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Moment Mapping of bcc $Fe_{1-x}Mn_x$ Alloy Films on MgO(001) YVES IDZERDA, HARSH BHATKAR, Montana State Univ, ELKE ARENHOLZ, Advanced Light Source — The magnetic moments of $\sim$ 20 nm single crystal films of compositionally graded $Fe_{1-x}Mn_x$ films ($0.1 \leq x \leq 0.2$) grown on MgO(001) are determined by spatially resolved moment mapping using X-ray absorption spectroscopy (XAS) and magnetic circular dichroism (MCD). RHEED measurements confirmed that the growth of $Fe_{1-x}Mn_x$ films remained epitaxial and in the bcc phase up to x=0.35 but, like Fe growth, is rotated 45 degree with respect to the MgO(001) surface net. This is beyond the bulk bcc stability limit of x=0.12. Both magnetometry and XMCD measurements show that the net magnetic moment of these alloy films behave similarly to the bulk behavior, with a gradual moment reduction at low Mn concentrations followed by an abrupt departure from the Slater-Pauling curve and disappearance of the moment at x=0.15. By generating a compositional variation around this critical concentration and subsequently using spatially resolved mapping of the X-ray absorption at the Fe and Mn L_3-edge using linear and circular polarized soft X-rays, the local composition and elemental moments can be simultaneously mapped across the surface of the sample. The Fe moment is found to gradually reduce with increasing Mn content with a very abrupt decline at x=0.15. Surprisingly, the Mn moment shows a very small net moment (<0.1 mu_B) at all compositions, suggesting a complicated Mn spin structure.

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