Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Tunable Positive/Negative Exchange Bias in Gd_xFe_{1-x}/NiCoO Thin Films DUSTIN GILBERT, NIST Center for Neutron Research, JUSTIN OLAMIT, University of California, Davis, BRIAN J. KIRBY, NIST Center for Neutron Research, RANDY K. DUMAS, University of California, Davis, ELKE ARENHOLZ, Advanced Light Source, LBNL, KAI LIU, University of California, Davis — The exchange bias phenomenon in ferromagnet/antiferromagnet has been a long-standing problem due to its intriguing mechanisms and critical applications in spin-valve devices. Generally, exchange biased systems which are cooled below the AF Néel temperature in a positive magnetic field become biased to negative fields, referred to as negative exchange bias. Here, we investigate thin films of ferrimagnet/antiferromagnet Gd_xFe_{1-x}/NiCoO, with $0.47 \leq x \leq 0.63$. A multi-stepped hysteresis loop is observed, with a primary loop (phase one, low anisotropy) and a pair of sub-loops (phase two, higher anisotropy). The exchange bias can be tuned by the cooling field to be either positive or negative. As the cooling field is varied, the bias of phase one moves opposite to that of phase two. Element-specific hysteresis loops were measured by x-ray magnetic circular dichroism (XMCD), identifying phase one as GdFe, while phase two is associated with rotatable Co and Ni. Polarized neutron reflectometry identified the CoNi as a 3nm interfacial layer, which is likely the cause for the tunable exchange bias. We attribute this CoNi layer to an interfacial redox reaction between the Gd and NiCoO. This work has been supported by the NSF (DMR-1008791 and ECCS-1232275).

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Date submitted: 14 Nov 2014 Electronic form version 1.4