Ferromagnetism in Mn-implanted Ge and epitaxial GeC
SAMARESH GUCHHAIT, JOHN MARKERT, Department of Physics, The University of Texas at Austin, MUSTAFA JAMIL, SANJAY BANERJEE, Department of ECE, The University of Texas at Austin — 20 keV energy Mn ions were implanted in two samples: 1) bulk Ge (100) and 2) a 250 nm thick epitaxial GeC film, grown on a Si (100) wafer. The GeC thin film was grown by UHV chemical vapor deposition using a mixture of germane (GeH4) and methylgermane (CH3GeH3) gases and contains less than 1% carbon. X-ray diffraction data shows a single crystal phase for the GeC film, and the surface rms roughness is about 0.3 nm, measured with AFM. The Mn implant dose was $1.1 \times 10^{16}/\text{cm}^2$ at a temperature of 300°C for both samples. For this relatively low energy Mn ion implant, the range is about 17 nm and the straggle is about 9 nm. A SQUID magnetometer study shows ferromagnetism in both samples. While the Curie temperature for both samples is about 180 K, the in-plane saturated magnetic moment per unit area for the first sample is about $2.2 \times 10^{-5}\text{emu/cm}^2$ and that for the second sample is about $3.0 \times 10^{-5}\text{emu/cm}^2$. These results show clear enhancement of magnetic properties of the Mn-implanted GeC thin film over the identically implanted Ge layer due to the presence of a small amount of carbon.

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