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Tunable spin-flop transition in artificial ferrimagnets

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In the present work authors studied magnetic and structural properties of Fe/Pd/Gd superlattices. The particular system [Fe(35 Å)/Pd(t)/Gd(50 Å)/Pd(t)]x12 was chosen with different layer thicknesses of Pd spacer.
By means of x-ray low-angle diffraction (reflectometry, XRR) and scanning transmission electron microscopy (STEM) with the energy dispersive x-ray (EDX) microanalysis the structural quality of the superlattices was attested.
SQUID and PNR techniques were used to analyze the magnetic properties.

It was shown that the insertion of a thin (t=10–14 Å) Pd layer between Fe(35 Å) and Gd(50 Å) layers into multilayer structure allows a considerable reduction the spin-flop transition field.

Study of the structure indicates that in the specified range of thicknesses, Gd and Pd are intermixed into a homogeneous alloy.

By measuring neutron spin-flip scattering we have detected the presence of a magnetically noncollinear state at temperatures T < 50 K in magnetic fields of above H > 500 Oe for the samples with 10 Å - t - 14 Å. By using an extended Stoner-Wohlfarth model we were able to describe the observed transition as a competition of Zeeman energy, bilinear interaction of order of 1 erg/cm2, and biquadratic addition of the order of 0.5 erg/cm2. The coupling energies can be tuned by varying the thickness of the spacer between

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