

Abstract Submitted  
for the MAR06 Meeting of  
The American Physical Society

**Structural and Magnetic Phase Diagrams of Co and Mn Doped Ge (100) Epitaxial Films** BRIAN COLLINS, LIANG HE, FRANK TSUI, University of North Carolina, YUNCHENG ZHONG, STEFAN VOGT, YONG CHU, Advanced Photon Source — We present studies of structural and magnetic properties of epitaxial films of  $\text{Co}_x\text{Mn}_y\text{Ge}_{1-x-y}$  magnetic semiconductors, grown by combinatorial MBE on Ge (100) substrates. Structural effects were examined *in-situ* by reflection high energy electron diffraction and *ex-situ* by microbeam x-ray diffraction. A ternary epitaxial phase diagram has been determined for doping concentrations (x and y for Co and Mn respectively) up to 30 at %, where regions of coherent epitaxy and associated strain states, and regions of rough disordered growth and the nature of the disorders have been examined and identified. Specifically, within a narrow range of compositions around the atomic ratio between Co and Mn (x/y) of 3, the observed epitaxial strain is low (<0.1%) and coherent epitaxial growth is most stable, where the thin film lattice constants obey Vegard's law and they match those of the Ge at x/y =3. Within this region of compositions, high quality epitaxial films of p-type magnetic semiconductors can be stabilized for total doping concentration of transition metal dopants as high as 13 at % and with  $T_C$  as high as 300 K. A ternary magnetic phase diagram has been measured using magneto-optic Kerr effect. The interplays between structural effects and magnetism have been investigated.

Frank Tsui  
University of North Carolina

Date submitted: 06 Dec 2005

Electronic form version 1.4