COMPLEX MAGNETIC STRUCTURE OF STRONGLY COUPLED Fe/Si MULTILAYERS

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9.7 cm

Fe/Si multilayers exhibiting a strong antiferromagnetic (AF) coupling for a nominal Si spacer thickness $10 < t_{Si} < 17$ Å have been investigated with various magnetic techniques. The in-plane magnetization measurements revealed maximal coupling strength for t_{Si}=11–13 Å with a saturation field $H_{sat} \approx$ 10–12 kOe. A biquadratic contribution of the same order as the bilinear term in exchange coupling was observed. Conversion-electron Mössbauer spectroscopy measurements suggest a complex nature of interface magnetic structure due to diffusion of Si into Fe. As a result, only 20–30 % of Fe reveals α–Fe structure, about 60 % constitutes Fe rich Fe-Si alloy and about 10 % of Fe is nonmagnetic. Ferromagnetic resonance spectra taken at 9.1 and 33.6 GHz consist of the fundamental mode and higher order modes which lie both on the low and the high magnetic field side of the fundamental mode for $t_{Si} < 15$ Å. This is attributed to a mixed F/AF coupling resulting in the apparent strong biquadratic term. Dispersion relations for AF coupled bilayer structures, frequently used for analysing FMR in multilayers, are shown to be not applicable to Fe/Si multilayers.

13.4 cm

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