SPIN-VALVE EFFECT IN A SINGLE FERROMAGNETIC LAYER

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9.7 cm

In the present paper we propose a theoretical model of the recently observed (Yanson et al, 2007) surface spin-valve effect in a single ferromagnetic (FM) layer. We consider the surface of FM layer as a separate phase and assume that due to a lower (compared to bulk) coordination number and possible presence of the defects the exchange coupling between the surface spins is too weak to establish FM order. On the other hand, surface layer can be polarized by external magnetic field or by the biased electric current. Flowing through the interface with FM layer the free electron gas became polarized due to the difference in reflection/transmission coefficients of spin-up and spin-down electrons. Due to the strong exchange interaction between the collective and localized electrons, the formers impose a FM ordering of the localized spins. In the case when the electrons flow from normal to FM metal, polarization is governed mainly by the reflection processes. As a result, the surface layer is magnetized in the direction opposite to the bulk magnetization, resistance of the contact increases. When the electrons flow from FM to normal metal, both surface and bulk magnetizations are parallel and contact resistance is low. Thus, current-induced nonequilibrium excess of spin up (spin-down) conductivity electrons acts as external magnetic field and thus is responsible for the magnetic switching in a single FM film.

13.4 cm

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