MAGNETORESISTANCE IN POSITIVE AND NEGATIVE EXCHANGE BIAS Ni/FeF2 BILAYERED 200 NM ANTIDOTS

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Despite the experimental and theoretical investigations, the exchange bias phenomenon (EB) in nanostructured systems remains poorly understood [1]. We used focused ion beam (FIB) lithography to prepare a series of samples of antidots of the same size and different distances in x-y directions. All of the fabrication has been performed on bilayered samples prepared by electron beam evaporation and consisted of antiferromagnetic (AF) FeF2 (70nm), ferromagnetic (FM) Ni (50nm) and Al (4nm) as a protective layer. The square antidots with antidot size of 200 nm and x and/or y distance of 120-900 nm have been fabricated using an ion current of 30 pA. It is well known that magnetoresistance (MR) measurements can be used to determine exchange bias in thin films and nanostructures. MR was measured with the standard four terminal dc techniques in a He4 flow cryostat equipped with a superconducting solenoid. All measurements were carried out with the field applied parallel to the easy axis of the AFM and transport data were taken with the current in plane and perpendicular to the field. The resistivity was measured at 4.2 K in various field cooling conditions. The measuring field was applied along the same axis as the cooling field.

We observed three different types of behaviour: for small cooling fields, MR displays a shift towards negative field values (negative EB), while for large cooling fields the shift is positive (positive EB). In the intermediate case, we observed two MR peaks with different height and area. In the first and second case (small and large cooling fields) the reversal is sharper in the opposite field direction to the resulting shift of MR data. It is worth stressing that the switching from positive to negative EB depends on the antidote density. The positions of the MR peaks are mostly independent of the cooling field, which suggest the AF domain size is comparable to or larger than the FM domain size and that each FM domain couples only to one AF domain with a particular direction of the EB [2] . For small/large cooling fields we have only one EB direction while two appear for the intermediate cooling cases.

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