

Structural Investigation of Combinatorial Ge-Co-Mn Epitaxial Thin-Film System Using Synchrotron X-ray Microprobe

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One of the critical challenges for the science and technology of spintronics is the ability to control synthesis and properties of doped magnetic semiconductors (DMSs). Studies of DMSs have shown that carrier-mediated ferromagnetism can be enhanced by increasing the doping concentration of a transition metals into a semiconductor matrix. By employing multiple x-ray microprobe techniques on composition spread thin-film samples grown by combinatorial molecular beam epitaxy techniques, we have performed systematic structural investigation of interfacial strain, crystalline disorders, short-range coordination and dopant stability against phase separation as a function of composition [1]. Complete and systematic investigation of this magnitude would have taken more than a decade of research if an enormous set of samples grown at each discrete composition was used instead. In addition to the scientific findings, the presentation will illustrate the experimental method for fabricating and correlating the multiple microprobe techniques on the common composition grids within a composition-spread sample.

[1] B. A. Collins, Y. S. Chu, L. He, Y. Zhong, and F. Tsui, Phys. Rev. B 77, 193301 (2008).

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