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Suppression of biquadratic coupling at the Cr Néel temperature in Fe/Cr(001) superlattices (invited) (abstract)

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Suppression of biquadratic coupling at the Cr Néel temperature in Fe/Cr(001) superlattices (invited) (abstract)

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We present the effects of antiferromagnetic (AF) order of the Cr spacers in Fe/Cr(001) superlattices on the interlayer coupling of the Fe layers. AF order of the Cr spacers is suppressed for layer thicknesses less than 42 Å. For >42 Å of Cr, the Néel temperature (T_N) increases rapidly and asymptotically approaches the bulk value for thick Cr spacers as characterized by a transition-temperature shift exponent $\lambda = 1.4 \pm 0.3$. Neutron diffraction confirms both the AF order of the Cr layers in superlattices with 62, 100, and 200 Å thick Cr layers, and the existence of the incommensurate, transverse spin-density-wave magnetic structure whose nesting wave vector is equal to that of bulk Cr. The AF ordering of the Cr results in anomalies in a variety of magnetic properties, including the interlayer coupling, remanent magnetization, coercivity, and magnetoresistance. Most strikingly, the 90° or “biquadratic” coupling of the Fe layers observed for $T > T_N$ is suppressed below T_N as confirmed by polarized neutron reflectivity. This behavior can be understood in terms of the combination of finite-size and spin frustration effects at rough Fe/Cr interfaces. © 1996 American Institute of Physics. [S0021-8979(96)58608-9]

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