QC06

Influence of a Non-ideal Interface on Magnetic Properties of Soft/hard Bilayer.

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Exchange coupled magnetic bilayer has been proposed as a candidate for future magnetic recording media [1,2]. The requirements for such an application are low coercivity and high long-term thermal stability. In such structures the reduction of coercivity can be achieved due to an exchange spring mechanism [2]. Here we describe modelling approach and results of detailed analysis of the magnetization reversal process within the atomic scale description of the interface properties. The lattice structure is included explicitly, by treating the lattice matching between the hard and soft regions and assuming a reduced interface exchange parameter Js. Importantly, the atomistic model predicts that the full coercivity reduction requires a small value of the interface exchange coupling relative to the bulk value [3]. The switching field dependence on the interface exchange becomes non-monotonic for small saturation magnetization (or small thickness) of the soft phase. The appearance of this non-monotonic behaviour is a signature of the transition from exchange-spring dominated behavior to a 2-spin model [1]. Clearly the exchange-spring mechanism leads to the lowest coercivity, and also gives the lowest sensitivity to the interlayer exchange coupling.

We have also studied the influence of the interfacial exchange on the value of the energy barrier DE for long-term thermal stability. The low-temperature energy barriers (saddle points) have been evaluated using the Lagrangian multiplier technique [4]. The value of the energy barrier saturates for values of the interfacial exchange higher than 5% of the bulk exchange. The saturation region is associated with a collective reversal mode (corresponding to the saddle point configuration) of the composite grain. This collective reversal mode corresponds to a domain wall in a hard layer. For lower exchange values energy barriers represent independent reversal of each layer. In order to study the effect of the magnetostatic coupling between grains we have also performed simulations in a multigrain system with periodic boundary conditions and then calculated the energy barrier corresponding to the rotation of one of the grains. The remanence of such system contains a domain wall, pinned at the interface, due to the effective in-plane anisotropy, proper to the thin film geometry. The saddle point for this configuration coincides with the domain wall in the hard layer. The net result is a crucial reduction of the energy barrier compared to the value foran isolated grain. Finally, we discuss the performance of different media on the basis of the quality factor DE/ Hc <M>, where <M> is the average grain magnetisation.

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QC07

Planar Hall effect in biosensor with different angles of junctions

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The Planar Hall effect in magnetic materials has been previously investigated, as a tool for studying the in-plane magnetization. It has also been studied for the low-field magnetic sensor applications. These sensors have micro-size junction with four-probe electrodes (fig. 1). However, it is very difficult to get exactly the angle between the electrodes f-g and a-d 90 degrees because of several limitations in lithography process. Therefore, a real sensor always has a small tilt angle $\Delta\zeta$. In this work, we tried to calculate the change of Planar Hall resistance by using the behaviour of a basic single domain structure in the external magnetic field. Our model also exhibits the real picture of anisotropy magnetoresistance when the angle of electrodes has a measurable angle $\Delta\zeta$.

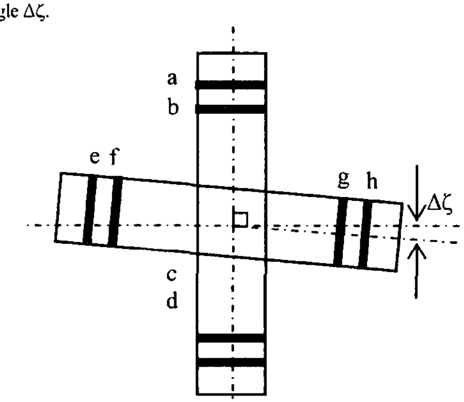

Fig. 1. Real junction geometry with a small tilt angle of junction

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