Abstract number 14

Optical and Electrical Characterization of $Cd_xNi_{1-x}S$ and Sb_2S_3 Thin Films for Photovoltaic Applications

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The limited supply of fossil fuels has motivated the search for alternative sources of energy. Much interest now focuses on the vast amount of radiation from the sun and thus devices that convert light energy into electrical energy are becoming increasingly desirable. Solar cells are devices that convert light energy into useful electrical energy and are fabricated using atleast the active layer being able to absorb energy from the suns radiation. They are formed by heterojunctions and homojunctions. Heterojunction and homojunction solar cells grown on glass substrates require an absorber layer and a wide band-gap window layer of optimum optoelectronic properties to form the p–*n* junction and then transparent conducting oxides (TCO) and specific metal contacts are used for both front and back electrical contacts. Efficiencies of these solar cells depend on various deposition methods and conditions because these conditions control the optoelectronic properties of the layers. In this research, Cadmium Nickel Sulphide (CdNiS) thin films will be prepared, optimized by chemical bath deposition (CBD) technique on glass substrates and used as a window material. Antimony Sulphide (Sb_2S_3) absorber layer will also be deposited using CBD technique and optimized from aqueous solutions on glass substrates. Optical properties like reflectance and transmittance data in the range from 300 nm-1100 nm will be measured by UV-VIS -NIR Spectrophotometer type DUV 3700 and used to calculate other optical and solid state properties like band gap (E_g), refractive index (n), extinction coefficient (k) and absorbance (α) which will be analyzed to determine how optical conductance, transmittance, absorbance vary with the conditions of deposition using the Scout Software. Electrical resistivity will be determined using the Four Point Probe. Alpha-step 500 surface profilometer (Tencor) will be used to determine film thickness. Solar cell properties like the current versus voltage characteristics (I-V) will be studied using Solar Cell Simulator. Conditions that give $Cd_XNi_{1-X}S$ and Sb_2S_3 optimum optical and electrical properties will then be selected and used to fabricate a $Cd_XNi_{1-X}S$ /Sb_2S_3 photovoltaic cell. The photovoltaic cell's performance characteristics like short circuit current (I_{sc}), open circuit voltage (V_{oc}), fill factor (FF) and conversion efficiency (η) will be calculated and discussed. Energy Dispersive X-rays (EDX) will be used to determine the elemental composition and chemical state of $Cd_XNi_{1-X}S$ and Sb_2S_3 thin films.