

OPTO-ELECTRICAL CHARACTERIZATION OF ALUMINIUM DOPED TIN OXIDE CODOPED WITH SULPHUR FOR SOLAR ENERGY

Valentine Wabwire Muramba*, Maxwell Jael Mageto¹

*Technical University of Mombasa, P.o. Box, 90420-80100, Mombasa.

Email:valentinewabwire@gmail.com; Cellphone: +254722855001

¹Masinde Muliro University of Science and Technology, P.o. Box, 190-50100, Kakamega.

Email:jmmageto@gmail.com; Cellphone: +254711448025

Abstract

Thin films of Tin Oxide co-doped with 28 atomic percentage of Aluminium (i.e. 28at%Al) and varied concentration of Sulphur were prepared on 1mm thick, 1cm by 1cm glass substrates at 470°C by Spray Pyrolysis technique. Films were produced from 2.0 M solution of hydrous Tin Chloride dissolved in Ethanol with 38% Hydrochloric acid concentration, 1.5M aqueous Aluminium chloride and 2.0M aqueous solution of Ammonium Sulphide. Effects of Sulphur concentration on optical and electrical properties of transparent Aluminium doped Tin Oxide thin films were investigated in the atomic percentage of Sulphur content range zero to fifty (i.e 0at%S -50at%S) with a fixed 28at%Al content. It was observed that the optical band gaps lay in the range 3.98eV – 4.02eV for Aluminium doped Tin Oxide thin films and 3.93eV – 4.02eV for Aluminium doped Tin Oxide co-doped with varied Sulphur concentration (28at%Al+S) films. The minimum resistivity was found to be $1.15 \times 10^{-3} \Omega \text{cm}$ for the Tin Oxide films doped with 32at%Al content and $9.59 \times 10^{-3} \Omega \text{cm}$ for Tin Oxide films co-doped with 28at%Al and 20at%S content. When Sulphur was intentionally introduced in the crystal structure of 28at%Al doped Tin Oxide, the electrical conductivity decreased appreciably and unlike in Al-doped SnO₂ where transmittance increases to 91% with the dopant at wavelength of 599nm, in the case of co-doping this takes place at higher wavelength of 711nm with transmittance of 86%.

Keywords:

Spray Pyrolysis; Transparent conductors; Co-doping.