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Damage Accumulation in Si During He and Self-ion Implantation. Y. Zhong, P. Partyka and R.S. Averback, Dept. of Materials Science and Engineering, Univ. of Illinois at Urbana Champaign, S.K. Ghose, I.K. Robinson, Dept. of Physics, Univ. of Illinois at Urbana Champaign, Kai Nordlund, Accelerator Laboratory, Univ. of Helsinki, Finland.

Accumulation and annealing of damage in Si implanted with either He or self ions were investigated using a combination of grazing incidence diffuse x-ray scattering, high resolution x-ray diffraction (HRXRD) scans, and transmission electron microscopy. For the He ion irradiations, it is shown that interstitial migration takes place at low temperatures, 150 K, while vacancies mobile at a somewhat higher temperature 175 K. For self ion implantation at 100 C, small vacancy and interstitial clusters formed at low doses, but their concentrations saturated after a dose of 3 x 1014 cm-2. The concentration of Frenkel defects at this stage of the implantation was 1 x 10-3. At doses above 1 x 1015 cm-2, the concentration of implanted interstitial atoms began to exceed the Frenkel pair concentration, causing the interstitial clusters to grow, and by 3 x 1015 cm-2, these clusters formed dislocation loops. Analysis of the rocking curves illustrated that at doses above 1 x 1015 cm-2, the “plus one” model was well obeyed, with one interstitial atom being added to the dislocation loops for every implanted Si atom. A key part to interpreting the x-ray results was the development atomistic