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Field Dependent Phase Front in Ni[1-x]Cu[x] Graded Alloy Films

B.J. KIRBY, NIST Center for Neutron Reseearch, H.F. BELLIVEAU, D.D. BELYEA, C.W. MILLER, University of South Florida — For heterostructures composed of distinct, homogeneous layers, the magnetic properties of the individual layers can be strongly affected by interlayer exchange coupling, leading novel and useful properties (exchange bias, GMR, etc.). Less well understood are structures exhibiting a gradient in magnetic properties, with no discrete interfaces. Particularly interesting is the case where a phase transition is expected across the length of the gradient - do individual regions behave as they would in isolation, or does exchange coupling cause a single phase? Ni[1-x]Cu[x] alloy is a useful model system for, as the Curie temperature (Tc) varies with x. We have studied a 100 nm Ni[1-x]Cu[x] film with x that varies smoothly from 0.39-0.30 across the thickness. Magnetometry measurements of homogenous x=0.39 (x=0.30) samples reveal Tc near 200 K (300 K). Polarized neutron reflectometry measurements of the graded sample magnetic depth profile reveal a distribution of Tc, demonstrating that the sample is not completely coupled. At 300 K we observe evidence of a non-magnetized / magnetized boundary that moves vertically with applied field. Implications of a spatially controllable paramagnetic-ferromagnetic phase boundary will be discussed. Work at USF was supported by NSF-CAREER.

Brian Kirby
NIST - Natl Inst of Stds & Tech

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