Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Exchange Bias and Unusual Initial Magnetization in Nanocrystalline Spinel Ferrite Thin Films[1] URUSA ALAAN, Stanford University, SREENIVASULU GOLLAPUDI, Oakland University, KIN MAN YU, Lawrence Berkeley National Laboratory, PADRAIC SHAFER, ELKE ARENHOLZ, Advanced Light Source, GOPALAN SRINIVASAN, Oakland University, YURI SUZUKI, Stanford University — We report on unconventional magnetic behavior in nanocrystalline $(Mn,Zn,Fe)_3O_4$ (MZFO) thin films grown at room temperature. Structural studies show no secondary phases, yet these films are exchange biased, with magnetic hysteresis loops shifted by as much as ~ 200 Oe at 10 K after field-cooling. The samples can be "trained" so that successive magnetization loops exhibit reduced exchange bias. Shifts of the hysteresis loops exist even after cooling in zero field, indicating that the MZFO is not externally biased. We attribute the exchange bias to disordered, grain-boundary-like regions that bias more ordered MZFO. Annealing experiments that improved sample crystallinity decreased the exchange bias. Higher annealing temperatures resulted in reduced coercivities, higher magnetizations, and even the elimination of the exchange bias. Annealing also removed an unusual crossover of the initial magnetization curve outside of the saturated magnetization loop. This behavior has been seen in so-called "mictomagnetic" alloys. Using x-ray magnetic circular dichroism measurements, we have shown that cation disorder was reduced with annealing, and correlated the atypical initial magnetization with the degree of disorder.

[1]We gratefully acknowledge the National Science Foundation for funding this research.

Urusa Alaan
Stanford University

Date submitted: 14 Nov 2014 Electronic form version 1.4