1997

Magnetic response of FeF_2 films on (100) MgO (abstract)

Shireen Adenwalla
University of Nebraska-Lincoln, sadenwalla1@unl.edu

G. P. Felcher
Argonne National Laboratory

J. Nogués
University of California–San Diego

I. K. Schuller
University of California–San Diego

Magnetic response of FeF_2 films on (100) MgO (abstract)

S. Adenwalla and G. P. Felcher
Argonne National Laboratory, Argonne, Illinois 60439

J. Nogués and I. K. Schuller
Physics Department 0319, University of California–San Diego, La Jolla, California 92093

Pairs of FeF_2/Fe films show large exchange bias. In bulk FeF_2 is antiferromagnetically ordered below 78 K, and the magnetic moments of the corner and center atoms in the rutile structure are respectively parallel and antiparallel to the tetragonal axis. Are the moments compensated in a thin film as well, or does a net magnetization develop, for instance at the interface with iron? A polarized neutron reflection measurement was taken on a single film of FeF_2, 920 Å thick, grown in the (110) orientation on a MgO (100) face. In polarized neutron reflection is measured the polarization dependence of the reflectivity as a function of k_z, the component of the neutron momentum perpendicular to the surface. From this, in principle, the detailed net magnetization profile along the thickness of the film can be obtained. Reflectivity patterns taken with the sample in different physical conditions (temperatures: 4.2–120 K, magnetic fields: 100–5000 Oe) showed the interference pattern characteristic for a 920 Å thick film. However the polarization dependence of the reflectivity was in all cases very weak and only by repeated runs it was possible to observe a statistically significant difference between patterns obtained at 80 K in field of 5 kOe and at 4.2 K after field cooling in the same field. In the paramagnetic region no polarization was observed; in the antiferromagnetic region weak polarization peaks were found at the values of k_z corresponding to minima of the interference oscillations. The precision of the measurements does not allow to give yet a detailed depth profile of the net magnetization. While the presence of a strong ferromagnetic component close to the surface seems to be ruled out, the results can be fitted by a magnetization of 0.025 μ_B/Fe uniform throughout the film as well as by the presence of $1\mu_B$/Fe on the three atomic planes most adjacent to MgO.
[S0021-8979(97)78108-8]

Work supported by US-DOE, BES-MS partially under Contract No. W-31-109-ENG-38.