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Magnetic Properties of Single Crystal Fe_{1-x}Gax Thin Films

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Magnetic Properties of Single Crystal $\text{Fe}_{1-x}\text{Ga}_x$ Thin Films ADAM MCCLURE, HONGYAN LI, PAUL RUGHEIMER, Montana State University, J.X. CAO, RUQIAN WU, University of California, Irvine, ELKE ARENHOLZ, Lawrence Berkeley National Laboratory, YVES IDZERDA, Montana State University — Single crystal thin films of the highly magnetostrictive $\text{Fe}_{1-x}\text{Ga}_x$ alloy have been prepared on GaAs(001), with a ZnSe buffer layer, and MgO(001) substrates by molecular beam epitaxy (MBE). The saturation magnetization of the samples, as determined by vibrating sample magnetometry (VSM) and Rutherford backscattering (RBS), shows a reduction as a function of Ga concentration which closely follows a simple dilution model up to a concentration of 25% Ga where the magnetization falls more abruptly than simple dilution allows. X-ray magnetic circular dichroism (XMCD) performed at the Fe and Ga $L_{2,3}$ -edges, along with *ab-initio* density functional (GGA) calculations, ascribe this trend to a decrease in the elemental Fe moment and an induced moment in the gallium of $0.1 \mu_B$ anti-aligned to the Fe, establishing $\text{Fe}_{1-x}\text{Ga}_x$ as a ferrimagnetic system.

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