Perpendicular-current studies of electron transport across metal/metal interfaces in multilayers

In multilayered structures, consisting of alternating layers of different metals (M1/M2), scattering of electrons at interfaces can have a significant effect on the transport, especially when the individual metal layers are thin. Of special interest are ferromagnetic/non-magnetic (F/N) multilayers that exhibit Giant Magnetoresistance, a discovery that has important computer applications and resulted in the awarding of the 2007 Nobel Prize in physics. Here the F/N interfaces can make a significant contribution to the magnetoresistance, and thus it is important to quantify the parameters associated with such interface scattering.

We have developed a technique for determining M1/M2 interface parameters by measuring the sample resistance with the current flowing perpendicular to the plane (CPP) of the multilayers. Such CPP studies give more direct access to these fundamental parameters: interface specific resistances, probability of electron spin flipping at interfaces and asymmetries of electron scattering at F/N interfaces. After an introduction to our CPP technique and analysis, I will present examples of those interfacial parameters that we have quantified for a wide variety of F/N and N1/N2 combinations. Of particular importance will be a comparison of interface specific resistances with no-free-parameters theoretical calculations, where excellent agreement is obtained between experiment and theory for M1/M2 combinations with the same lattice structure and lattice constants that are the same to within 1%.

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