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Abstract

Silver doped indium sulphide thin films (In_2S_3:Ag) were deposited by spray pyrolysis technique on glass substrates at temperature 350 °C. The films were prepared by varying the Ag:In ratio from 0% to 8%. The effect of silver concentration on structural and optical properties of In_2S_3:Ag thin films have been studied in detail using X-ray diffraction (XRD) and ultra violet, visible and near infra red (UV-Vis-NIR) transmittance spectroscopy. The X-ray diffraction analysis showed that the prepared layers are polycrystalline and crystallize in a β-In_2S_3 cubic structure and the size of the crystallites varies between 16 to 20 nm. UV-Vis-NIR spectroscopy measurements revealed that the optical transmittance of the films exceeds 90% in the visible and near infrared region and also the direct band gap energy of the fabricated thin film samples increases with doping from 2.63 to 2.97 eV. The roughness values evaluated are almost constant for different doping concentration.

Key-words: In_2S_3 thin films, Ag doping, spray pyrolysis, X-ray diffraction, Transmittance spectroscopy.

1. Introduction

Thin films of toxic cadmium sulfide (CdS) were used as a buffer layer for Cu(In,Ga)Se, $CuInSe_2$ and $CuInS_2$ solar cells, and play a vital role in enhancing the efficiency up to 20% [1]. Hence, the interest of using non toxic films like In_2S_3 [2] due to its eco-friendly nature and its wide energy band gap varying from 2 to 2.75 eV [2-7] and photoconductive behavior [8].

Indium sulfide is one of the important n-type semiconductor materials for group (III-VI). The films fabricated using this material attract an intense interest due to their high photocatalysis characteristics under ambient conditions, photosensitivity and photoconductivity [9-12].