The polycrystalline chalcogenide semi-conductors in solar cell

Science, Biology

II-VI semiconductors are of great importance due to their applications in various electro-optic devices. Sulphides of zinc and cadmium have been utilized effectively in various opto-electronic devices. The structural, morphology as well as optical properties of the samples were investigated by X-ray diffraction (XRD), TEM, and UV–Vis absorbance techniques. The XRD patterns of CdxZn1−x1−xS nanocrystals indicated that the solid solution possesses cubic zinc-blende structure. By tuning the composition of Zn ions in the alloy, the band gap of CdxZn1−x1−xS can be modulated from 2. 10eV to 3. 17eV.

Introduction

The polycrystalline chalcogenide semi-conductors play an important role in solar cell due to their favorable electrical and optical properties. Among the chalcogenide semi-conductors, CdZnS is one of such type materials, which is an important materials for the development of various modern technologies of solid state devices such as solar cells, light emitting diode, detector etc. The growth of ternary semiconductors thin films has been studied very extensively in the recent years, since these films play an important role in the fabrication of solar cells due to their favorable electrical and optical properties. Sulphides of cadmium and zinc have been utilized in various optoelectronic devices. It is of great technological interest that cadmium zinc sulphides (CdZnS) thin films have been used as a wideband gap window material in heterojunction solar cell and in photoconductive devices. Photoconductivity studies of II-VI compounds are quite important due to their broad applications in photovoltaic solar energy and thin film transistor electronics. Photoconductivity by visible light in polycrystalline

semiconductor films has been reported by many researchers studying a wide range of materials. Photo decay and photo response properties are employed for investigation of photoconductive materials and photovoltaic structures.

In recent years, major attention has been given to the investigation of electrical and optical properties of CdZnS thin films. In this work, Cd1-xZnxS thin films were prepared by chemical bath deposition technique. Phase purity and surface morphology properties were studied using X-ray diffractogram (XRD) and Field Emission Scanning Electron Microscope (FESEM). Chemical composition was studied using energy dispersive spectrophotometer (EDAX). Optical band gap property was investigated using UV-Spectroscopy. Electrical conductivity measured by two probe method. Thermoelectric power set up (TEP) used to determine type of material. This work reports the effect of Zn composition on structural, micro structural, electrical and optical properties of these films.

Experimental Details

The physical properties of the chemical deposition of Cd1-xZnxS films are dependent upon the growth parameters such as the bath temperature, the relative concentrations of the various reactants in the solution the pH value and the type of substrate. The chemical bath deposition technique was used to deposit the thin films of Cd1-xZnxS on glass substrate. The starting materials used were cadmium sulphate and thiourea (Made: Sd-fine 99. 99% purified). For the deposition of Cd1-xZnxS thin films a well cleaned glass substrate was immersed vertically in the solution and temperature of bath maintained at 60 to 800C for 1 to 3 hours. Triethanolamine (TEA) was used

as a complexing agent. Ammonia solutions were used to adjust pH of the reaction mixture. Finally, the substrates then washed with distilled water and annealed at temperature 2250C. In order to obtain good quality of thin films, following parameter were adjust such as deposition time, temperature of deposition, pH of the solution is adjust by addition of liquid ammonia drop in the prepared solution.