MAR10-2009-006104

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Ab-initio study of the resistivity, Gilbert damping and spin-flip diffusion in transition metal alloys

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Using a formulation of first-principles scattering theory that includes disorder and spin-orbit coupling on an equal footing, we calculate the resistivity ρ, spin-flip diffusion length λ_{sf} and the Gilbert damping parameter α for Fe_xNi_{1-x} substitutional alloys as a function of x over the entire concentration range. For the technologically very important $Fe_{20}Ni_{80}$ alloy, permalloy, we calculate values of $\rho = 3.7\pm0.5$ Ohm-cm, $\lambda_{sf} = 5.2\pm0.2$ nm and $\alpha = 0.0046\pm0.002$ compared to experimental low-temperature values in the range 4.4-5.1 Ohm-cm for ρ, 5.0-6.0 nm for λ_{sf} and 0.005-0.009 for α indicating that our scattering theoretical formulation captures the most important contributions to these parameters. Work carried out with A.A. Starikov in collaboration with A. Brataas, Y. Tserkovnyak and G.E.W. Bauer.