Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Influence of Mn Distribution on Ferromagnetism in Magnetic Semiconductor $\mathbf{Mn_xGe_{1-x}}$ A.P. LI, Oak Ridge National Laboratory, C. ZENG, The University of Tennessee, L.C. FELDMAN, Vanderbilt University, J.F. WENDELKEN, Oak Ridge National Laboratory, N. RAO, Vanderbilt University, J. SHEN, H.H. WEITERING, Oak Ridge National Laboratory and The University of Tennessee — The ferromagnetism of Mn-doped Ge, grown with molecular beam epitaxy, is studied by controlling Mn distributions in the films via post-annealing and digital doping techniques. Randomly doped Mn_xGe_{1-x}films exhibit a high concentration of Mn trapped at interstitial sites in Ge, and reveal two ferromagnetic transitions at T_C* and Tc, respectively. A strong correlation between magnetic and transport properties is observed both at T_C* and T_C. Upon annealing as-grown films at a low-temperature, some interstitial Mn atoms are driven toward the surface of the film and even to the substitutional sites of Ge, as predicted by a theory and revealed by ion channeling and x-ray photoemission spectroscopy. This Mn redistribution leads to a large increase in ferromagnetism with both T_C* and T_C shifting toward higher temperatures. Spatial control of Mn atoms along the growth direction is achieved in a Mn_xGe_{1-x}/Ge digital heterostructure. Ferromagnetism enhancement is also observed in digital structures as compared to randomly doped material with same nominal x. The ferromagnetism variation is studied by changing undoped Ge spacer layer thickness and x in doped Mn_xGe_{1-x} layer.

An-Ping Li
Oak Ridge National Laboratory

Date submitted: 04 Dec 2004 Electronic form version 1.4