ABSTRACT

The effects of singly charged gold (Au^+) and silicon (Si^+) ions irradiation on surface, structural, electrical and mechanical properties of niobium (Nb) have been investigated. The Nb samples were exposed with 1 MeV Au^+ and Si^+ ions at four different fluences of 0.5×10^{14} ions/cm^2, 1×10^{14} ions/cm^2, 0.50×10^{15} ions/cm^2 and 1×10^{15} ions/cm^2 using Pelletron Linear Accelerator. The ions penetration depth, electronic/nuclear energy losses and vacancies were estimated using SRIM/TRIM simulation. The surface and structural analysis of both un-irradiated and ions beam irradiated Nb were performed by Scanning Electron Microscopy (SEM) and X-ray diffraction (XRD). The SEM results reveal the formation of cavities, craters, voids and melted channel like structures at the surface of irradiated specimens. Whereas, in case of Au ions irradiation, the surface damage is more prominent. The XRD results depict the decrease in crystallinity after ions irradiation. However, in case of Au irradiated samples the crystallinity increase at higher fluences. The average crystallite size continuously decreases in case of Si ions irradiation, whereas, for Au ions the average crystallite size initially decreases and then increases at higher fluences. In case of Si irradiated Nb samples, the conductivity continuously decreases and hardness increases with increasing the ions fluence. Whereas, in case of Au ions irradiated samples the anomalous trend in both the conductivity and surface micro-hardness has been observed with the increase of ions irradiation fluence.