ION IMPLANTATION STUDY OF Be IN InSb FOR PHOTODIODE FABRICATION

Ion Implantation of Be into InSb

Ion implantation tools are comprised of an ion source, an accelerator, and a substrate chuck. To ensure ion beam purity, the ion source is accelerated and turned through a separation magnet. Only ions of a specific molecular weight will make the turn successfully through the aperture. By integrating the ion current over time, the applied dose during implantation can be monitored and controlled. The ion flux incident on the substrate during implantation can be controlled by adjusting the current through the ion source material. The substrate can typically be cooled and/or tilted if necessary. Semiconductor wafers like InSb are comprised of regular periodic crystal lattice of atoms. These wafers are grown such that prominent planes of these crystals face the surface. When ion implantation is performed at normal incidence to a regular crystalline plane, the resultant ion range becomes unpredictable due to an effect known as channeling (24). To reduce channeling effects during ion implantation, the crystal is tilted slightly from normal. To test the accuracy of the SRIM simulations, implantations at a variety of implant energies were performed. These implantations were completed by Core Systems Inc, a leader in semiconductor ion implant services. Implantations were done with a substrate tilt of 7°, and no substrate cooling. Typical ion flux was used. The following implant energies and doses were performed on separate substrates.

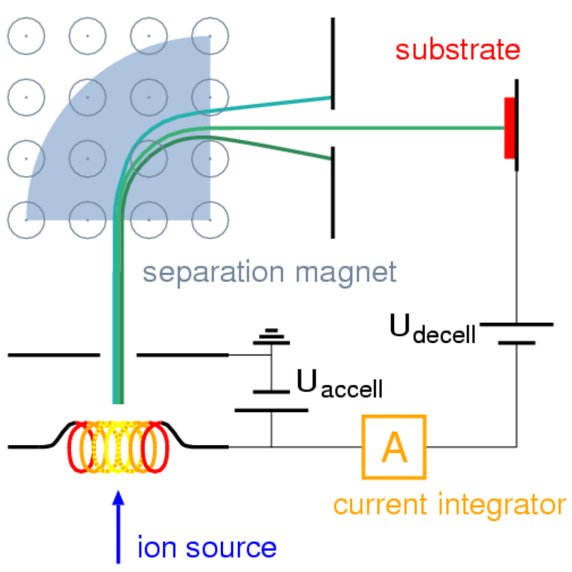


Figure 1: Schematic of a generic ion implantation tool

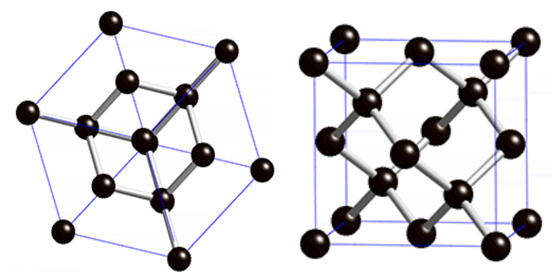
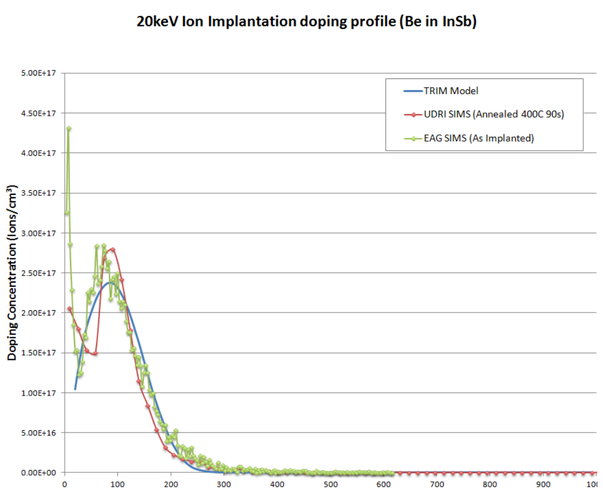
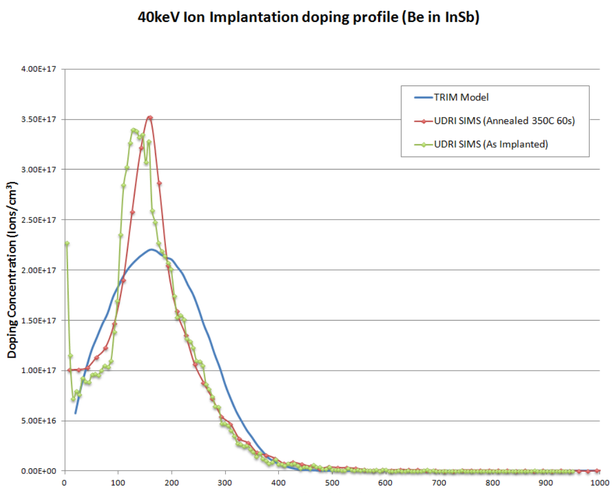
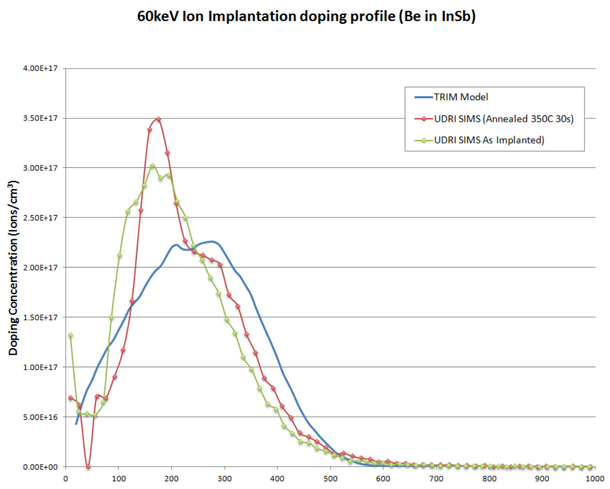
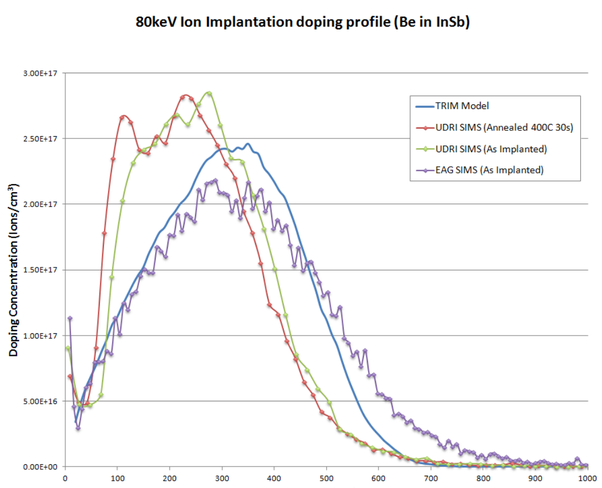


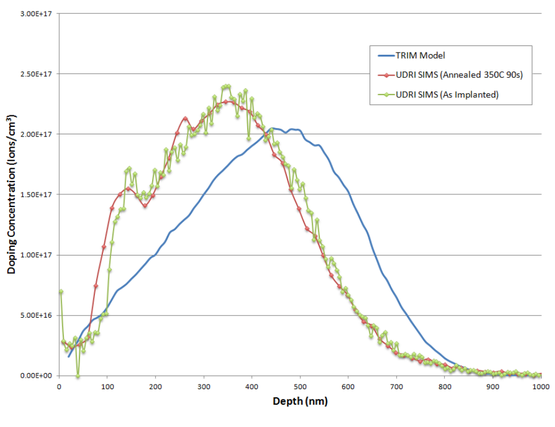
Figure 2: Left) On-axis orientation of atoms in a crystal. Right) Tilted orientation of atoms in a crystal.











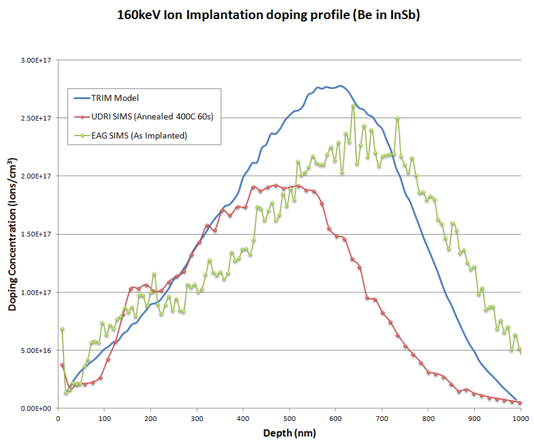


Figure 3: Comparison of SRIM model to SIMS measurement of doping profiles for specified implant energies and annealing parameters.