Local structure and spin states of Mn-Co and Fe-Co codoped Ge epitaxial films of dilute magnetic semiconductors

BRIAN COLLINS, LIANG HE, FRANK TSUI, University of North Carolina at Chapel Hill, YONG CHU, DANIEL HASKEL, EVGENY KRAVTSOV, APS Argonne National Laboratory — Codoping with Co has been shown to promote successful dilution of magnetic dopants of Mn and Fe into Ge up to a combined doping level of 15 at. %. Local structure, magnetic moment, and spin-dependant states of these diluted magnetic semiconductors (DMS) have been probed as a function of composition using X-ray and tunneling spectroscopy techniques. Extended X-ray Absorption Fine Structure (EXAFS) measurements reveal an increased level of substitution for each dopant species with respect to traditional single dopant DMS materials. A codoped environment results in 70% of Mn and 90% of Co successfully incorporating substitutionally into the Ge lattice. The remaining dopants are seen to form interstitial dimmers and trimers rather than metallic precipitates. Tunneling spectroscopy measurements on these systems through Al₂O₃ barriers using both Nb and Fe as spin detectors will be discussed in their correlation with the structural results.

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