KMS-2-I3 (Invited)

Scattering at Metal/Metal Interfaces, with and without spin-flips.

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Interfaces play important roles in transport in the metallic magnetic multilayers used in Current-Perpendicular-to-Plane (CPP) Magnetoresistance (MR) and Current-Induced Magnetization Switching (CIMS). The parameters of interest for perpendicular transport through interfaces are: (a) the interface specific resistance AR (sample area A times resistance R) for pairs of both non-magnetic/non-magnetic (N1/N2) and ferromagnetic/non-magnetic (F/N) metals; (b) the asymmetry parameter $\gamma = (AR\downarrow - AR\uparrow)/(AR\downarrow + AR\uparrow)$ for F/N pairs; and (c) the spin-flipping probability δ for an electron crossing the interface, mostly for N1/N2 pairs. Here $AR\downarrow$ and $AR\uparrow$ are the specific resistances for the moment of the current-carrying electron along ($\uparrow$) or opposite to ($\downarrow$) the local ferromagnetic moment. To maximize CPP-MR and CIMS, we usually want AR and γ to be large and δ to be small. I will first explain how we measure 2AR, γ, and δ. Then I will argue that the scale for AR is $f\Omega m^2$, and present, for sputtered metal pairs, measured values of 2AR that vary from 0.1 $f\Omega m^2$ to 10 $f\Omega m^2$. I'll show that in some cases 2AR can be calculated correctly with no adjustable parameters and in most cases calculated within a factor of two or better. I will present our measured values of γ (ranging from -0.7 to $+0.7$) for a variety of metal pairs and of δ (ranging from 0 to 1) for a variety of N1/N2 pairs. I will explain what we do and do not yet understand about these parameters.