Lawrence Berkeley National Laboratory

Recent Work

Title

Parallel Versus Antiparallel Interfacial Coupling In Exchange-biased Co/FeF₂

Permalink

<https://escholarship.org/uc/item/9c29m36g>

Authors

Ohldag, H.
Shi, H.
Arenholz, E.
et al.

Publication Date

2005-06-24

Parallel Versus Antiparallel Interfacial Coupling In Exchange-biased Co/FeF₂

H. Ohldag¹; H. Shi³; E. Arenholz²; J. Stohr¹; D. Lederman³

1. SSRL, Stanford University, Menlo Park, CA, USA.

2. ALS, Lawrence Berkeley National Laboratory, Berkeley, CA, USA.

3. Physics, West Virginia University, Morgantown, WV, USA.

The nature of exchange bias in FeF₂(110) remains elusive due to its nominally compensated surface. Other interesting phenomena include positive exchange bias [1] and an enhancement of the coercivity near T₂ [2]. In order to address these issues, soft x-ray dichroism absorption spectroscopy was used to investigate the direction of interfacial exchange coupling in a antiferromagnetic/ferromagnetic exchange-coupled Co (2.5 nm) /FeF₂ (68 nm) bilayer. Because of its excellent surface and interface sensitivity this technique is excellently suited to unambiguously address the size and the orientation of the magnetic moment at the interface of such a structure [3,4].

The FeF₂ was epitaxially grown on MgF₂ (110) and the Co layer was polycrystalline. The sample was capped with a 2.0 nm layer of Pd to protect it from oxidation. For comparison, a nominally identical sample without Co was also grown. A small portion of interfacial Fe spins couples antiparallel to the ferromagnet, causing the positive exchange bias for cooling fields. A larger portion of interfacial spins, coupled more strongly and parallel to the ferromagnet, increases the degree of antiferromagnetic order and plays an important role in the observed coercivity increase at high temperatures [5].

Work supported by DOE at SSRL and by NSF grant DMR-0400578 at WVU.

[1] J. Nogues et al., Phys. Rev. Lett. (76), 4624 (1996).

[2] M. Grimsditch et al., Phys. Rev. Lett. (90), 257201 (2003).

[3] H. Ohldag et al., Phys. Rev. Lett. (87), 247201 (2001).

[4] H. Ohldag et al., Phys. Rev. Lett. (91), 017203 (2003).

[5] H. Ohldag et al. submitted to Phys. Rev. Lett.