Structure and surface Properties of ZnS thin film deposited by using Chemical Spray Pyrolysis method

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Abstract- At this work, our aim to study the structural and surface properties of ZnS thin film deposited by using Chemical Spray Pyrolysis. Aqueous solutions of Zinc Acetate (Anhydrous, purity 98%) and thiourea ($(NH_2)_2CS$, were chosen as main precursors for the preparation of ZnS thin films by using this technique. After ZnS thin film deposition, ZnS thin film has a clear grey color. X-Ray Diffraction and Atomic Force Microscopy techniques were used for determining the structural, morphological properties of as-deposited ZnS thin film.

II–VI compound semiconductors have attracted much attention as materials in various application devices [1].Zinc sulphide is II–VI semiconductor with a wide direct band gap (3.7eV), high refractive index (2.35), and high dielectric constant [2]. ZnS thin films are promising materials for their use invarious device applications [3]. It can thus be used for the fabrication of optoelectronic devices such as blue light-emitting diodes, electro-optic modulators and the n-window layer of solar cells [4].

ZnS is highly suitable as a window layer in heterojunction photovoltaic solar cells; because the wide band gap decreases the window absorption loses and improves the short circuit current of the cell [5].

The spray pyrolysis technique offers interesting possibilities because it is a large area technique, with a relatively low cost, and a capacity to deposit optically smooth, uniform and homogeneous layers [4]. The sprayed ZnS thin films were deposited using Zinc Acetate and TU aqueous solution. The volume of the solution for deposition was 50 ml. The concentration of solution was fixed at 0.01 M. Compressed air was used as a carrier gas. The spray rate was fixed 5ml min^{-1}.The low speed motor rotation speed was fixed 0.6 cycles per second. The temperature of substrate was determined as 350^0C.

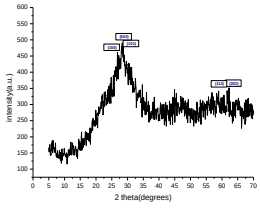


Fig.1. X-ray diffractograms of ZnS thin film obtained by using chemical spray pyrolysis method at 350 ^{0}C

Zinc sulphide exists in sphalerite, cubic (zinc blend) and hexagonal (wurtzite) forms [6].Two diffraction peaks corresponding to (002) and (101) were detected [7]. Moreover the other characteristic peaks of (100), (112), (202) planes of hexagonal form were detected.

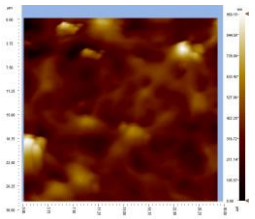


Fig.2. Two dimensional AFM image of as deposited ZnS thin film.

The image was recorded from area 30x30 micrometer square on the film. İt can be seen grains at the image which at probably tendency to be directed along (002) plane. So AFM image also sustains XRD information.

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