MAGNETIZATION AND FMR STUDIES OF $[Fe/Cr]_n$ STRUCTURES WITH ULTRATHIN IRON LAYERS

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9.7 cm

A set of magnetic multilayer structures $[Fe(t_{Fe})/Cr(t_{Cr})]_n$ with ultrathin ($t_{Fe} < 5$ Å) iron layers was studied using SQUID-magnetometry and ferromagnetic resonance (FMR) technique. The samples were prepared on MgO substrates by means of molecular beam epitaxy method. Two different types of multilayers were investigated: with ferromagnetic ($t_{Cr} \approx 20$ Å) and antiferromagnetic ($t_{Cr} \approx 10$ Å) interlayer coupling. For the samples with $t_{Fe} \geq 5$ Å, magnetization curves and FMR spectra at room temperature show a behaviour typical for magnetic superlattices. On the contrary, the samples with $t_{Fe} \leq 5$ Å demonstrate superparamagnetic-like properties. Nevertheless, magnetization curves measured in $4 - 300$ K temperature range do not obey a superposition rule for superparamagnets. In addition, a four-fold in-plain anisotropy of the FMR spectra was detected in samples with $t_{Cr} \approx 10$ Å and $t_{Fe} \sim 3$ Å at low temperatures. This anisotropy vanished as the temperature grew. To explain the obtained results, we propose a theoretical model considering a cluster structure of iron layers. Magnetization curves and FMR spectra are calculated in the frame of a mean field approximation taking into account an interlayer interaction. The calculated dependencies show a qualitative agreement with the experimental data.

13.4 cm

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