Vacancy-impurity interactions in ion-implanted silicon

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We have investigated the role of impurities in the annealing of ion-implanted silicon. The process of ion implantation creates vacancies and interstitials, as well as introducing impurities. These populations interact with impurities already present in the host material, especially oxygen and dopant species. In order to explore the energetics of defect migration, we have constructed a positron accelerator to probe vacancy-type defects via positron annihilation, with an *in situ* gas-source ion implanter. This novel apparatus allows us to implant energetic ions at cryogenic temperatures, and to probe vacancy concentrations as a function of isothermal annealing time and temperature. The dependence of annealing behaviour on impurity concentrations in the starting material provides a window into vacancy-impurity interactions that are important to the doping of silicon devices.