Magnetic properties of ($Ni_{80}Fe_{20}$/Au/Co/Au) multilayers with different number of repetition

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Increased repetition number N of multilayers showing GMR effect results in an enhancement of the magnetoresistance ($\Delta R/R$). In this contribution the influence of N on magnetization reversal and magnetoresistance effect of sputter deposited $(Ni_{80}Fe_{20}/Au/Co/Au)_N$ ($1 \le N \le 15$) multilayers (MLs) characterized by in-plane ($Ni_{80}Fe_{20}$ layers) and out-of-plane (Co layers) anisotropy of ferromagnetic layers is discussed [1]. The main results can be summarized as follows. The strong increase of $\Delta R/R$ with increasing N is caused not only by diminishing the role of electron scattering at the surfaces, but also by erasing the effect of the structural imperfections of the first period and the lack of the perpendicular anisotropy in Co layers (Fig. 1). This interpretation is corroborated by a low $\Delta R/R$ value (0.5%) observed for $N = 1$ and a characteristic kink in the $\Delta R(H)/R$ dependence clearly visible for $N \le 3$. For $N \ge 7$ $\Delta R/R(N)$ dependence saturates and the influence of the first layer becomes negligible. The influence of N on perpendicular anisotropy of Co layers is also visible for $N \ge 2$. The magnetic properties of permalloy layer do not depend on N (Fig. 2).

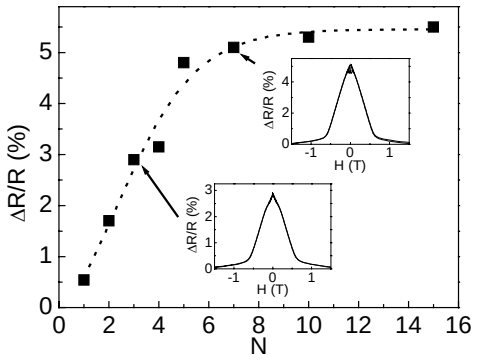

Fig. 1. Magnetoresistance of (NiFe-2nm/ Au-3nm/Co-0.8nm/Au-3nm)$_N$ MLs *versus* number of repetition N. Insets show the field dependence of resistance for MLs with N=3 and N=7.

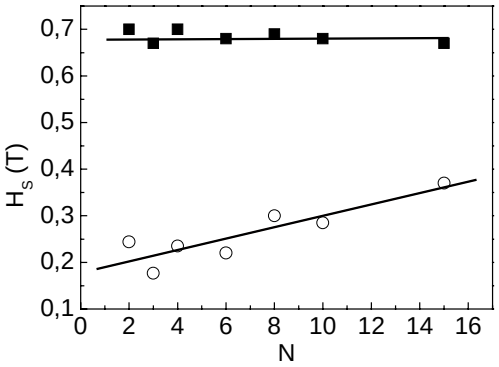

Fig. 2. The absolute value of the anisotropy field of $Ni_{80}Fe_{20}$ layers (■) and Co layers (○) determined for the same multilayers as in Fig. 1.

[1] F. Stobiecki *et al.*, J. Magn. Magn. Mater. **282** (2004) 32.

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