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Lateral length scales and local character of exchange bias. IVAN K. SCHULLER, IGOR V. ROSHCIN, O. PETRACIC¹, R. MORALES², ZHIPAN LI, XAVIER BATLLE³, Physics Dept., UCSD — Exchange bias (EB) is a ferromagnet (F) – antiferromagnet (AF) proximity effect. EB manifests itself as a horizontal shift of a single hysteresis loop. In our studies, an untwinned 38–100 nm-thick layer of (110) FeF₂ is epitaxially grown on (110) MgF₂, followed by a 4–70 nm-thick layer of Co, Ni or Fe. Easy axis magnetization curves (SQUID and spatially resolved MOKE) for different cooling fields and remanent magnetizations for zero-field cooled samples exhibit negatively or positively shifted single or tunable double hysteresis loops (DHL). In the untwinned epitaxial FeF₂, the AF domains can be much larger than the grains, and, hence, as large as the F domains. When each F domain is in contact with only one AF domain, it does not average the direction and the magnitude of EB. In this regime, inhomogeneity of an AF-F sample, either structural or magnetic, can result in two subsystems formed upon cooling through the AF transition temperature. Each subsystem exhibits EB of the same magnitude but of the opposite sign, which gives rise to DHL. We conclude that when the domain size in the AF is larger than or comparable to that in the F, the local, non-averaging character of EB can be observed. Work supported by DOE and AFOSR.

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