ABSTRACT

The present study deals with the fabrication and characterization of ternary NiO-CuO-ZnO composite films for optical and photoelectrochemical applications. In this work nickel oxide (NiO), copper oxide (CuO), zinc oxide (ZnO), binary oxides (NiO-CuO, CuO-ZnO and ZnO-NiO) and ternary (NiO-CuO-ZnO) composite were synthesized by simple chemical precipitation method by using acetate salts as precursor. Composite films were fabricated on fluorine doped tin oxide (FTO) substrate by simple drop-casting method followed by calcination at 400°C for 30 mins. These synthesized films were characterized by X-ray diffraction spectroscopy (XRD), scanning electron microscopy (SEM), Raman spectroscopy and UV-visible spectroscopy to determine their properties such as structure, morphology, composition and band gap energy. The diffraction peaks of XRD are used to determine crystallite size of composites by using Scherrer equation. The SEM images of ternary composite showed spherical morphology. The linear sweep voltammetry (LSV), electrochemical impedance spectroscopy (EIS) techniques were used to study the photoelectrochemical (PEC) properties of the composite films. The study revealed improved PEC performance of ternary composite film as compared to binary composite films. Inorganic semiconducting materials are the most economical and viable source for the renewable energy industry. NiO-CuO-ZnO composite was found to possess low Rct value and higher current density as compared to binary oxides due to small band gap energy which allow the electron movement from valance band to conduction band. It can be applied in photovoltaic cells.