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Polarized Neutron Reflectivity and Electron Microscopy Analysis of the Magnetic Microstructure in Antiparallel-Coupled Co Multilayers JOHN UNGURIS, BENJAMIN MCMORRAN, Center for Nanoscale Science and Technology, JULIE BORCHERS, BRIAN MARANVILLE, BRIAN KIRBY, THERESA GINLEY, Center for Neutron Research, National Institute of Standards and Technology — Antiparallel exchange-coupled thin films are a convenient way to provide a ferromagnetic surface in situations where zero net magnetization is required, for example, when studying superconducting-ferromagnetic proximity effects with spin-triplet superconducting correlations.[1] We use the complementary techniques of polarized neutron reflectivity (PNR) and scanning electron microscopy with polarization analysis (SEMPA) to characterize the magnetic structure of such an antiferromagnetically coupled Co/Ru/Co multilayer. We find that, although the average macroscopic magnetization follows the simple antiparallel coupling picture, at the nanoscale the 3-dimensional magnetic structure is much more complex. The films are mostly antiparallel, but the magnetization directions fluctuate by as much as $\pm$ 40 $^\circ$ over lengths as small as 100 nm. This structure has significant implications when trying to understand the local spin-dependent transport properties at the ferromagnetic interface. Applying magnetic fields further complicates the structures, leading to spin-flop related magnetic arrangements.

[1]T. Khaire, etal. Phys. Rev. Lett. 104, 137002 (2010)

John Unguris
National Institute of Standards and Technology

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