ABSTRACT

Zinc oxide is considered as the vital member of the oxide materials due to its semiconducting, electrical and optical properties. As an optimal bang gap is necessary for a semiconducting material to make it useful in variety of applications. As the pure ZnO has a bandgap > 3.3 eV at 300K, I aimed to modify its band gap by variation in V doping level and hence making it more favorable for semiconducting applications. In addition this study was carried out to analyze and evaluate the change in structural, optical and electrical properties by doping of Vanadium in ZnO which vary with the concentration of dopant and grain size. In present work pure and Vanadium doped ZnO nanoparticles were synthesized by a chemical micro emulsion method. Dopant percentage of V was 0, 2, 4, 6, 8 and 10 mol%. The prepared powders were sintered at 300°C and annealed at 500°C. Crystallographic, morphology, electrical and optical properties are investigated by means of X-ray diffraction (XRD), Field Emission Scanning Electron Microscope (FESEM), Fourier Transformation Infrared Spectroscopy (FIIR), UV-Vis and Near Edge X-ray absorption spectroscopy (NEXAS). XRD analysis of pure and doped samples confirms its Wurtzite structure. The average crystalline size shows a decreasing trend with increase in doping ratio. Agglomeration and spherical shape of particles can be observed from surface morphology. Chemical bonding and presence of oxidation state is exposed by using FIIR and NEXAS respectively. The slight change in band gap in $Zn_xV_{1-x}O$ (where x =0.0, 0.02, 0.04, 0.06, 0.08 and 0.1) has been observed. This band gap in a range of 3.2 eV has been calculated. Such V doped nanocrystalline ZnO material can be used in spintronics applications and optoelectronic materials.