Abstract

In this work we present the analysis of small interstitial clusters (ICs) introduced in p-type Si after ion implantation using deep level transient spectroscopy (DLTS) and photoluminescence. Silicon ions with energy 380 keV and fluence of 1.0 x 10^{12} cm^{-2} have been implanted into bulk p-type Si and post-implant annealing at temperatures between 500 ^{o}C and 800 ^{o}C specifically to create small interstitial cluster (ICs) defects. In the samples annealed at 500 ^{o}C, DLTS spectra show deep level hole traps at E_V + 0.20 eV, E_V + 0.25 eV, E_V + 0.36 eV, and E_V + 0.50 eV. The hole traps E_V + 0.36 eV and E_V + 0.50 eV have been attributed to the small Si self-interstitial clusters. After increasing the post-implant anneals to 600 ^{o}C there is a significant decrease in defect concentration and all the defects are annealed-out at 700 ^{o}C. Photoluminescence (PL) spectroscopy of the samples reveals optical band levels, at 1218 nm (1.019 eV), and 1233 nm (1.007 eV) which have both been attributed to interstitial cluster defects. The interstitial cluster-related optical band levels have been observed in the samples annealed at 500 ^{o}C which correlate well with DLTS measurements.