FMR relaxation mechanism in exchange-biased thin films

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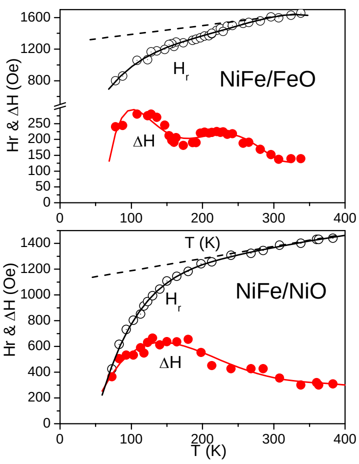
Thin ferromagnetic films in intimate contact with antiferromagnets are known to exhibit exchange-bias – a phenomenon of considerable interest due to its application to magnetoresistive devices. Exchange-bias (EB) strongly modifies magnetization relaxation (spin-wave damping) in thin films and several models have been proposed for microscopic sources of the enhanced spin-wave damping in EB structures. A strong dependence of ferromagnetic resonance (FMR) damping on the thickness of ferromagnetic layers was explained by a relaxation mechanism based on two-magnon scattering due to local fluctuations of the exchange field [1]. However, this approach does not explain a substantial temperature dependence of the damping which have been observed both in FMR [2] and Brillouin light scattering (BLS) [3] measurements. Thus, the second approach assumes a slow relaxation mechanism induced by thermal reversals of small antiferromagnetic grains [4].



In this contribution we present the results of temperature FMR measurements in NiFe/NiO and NiFe/FeO EB structures. It is shown (Fig. 1) that in both structures an anomalous broadening of the FMR line and a negative resonance line-shift are observed at low temperatures while in the same structures without EB the magnetization relaxation is nearly temperature independent. The characteristic maximum (or two maxima for NiFe/FeO structures) in the spin-wave damping and the large negative dynamic line-shift are consistently interpreted in terms of so-called "slow relaxing ion " mechanism *via* interaction of the magnetization precession with the slowly relaxing impurities [5]. The nature of the slowly relaxing impurities is not yet clear but we suppose from a T^2 dependence of the relaxation time and from discussion of other FMR/BLS experiments that they might be Ni^{2+} and Fe^{2+} ions situated at the NiFe/NiO or NiFe0/FeO interfaces.

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