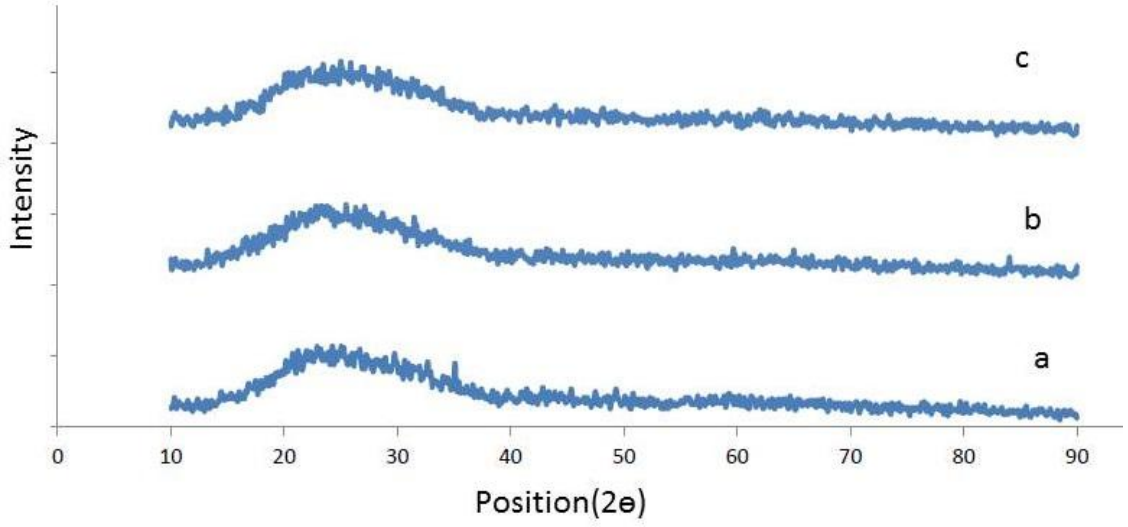

Figure 4: XRD pattern of In_2S_3 films produced by CBD method at a) 35 ºC, b) 50 ºC and c) 70 ºC

Conclusion

Indium Sulfide thin layers were produced by chemical bath deposition method on glass substrates at three different deposition temperature 35 ºC ,50 ºC and 70 ºC. Crystalline structure was investigated by XRD and SEM analysis. All of the layers were amorphous and by increasing the deposition temperature, energy of grains increases and layers goes to be crystalline.

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