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# Influence of Molar Concentration on Nano Tin Disulphide Thin Films Grown by Spray Pyrolysis Technique

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**Abstract:** Tin disulphide (SnS2) thin films has been prepared on glass substrates by chemical spray pyrolysis technique, using the precursor solutions of SnCl2.2H2O and thiourea with different molar concentration of 0.1 M – 0.4 M in steps of 0.1 M, at the substrate temperature of 548 K. The Structural properties have been determined by X-ray diffraction (XRD), and surface morphology have been observed on the surface of these films using Scanning Electron Microscope (SEM). The optical properties of the thin film deposited was obtained, using experimentally recorded absorption spectral data as functions of the wavelength in the range of 400– 800 nm at different molar concentrations. An analysis of the spectral absorption of the deposited film revealed optical direct and indirect band gap energy for SnS2 layer. A Fourier Transform Infrared Spectroscopy (FTIR) study confirms the presence of Sn–S bonds in SnS2 film in the molecular structure.
**Keywords:** Thin Flm, Diffraction, Optical, Absorption, Band Gap, Crystallite.

## 1 Introduction

Metal chalcogenides thin films have been extensively studied due to their potential application in electronic, optical and superconducting devices [1-2]. Tin chalcogenide belonging to IV–VI compound semiconductors has been attracting considerable interest in the field of photovoltaic energy conversion [3-7]. $SnS_2$ is considered to be one of the most useful group semiconducting tin chalcogenides, which has found applications in opto-electronic devices, a part of solar collectors. The different phases of tin sulfide compounds such as SnS, $SnS_2$, $Sn_2S_3$, $Sn_3S_4$, etc. due to versatile coordinating characteristics of tin and sulfur [8-10]. Each preparation technique has its own characteristics merits and demerits in producing a homogeneous and defect free thin film. Among them, spray pyrolysis method is principal to prepare tin disulphide thin film, which is low cost and can be used to deposit uniform coatings on a large surface area [6,20].Thin films of $SnS_2$ have been deposited using different techniques such as vacuum evaporation [11], electro- deposition [12], electroless deposition [13,14], chemical melt growth [15], chemical vapour deposition (CVD) [16], plasma-enhanced CVD [17] and spray pyrolysis [18,19]. Each preparation technique has its own characteristics merits and demerits in producing homogeneous and defect free thin film nano materials, and new preparation methods are being evolved to produce controlled size and shape of desired morphology. The intention of this present paper is to prepare and characterize the $SnS_2$ thin films with different molar concentrations using $SnCl_2$ and thiourea as a starting material by chemical spray pyrolysis technique.

## 2 Experimental Method

The precursor solutions of $SnCl_2.2H_2O$ and thiourea were dissolved separately in a solution containing deionised water and isopropyl alcohol in a proper ratio. A few drops of concentrated hydrochloric acid were added for a complete dissolution. Equal volume of these two solutions were mixed together and sprayed on the hot glass substrates with an area of 75 x 25 $mm^2$. The precursor solutions were sprayed at different molar concentration (0.1 M – 0.4 M in steps of 0.1 M) and their films were prepared. The gas pressure monitoring gauge was connected to the other side of the spray head. The spray head was allowed to move

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