Investigation of Silver Doping on Structural, Optical and Electrical Properties of Spray Deposited Tungsten Trioxide Thin Films

Speaker: Md. Arifuzzaman

Abstract

The spray pyrolysis technique is used to synthesize un-doped Tungsten Trioxide (WO_3) and Silver (Ag) doped WO_3 thin-film onto the glass substrates at 450 °C. The surface morphology and the structural, optical, and electrical properties of Ag-doped WO_3 thin films have been investigated by the Field-Emission Scanning Electron Microscopy (FESEM) and X-ray diffraction (XRD) technique, UV-Visible spectroscopy and four-point probe electrical method, correspondingly. The surface morphological, structural, optical~~,~~ and electrical properties of un-doped WO_3 and Ag-doped WO_3 thin films have been investigated for the doping concentrations of 2, 4, 6, 8 and 10 at.% of Ag. The FESEM investigations of un-doped and Ag-doped WO_3 films have shown particle formation with the crack surface. The XRD pattern of un-doped and Ag-doped WO_3 thin films has confirmed the monoclinic structure. The observed results have shown that the thin films with high crystallinity and Ag substitution effect lead to an increase of crystallite size. Higher Ag concentration showed a different nature. The optical properties have been studied in the wavelength range of 300-1000 nm. The calculated band gap for un-doped WO_3 was found 3.20 eV and 2, 4, 6, 8 and 10 at.% Ag doped WO_3 thin films were 3.15, 3.07, 2.95, 2.90 and 3.02 eV, respectively. The electrical properties showed that the resistivity of WO_3 has decreased with increasing doping concentrations of Ag and gradually decreased with the increase of temperature. All the samples of thin films showed the semiconducting nature. The activation energy was calculated with higher and lower temperature regions. Overall analyses of the structural, morphological, optical and electrical properties have indicated that Ag-doped WO_3 thin films are sesame candidates for optoelectronic device applications.