EXCHANGE COUPLING IN Fe/FeSi MULTILAYERS

V. Kambersky[a], Z. Frait[a], I. Vavra[b], P. Svec[b], G. Hilscher[c], K. Zaveta[a], P. Sturc[a], J.R. Lopusnik[a]

[a]Institute of Physics, Acad. Sci. C.R., Praha, Czech Republic
[b]Institute of Electrical Engineering, SAS, Bratislava, Slovak Republic
[c]Technical University, Wien, Austria

9.7 cm

Exchange coupling in Fe/FeSi multilayers and particularly its extreme sensitivity to the spacer thickness (first indicated by Fullerton and Bader) remains a challenge to physical understanding. Our multilayers were prepared as very smooth wedges with FeSi spacers (sputtered from an amorphous alloy target) from 1.1 to 1.9 nm thick (measured by low-angle XRD). Spacer composition was studied by TEM and by conversion electron Moessbauer spectroscopy. Antiferromagnetic coupling was detected and its magnitude measured by local FMR. The expected mode splitting was detected in a narrow range of spacer thickness around 1.6 nm. In the same range, local hysteresis loops measured by MOKE confirm strong decrease of coercivity and remanence. An analysis of both low-field hysteresis and high-field approach to saturation at temperatures between 10 and 340 K, by SQUID magnetometry on small sections of the wedge, allow for tentative separation of bilinear and biquadratic effective coupling. The saturation field (equal to FMR mode splitting) increases from about 500 Oe at room temperature to over 5000 Oe at 10 K; the prevalent contribution appears to result from bilinear coupling. Interpretations are still a matter of debate.

13.4 cm

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Corresponding author :
V.Kambersky

Address for correspondence :
Institute of Physics ASCR
Cukrovarnicka 10
16253 Praha 6
Czech Republic

Email address :
kamber@fzu.cz