

CHARACTERIZATION OF TIN SELENIDE: NICKEL-DOPED TIN OXIDE PREPARED BY SPRAY PYROLYSIS FOR PHOTOVOLTAIC APPLICATION

MUGAMBI NELSON (B. ED SCI.)

I56/CE/26617/2011

Signature.....*Mugambi Nelson*.....

Date.....*24/03/14*.....

DEPARTMENT OF PHYSICS

A research proposal submitted in partial fulfillment of the requirements for the award of the Degree of Master of Science in the School of Pure and Applied Sciences of Kenyatta University

SUPERVISORS

DR. M. MUNJI

Signature.....*M. Munji*..... Date.....*24/03/2014*.....

DEPARTMENT OF PHYSICS

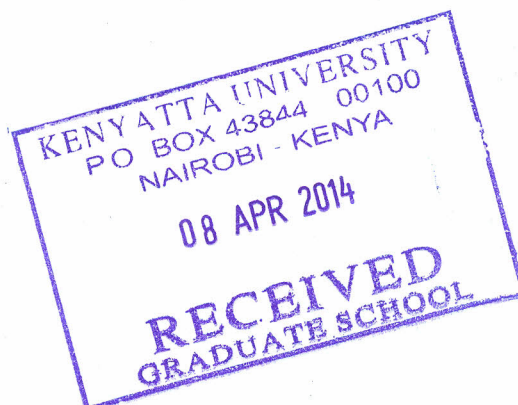
KENYATTA UNIVERSITY

DR. R.J. MUSEMBI

Signature.....*R.J. Musembi*..... Date.....*24/03/2014*.....

DEPARTMENT OF PHYSICS

UNIVERSITY OF NAIROBI



ABSTRACT

Thin film semiconductors of Sn_xSe_y and nickel doped Tin oxide are potential candidates for the development of future generation improved efficiency and low cost solar cell devices. This is due to their high absorption coefficient and good optical properties in the visible region of the solar spectrum. Nickel doped tin oxide and tin monoselenide thin films will be deposited using spray pyrolysis. Precursor solution will be prepared using a 0.05M Tin (II) Chloride ($\text{SnCl}_4 \cdot 2\text{H}_2\text{O}$) in de-ionized water and then being added in 100 ml ethanol to get equal proportions or to obtain a consistent balance of water and ethanol, followed by 1.5 weight percentage of nickel chloride 6-hydrate ($\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$). Thin films of tin selenide (S_xSe_y) with atomic ratio $y/x = 0.5$ will be prepared on a glass substrate at deposition temperature, $T=470^\circ\text{C}$ using spray pyrolysis technique. The initial materials for the preparation of the films will be an alcoholic solution consisting of tin chloride $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ and 1,1-dimethyl-2-selenourea ($\text{C}_3\text{H}_8\text{N}_2\text{Se}$). Thin films of SnO_2 , SnO_2 : Ni, Sn_xSe_y and Sn_xSe_y - SnO_2 : Ni will be deposited on glass substrate using Spray pyrolysis. Spray pyrolysis deposition is a low-cost, up-scalable technique that allows obtaining thin (poly) crystalline films over large surface areas. The samples will be characterized by measuring their optical properties using UV-VIS-NIR spectrophotometer and will be used to calculate solid state and optical properties like band gap (E_g), refractive index (n) and absorbance (α). This will be analyzed to determine how optical conductance, transmittance, absorbance vary with the conditions of deposition using the Scout Software. Electrical characterization measurements especially sheet resistance will be done using four point probe method using Keithley 2400 Source Meter. Tin Selenide a p type and Nickel doped tin oxide n type deposited on a glass substrate will form a p-n junction. The diode characteristics such as short circuit current (I_{sc}), open circuit voltage (V_{oc}), fill factor (FF) and conversion coefficient (η) of the solar cell will be determined. Tin selenide (Sn_xSe_y) and nickel doped tin oxide (SnO_2 : Ni) semiconductor have an important role in solar cell devices. Its fabrication is expected to be cost effective and of improved solar conversion efficiency.