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Study of Magnetic Structures with Circularly Polarized Synchrotron Radiation*. G. Srajer,¹ D. Haskel,¹ J.C. Lang,¹ D. Lee,¹ Y. Choi,¹ D.J. Keavney,¹ J.S. Jiang,² J. Meersschant,² S.D. Bader,² W.C. Uhlig³, J. Shi³, ¹Advanced Photon Source, Argonne National Laboratory Argonne, IL 60439, ²Materials Science Div., Argonne National Laboratory, Argonne, IL 60439, ³Univ. of Utah, Salt Lake City, UT.

The low-field surface nucleation and evolution of the inhomogeneous magnetic state in strongly coupled Fe/Gd ferromagnetic multilayers is measured via grazing-incidence x-ray magnetic circular dichroism. At $T = 0.7 T_0$, where $T_0 = 110\text{K}$ is the ferromagnetic compensation temperature, the inhomogeneous state nucleates at the surface. At nucleation, the surface state extends tens of interatomic distances into the bulk ($\sim 200 \text{ \AA}$), a direct consequence of the strong interlayer coupling. At $T \sim T_0$, the inhomogeneous state penetrates throughout the bulk, while homogeneous magnetic states occur far below and above T_0 . Our results have unambiguously determined the existence of the inhomogeneous magnetic state. We also studied the effect of proximity in artificially structured Cobalt arrays using photoelectron emission microscope. Our results show that a single domain state is favored when the elements of the array are separated by a distance less than 250 nm.

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