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# EVOLUTION OF VACANCY SUPERSATURATIONS IN MeV Si IMPLANTED SILICON

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Implantation into silicon at high-energies (MeV) is known to produce concurrent supersaturations of vacancies near the surface and interstitials near the ion projected range [1]. We investigate the evolution of the near surface vacancy supersaturation, from creation of point defects during ion implantation to cluster formation during post-implant annealing. A buried $SiO_2$ layer is used to isolate the interstitial supersaturation from interacting with the vacancy supersaturation during post implant annealing. Sharp Sb and B dopant-diffusion markers are used to measure free vacancy and interstitial supersaturations, respectively. Clustered vacancies are profiled by Au labeling [2], a technique using Rutherford backscattering spectrometry to profile Au trapped by the vacancy clusters.

By correlating the free vacancy supersaturations with the presence of vacancy clusters we identify three stages of defect evolution in the near surface region of 2-MeV Si implant silicon. The first stage is during defect creation. We show that the interstitials and vacancies that are created during ion implantation at slightly elevated temperatures (<300°C) interact with dopants, resulting in radiation enhanced diffusion. The second stage occurs during post-implant annealing, when defect recombination takes place. We show that during recombination of the interstitial and vacancy distributions a large free vacancy supersaturation dominates the near surface region. In the final stage of evolution, the large vacancy supersaturation evolves into stable clusters of vacancies. We show that the rate at which vacancies are released from clusters is similar to the rate of formation of thermally generated vacancies, indicating that the binding energy of the clusters is similar to the vacancy formation energy.

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