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Studies of Mn/GaAs Digital Alloys Using X-ray Absorption Fine Structure and X-ray Diffraction Methods

Y.L. Soo, G. Kioseoglou, S. Kim, X. Chen, H. Luo, Y.H. Kao (SUNY at Buffalo); Y. Sasaki, X. Liu, and J.K. Furdyna (U. of Notre Dame)

Beamline(s): X3B1

The x-ray absorption fine structure (XAFS) techniques have been employed to investigate the local structure and effective chemical valency of Mn atoms in Mn/GaAs *digital alloys*. The samples were prepared by molecular-beam-epitaxy with GaAs layers of different thickness separating the nominal Mn monolayers. Lattice constants of the digital alloys have also been determined by x-ray diffraction. Our x-ray results indicate that Mn in the nominal Mn monolayers actually combines with GaAs to form (Ga,Mn)As alloys with Mn substituting for the Ga site in GaAs. The lattice constant of the digital alloy increases linearly with the average Mn concentration in the samples. Also, the average effective chemical valency of Mn in the samples is estimated to be positive but appreciably lower than 2+, suggesting possible formation of disordered Mn clusters in the III-V matrix.

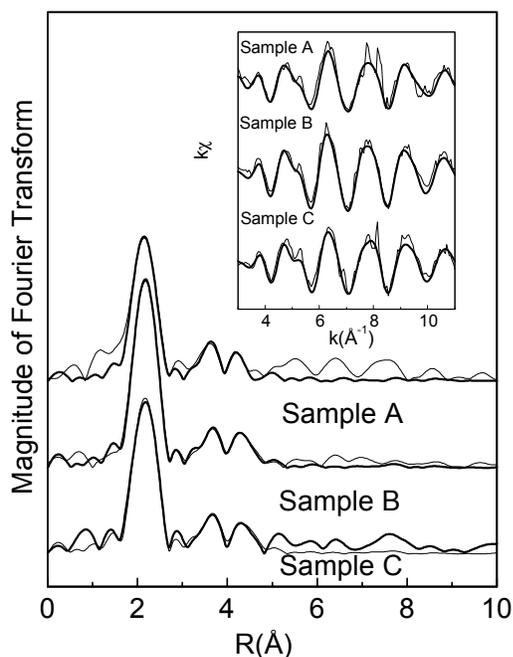


Figure1. EXAFS data for Mn/GaAs digital alloys

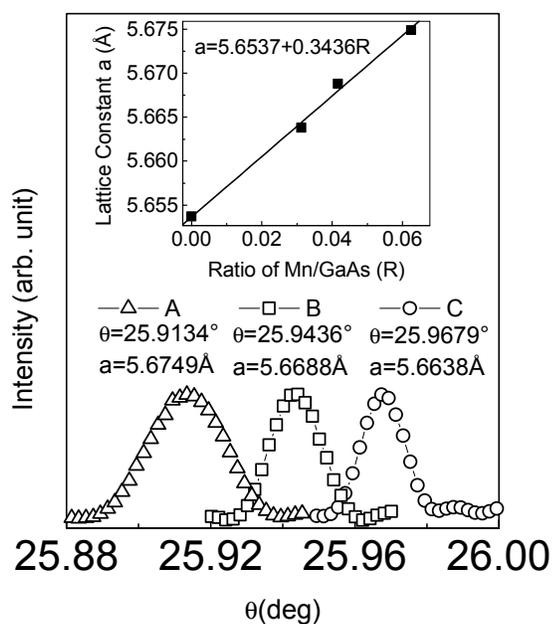


Figure2. XRD data for Mn/GaAs digital alloys

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