

I-V and C-V characterization of semiconductor thin films

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ABSTRACT

Cuprous oxide (Cu_2O) and ZnSe thin films were potentiostatically electrodeposited on indium-doped tin oxide (ITO) substrates in order to investigate the I-V and C-V characteristics of ITO/n- Cu_2O /(p- Cu_xS or metal or electrolyte) and ITO/p-ZnSe/electrolyte systems. An electrochemical cell containing aqueous solutions of 0-1 M sodium acetate and 1.6×10^{-2} M cupric acetate was used for electro deposition of Cu_2O thin films on ITO-coated glass substrates. Potentiostatic condition of -250 mV against standard calomel electrodes (SEC) was used for the electro deposition. To convert the top layers of the Cu_2O to Cu_xS by sulphidation, exposed the surface to a spray of aqueous solution of sodium sulphide or to a mixture of hydrogen sulphide and nitrogen gases to form ITO/n- Cu_2O /p- Cu_xS system. For the system ITO/n- Cu_2O /metal, metal layer was evaporated on to the n- Cu_2O surface. An electrolyte of 0.1 M sodium acetate was used in the ITO/n- Cu_2O /electrolyte system. Electro deposition of ZnSe thin films were carried out under potentiostatic condition at -550 mV against SCE using aqueous solutions of 0.1 M ZnSO_4 and 10^{-5} M SeO_2 at the temperature of 65°C . The theoretical and experimental I-V characteristics of ITO/n- Cu_2O /(p- Cu_xS or metal or electrolyte) system suggest that Cu_2O films made on ITO substrate form Schottky type junctions at the back contact in addition to the Cu_2O /(p- Cu_xS or metal or electrolyte) junctions. Furthermore, C-V characteristics suggest that the doping concentration of the Cu_2O layer is in the order of 10^{18} . Light and dark I-V measurements of doped and undoped ITO/ZnSe in KI electrolyte suggest the p-type photoconductivity in this system and C-V measurements confirmed it.

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