Abstract

Ion induced modifications in surface, structural and electrical properties of Si and Ge have been investigated. Si and Ge samples were irradiated at constant energy of 250KeV for varying ion fluences of $1.1x10^{13}$ions/cm^2, $4.5x10^{13}$ ions/cm^2, $9.39x10^{13}$ions/cm^2, $1x10^{14}$ions/cm^2, $1.6x10^{14}$ ions/cm^2 by using Pelletron Linear Accelerator. Scanning Electron Microscopy (SEM) of Ge exhibits the formation of ion induced defects such as irregular shaped crystallites, particulates and agglomers. Whereas, surface morphology of Si reveals the formation of droplets, particulates and cracking due to the heating, melting and re-solidification. The formation of such kind of surface features is explainable on the basis of collisional cascade theory and thermal spike model. From XRD analysis of ion irradiated Si and Ge no new phases are identified. However, a slight peak shifting with peak intensity fluctuations and peak broadening is observed. The crystalline size of Ge shows a decreasing and then increasing trend. Whereas a monotonic decrease in crystalline size of Si is observed. The FTIR results of Ge show a new band at wave number 2130cm^{-1}. This band corresponds to N≡N triple bond's stretching vibrations. The FTIR results of Si show a new band at wave number 2343cm^{-1}. This band corresponds to NO_2 asymmetric vibrations. The maximum penetration depths of nitrogen ions in Si and Ge substrates evaluated by using SRIM software is 0.6μm and 0.55μm respectively. The values of electronic and nuclear stopping powers of Si are 46 eV/A° and 3.517 eV/A° respectively. For germanium the values of electronic and nuclear stopping powers are 52eV/Angstrom and 4.841eV/Angstrom respectively. The Electrical conductivity measurements of ion irradiated Si and Ge by four probe method are well correlated with XRD analysis. Four probe results of Ge show a decreasing and then increasing trend. The decreasing trend in electrical conductivity of Si is due to the continuous amorphisation of Si after N_2 ions irradiation.