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Room Temperature Ferromagnetism in Mn-implanted CVD-Grown ZnO Films and Nanostructures[1] D. HILL, R. GATEAU, R.A. BARTYNSKI, P. WU, Y. LU, L. WIELUNSKI, V. POLTAVETS, M. GREENBLATT, Rutgers University, D.A. ARENA, Brookhaven National Lab., J. DVORAK, Montanna State University, A. MOODENBAUGH, Brookhaven National Lab., S. CALVIN, Sarah Lawrence College — We have characterized the chemical, compositional, and magnetic properties of Mn-ion implanted epitaxial ZnO films and single crystal nanostructures grown by MOCVD as candidate room temperature diluted magnetic semiconductors. X-ray absorption spectroscopy (SXAS) and EXAFS show that the as Mn-implanted films contain isolated Mn^{2+} ions substitutional for Zn. Upon annealing the distribution of Mn ions changes becomes locally enriched with a substantial fraction of the nearest cation neighbors being Mn. SQUID magnetometry shows that as-implanted films are ferromagnetic at 5K with a saturation magnetization of ~ 0.2 μ_B/Mn-ion. The annealed films have an Ms that is ~ 1 μ_B/Mn-ion and are ferromagnetic at room temperature. Elemental analysis of the nanorods in the transmission electron microscope shows that the Mn concentration is relatively uniform perpendicular to the axis of the structure, but has a higher concentration near the tip than at the base.

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