

Microstructural and Optical Characterization of Heterostructures of ZnS/CdS and CdS/ZnS Synthesized by Chemical Bath Deposition Method

Authors : Temesgen Geremew

Abstract : ZnS/glass and CdS/glass single layers and ZnS/CdS and CdS/ZnS heterojunction thin films were deposited by the chemical bath deposition method using zinc acetate and cadmium acetate as the metal ion sources and thioacetamide as a nonmetallic ion source in acidic medium. Na₂EDTA was used as a complexing agent to control the free cation concentration. The single layer and heterojunction thin films were characterized with X-ray diffraction (XRD), a scanning electron microscope (SEM), energy dispersive X-ray (EDX), and a UV-VIS spectrometer. The XRD patterns of the CdS/glass thin film deposited on the soda lime glass substrate crystallized in the cubic structure with a single peak along the (111) plane. The ZnS/CdS heterojunction and ZnS/glass single layer thin films were crystallized in the hexagonal ZnS structure. The CdS/ZnS heterojunction thin film is nearly amorphous. The optical analysis results confirmed single band gap values of 2.75 eV and 2.5 eV for ZnS/CdS and CdS/ZnS heterojunction thin films, respectively. The CdS/glass and CdS/ZnS thin films have more imaginary dielectric components than the real part. The optical conductivity of the single layer and heterojunction films is in the order of 10¹⁵ 1/s. The optical study also confirmed refractive index values between 2 and 2.7 for ZnS/glass, ZnS/CdS, and CdS/ZnS thin films for incident photon energies between 1.2 eV and 3.8 eV. The surface morphology studies revealed compacted spherical grains covering the substrate surfaces with few cracks on ZnS/glass, ZnS/CdS, and CdS/glass and voids on CdS/ZnS thin films. The EDX result confirmed nearly 1 :1 metallic to nonmetallic ion ratio in the single-layered thin films and the dominance of Zn ion over Cd ion in both ZnS/CdS and CdS/ZnS heterojunction thin films.

Keywords : SERS, sensor, Hg²⁺, water detection, polythiophene

Conference Title : ICC 2023 : International Conference on Chemistry

Conference Location : Honolulu, United States

Conference Dates : December 25-26, 2023