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Substrate dependent structural, optical and electrical properties of ZnS thin films grown by RF sputtering

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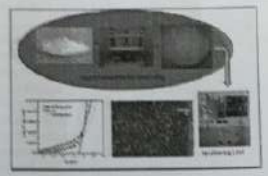
HIGHLIGHTS

- ZnS thin films deposited using RF sputtering method.
- The crystal structures of the films were found to be the zincblende (cubic) structure.
- The transmittance of all the films was about 77% in the visible region.
- The optical constant results were uniform for corning glass substrate based ZnS thin films.
- ZnS films deposited on corning glass shows small current (1.2 nA) for 8 V applied potential difference.

GRAPHICAL ABSTRACT



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ABSTRACT

Zinc sulphide (ZnS) films are of great importance for applications in various optoelectronic devices. ZnS thin films were grown on glass, indium tin oxide (ITO) and Corning glass substrates by radio-frequency magnetron sputtering at a temperature of 373 K and a comparative study of the structural, optical and electrical properties was performed using X-ray diffraction (XRD), scanning electron microscopy, optical and current-voltage (I-V) measurements. The XRD patterns showed that the sputtered thin films exhibited good crystallinity with the (111) peak around $2\theta = 28.3°$ indicating preferential orientation of the cubic structure. The maximum strain and most densely packed grains were obtained for the Corning glass substrate. The transmittance spectra of the films were measured in the wavelength range from 200 to 800 nm, showing that the films are about 77% transparent in the visible region. A slight change of 3.50 eV to 3.54 eV was found for the bandgap of the films deposited on different substrates. The ZnS thin films deposited on Corning glass show better crystallinity, morphology and I-V characteristics than that deposited on ordinary glass and ITO substrates.

1. Introduction

Zinc sulphide (ZnS) is a II–VI compound semiconductor material which has great importance in light emitting diodes [1], cathode-ray tubes [2], thin film electroluminescence [3] and window layers in photovoltaic cells [4] due to its large bandgap of 3.7 eV [5]. It is potentially important material to be used as an antireflection coating, detection emission, and modulation of visible and near UV light. Thin film solar cells (TFSCs) have attracted research attention because of their high efficiency and low cost [6] and ZnS thin films are used in TFSCs as a buffer layer [7] due to its excellent optical characteristics like high refractive index

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