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Carbon Impurity Effects on Structural and Magnetic Properties of Manganese Doped Silicon JOSHUA LAROSE, ROGER PINK, TARA P. DAS, MENGBING HUANG, SUNY-Albany, JIAN-QING WANG, SUNY-Binghamton — The recent finding of room temperature ferromagnetism in Mn-doped Si may open up a promising route toward Si-based spintronics. In this work, we investigate effects of co-doped carbon on the structural and magnetic properties of Si:Mn, in a hope to identify possible microstructures responsible for ferromagnetism. Carbon atoms of 0.25 at. % are uniformly doped within the 250-nm surface layer of Si(100) using ion implantation. The C-rich Si and the Si control are subsequently implanted at 300 $^\circ$C with Mn ions, yielding a concentration profile of Mn ([Mn] $\sim$ 0.25 at. %) within the depth of 160 nm. Post-implantation annealing is conducted in the range of 800-1000 $^\circ$C. Ion channeling measurements suggest that Mn could occupy several lattice sites in Si including the tetrahedral interstitial and substitional site, with respective occupancy affected by carbon impurity and thermal annealing. The Hartree-Fock Cluster Method is used to calculate the binding energies of Mn for different lattice sites in Si. These structural information are compared with the results of superconducting quantum interference device (SQUID) experiments.

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