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Theory of spin loss at metallic interfaces[1]

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Interfacial spin-flip scattering plays an important role in magnetoelectronic devices. Spin loss at metallic interfaces has usually been quantified by matching the magnetoresistance data for multilayers to the Valet-Fert model, while treating each interface as a fictitious bulk layer whose thickness is δ times the spin-diffusion length. In this work, the relation of the parameter δ to the spin-flip transmission and reflection probabilities at an individual interface is established using the properly generalized magnetoelectronic circuit theory. It is found that the parameter δ extracted from the measurements on multilayers is proportional to the square root of the probability of spin-flip scattering. The spin-flip scattering probabilities are calculated for several specific interfaces using the Landauer-Büttiker method based on the first-principles electronic structure, and the results are compared with experimental data. The implications of these findings for spintronic devices will be discussed.

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