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A study on the standing and surface spin wave in a permalloy film by Brillouin scattering

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The surface and the standing spin-wave modes of polycrystalline fcc Ni-rich and Fe-rich Ni-Fe alloy films with the thickness of 100 nm were by Brillouin scattering The asymmetry features are present in the spectra obtained by the Ni-rich alloy film. The experimental results were observed that bottom and upper surface is strongly pinned and unpinned for all the samples, respectively. We also observed shift in positions of standing spin-wave modes. The values of the phase shift obtained from pinning condition of q_n increase at rate of $\pi/2$ with increasing with n [1]. n is the mode number. We determined the exchange stiffness constant D_B with standing spin-wave frequencies, revealing D_B = $(0.6\pm0.05)\times10^{-9}$ Oe-cm^2 and $(1.85\pm0.05)\times10^{-9}$ Oe-cm^2 for the Fe-rich and the Ni-rich alloy films, respectively. The exchange field D_Bq^2 was compared with the pinning field, calculated from the absorption coefficient [2]. The surface anisotropy constant K_s has also been determined by examining the in-plane wave-vector dependence on the surface magnon frequency. K_s turns out to be 0.284 ± 0.013 erg/cm^2 for the $Ni_{84}Fe_{16}$ alloy film.

[Reference]
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2. A. P. Malozemoff, M. Grimsditch, J. Abosf, and A. Brunsch, J. Appl. Phys. 50 (1979) 5885.