

3rd International Conference on

THEORETICAL AND CONDENSED MATTER PHYSICS

October 19-21, 2017 New York, USA

Large moments in bct $\text{Fe}_x\text{Co}_y\text{Mn}_z$ ternary alloy thin films

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Establishing high magnetic moment materials in thin film form is critical for magnetic device applications. Shown in the figure is the average magnetic moments of bct $\text{Fe}_x\text{Co}_y\text{Mn}_z$ ternary alloy thin films deposited on $\text{MgO}(001)$ determined from the X-ray magnetic circular dichroism measured elemental moments as a function of composition. Thin film epitaxy stabilized the bct structure for 80% of the available ternary compositional space compared to only a 23% stability region for the bcc bulk phase. A maximum average atomic moment of $3.2 \mu\text{B}/\text{atom}$ was observed for a $\text{Fe}_{0.32}\text{Co}_{0.47}\text{Mn}_{0.21}$ (well above the $2.4 \mu\text{B}/\text{atom}$ found at the peak of the Slater-Pauling binary alloy curve). The compositions exhibiting high moments are not stable as a bcc structure in the bulk ternary phase diagram.

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