Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Above Room Temperature Ferromagnetism in Mn-implanted Si MARTIN BOLDUC, CHAFFRA AWO-AFFOUDA, ANDY STOLLENWERK, MENGBING HUANG, FRANK RAMOS, VINCENT P. LABELLA, College of Nanoscale Science and Engineering, University at Albany, State University of New York, Albany, New York — Utilizing the spin of the electron in semiconductor devices holds great potential to provide novel device structures. The integration of ferromagnetic materials into conventional semiconductors is necessary to achieve spintronic devices. Ion implantation is an attractive means for the fabrication of diluted magnetic semiconductors by integrating magnetic materials into existing CMOS electronic devices. We demonstrate that p-doped and n-doped Si crystals can be made ferromagnetic above room temperature through Mn-ion implantation. 300-keV Mn^+ ions were implanted at dose of (1-10)X10^{15} cm^{-2} reaching peak concentration of (0.1- 0.8) at.% as measured through SIMS profiling. Ferromagnetic hysteresis loops were obtained using a SQUID magnetometer at temperature of (10-300) K, yielding a saturation magnetization of 0.1-0.3 emu/g-sample. The Curie temperature is found >400 K with carrier concentration dependence. The crystal structure has been investigated by RBS in the channeling mode and by TEM cross-section images analysis. In this study, we will report the effects of Mn concentration and post implantation annealing on the strength of the ferromagnetism and on the crystal composition.

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Date submitted: 01 Dec 2004 Electronic form version 1.4