Abstract

In the present study the effect of Ar thermal plasma treatment on compositional, morphological and field emission properties of Sn has been investigated. For this purpose Tin (Sn) has been treated for different exposure times ranging from 2.5 min to 20 min at constant Ar flow rate of 10 L/min. X-ray Diffraction (XRD) analysis identifies no new phase formation. However, the variations in peak intensities, FWHM with angular shifting are observed at different treatment times. The crystallite size of plasma treated Sn goes on increasing upto 15 min and then decreases for treatment time of 20 minutes. Whereas, vice versa is true foe dislocation line density. The anomalous trends are observed for stress and strain measurements. Scanning Electron Microscopy (SEM) analysis of thermal plasma treated Sn reveals the formation of ridges, cones, droplets, cavities, voids and pores at different treatment times. The work function was measured by Kelvin Probe (KP) technique and varies from 4.38 eV to 5.08 eV for different treatment times. The Field Emission (FE) parameters are evaluated by I-V characteristics and Fowler-Nordheim (F-N) curves using diode configuration. The maximum current density (J_{max}), turn on field (E_o) and field enhancement factor (β) come out to be in the range of 564 nA/cm^2 to 2522 nA/cm^2, 4 V/μm to 11 V/μm and 2600-4520 respectively. The work function and surface structural density (emission sites) are well correlated with current density and β. The structured surfaces of Sn are highly applicable for FE-SEM as well as LCD displays.