Magnetoresistance and Magnetization reversal process of Pt covered Co nanowires

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Single polycrystalline Co-nanowires are prepared by electron beam lithography (EBL) onto Si substrates at room temperature. Some of them are covered with a thin Pt layer, the others are not. The width w of the Co-wires is varied between $100nm$ and $2\mu m$. Structural properties are characterized using SEM, TEM and STM. Magnetic properties of single wires are investigated by magnetic force microscopy (MFM), wire-gratings and thin films by SQUID magnetometry. The interpretation of the magnetic behavior and the magnetization reversal process is supported by micromagnetic calculations based on Monte Carlo-simulations [1]. Magnetoresistance measurements are carried out at a temperature of $T = 4.2K$ applying magnetic fields $\mu_0 H$ up to 5T. The magnetoresistance shows hysteretic behavior with pronounced resistance minima at coercive fields $\mu_0 H_c$. However, the resistance behavior of Pt covered Co nanowires deviates significantly from the behavior of the uncovered nanowires as can be seen in Fig.1 .

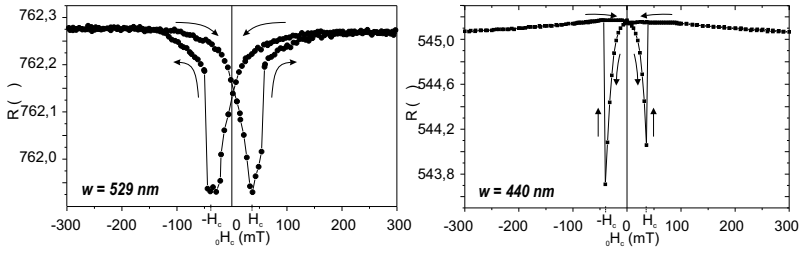

Figure 1: *Longitudinal Magnetoresistance of Co nanowires* ($T = 4.2K$). *Data obtained from a Co nanowire* ($w = 529nm$, *left) and from a Pt covered Co nanowire* ($w = 440nm$, *right). The arrows indicate the measurement procedure.*

In the case of the uncovered wires a broadening of the resistance minima is observed which we ascribe to pinning and depinning of domain walls during the magnetization reversal process [3]. In contrast, the resistance minima of the covered wires are pretty steep. As a consequence we suggest that no pinning effects occur which is confirmed by Monte Carlo simulations [2]. Surprisingly, varying the wire width w we find for both types of nanowires the same $1/w$-behavior which is discussed in more detail elsewhere [3].

References

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