

Magnetic Reflectivity Measurements in Fe/Gd Multilayers

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We studied spin structures in a Fe/Gd magnetic multilayer using resonant x-ray magnetic scattering at the Gd L_3 edge (7.246 keV). Reflectivity curves were measured with opposite incident photon helicity to obtain the difference signal that contains information about the magnetic moments within the Gd layers. Theoretical predictions and previous neutron measurements have confirmed that the spin structure in the multilayer will undergo a transition as the T is increased for a constant applied magnetic field. The low T phase will be Gd-aligned at low fields, surface-twisted at intermediate fields, or bulk-twisted at higher fields. The high T phase will be Fe-aligned. Preliminary analysis of the data indicate the definite presence of this phase transition from the twisted to the aligned phase between 160 and 180 K, consistent with the bulk magnetization results. Details regarding the sign and magnitude of the difference peaks, measured to the 4th order, require fitting the data to models that, in turn, require the values of magnetic form factors f_m' and f_m'' . This analysis is in progress. The data pertaining to the in-plane magnetic structure suffer from poor statistics, as the difference signal in the diffuse spectrum is extremely weak. However, we did observe a finite signal in these measurements suggesting a difference between charge and magnetic structures.