ABSTRACT

Laser induced surface, structural, electrical and mechanical modifications of antimony (Sb) have been investigated after its irradiation by using Nd: YAG (1064nm) laser at four different fluences ranging from 2.21 Jcm^{-2} to 8.84 Jcm^{-2}. Sb samples have been exposed under two different environments of air and vacuum. After irradiation, surface modifications investigated through optical microscopy revealed the formation of craters where their size initially increases with increase in fluence and then decreases up to maximum fluence. Moreover, Scanning Electron Microscope (SEM) exhibits the formation of island like structures, wave like ridges, pinholes and cracks formation in air. Whereas, the formation of ripples, cluster, nanoparticles, flakes, cavities and spherical headed cones have been observed for Sb irradiation under vacuum. The outer boundaries of irradiated Sb contain island like structures in both air and vacuum. These surface structures are less distinct and diffusive in air than vacuum which is attributed to the excessive and pronounced formation of Sb_2O_3, XRD analysis confirms the formation of Sb_2O_3 in both environments. However pronounced oxide formation is observed in air. The overall crystallite size of Sb decreases after laser treatment as compared to virgin target. Whereas vice versa is true for dislocation line density. Fourier Transform Infrared Spectroscopy (FT-IR) also confirms the oxides formation (Sb_2O_3) after irradiation under both environmental conditions at all fluences. The electrical conductivity decreases and hardness of Sb increases with increasing fluence under both environments. This decrease in crystallite size and increase in hardness are attributed to defects generation, which cause the hurdles for mobility of free electrons and dislocation movements.