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Temperature-dependent spin scattering in Pt and at its interfaces
RYAN FREEMAN, ANDREI ZHOLUD, SERGEI URAZHDIN, Emory Univ — Pt is an important material for spintronic devices, as it exhibits a significant spin Hall effect, enabling its applications as an efficient source of spin currents. Among key parameters describing spin-transport properties are the spin diffusion length (SDL) and the interfacial spin-scattering δ. The reported values of SDL in Pt range from 0.5 to 15nm, likely due to the differences in the measurement approaches and material purity. Little is presently known about δ. We utilized current-perpendicular-to-plane giant magnetoresistance (CPP-GMR) and magnetic nanopillar structures to determine the dependence of δ and SDL in Pt on temperature T. Both δ and SDL increase by almost a factor of two between 300K and 7K, implying that the bulk spin scattering decreases while the interfacial spin scattering increases with decreasing T. These opposite trends result in a nonmonotonic dependence of GMR on T for thin Pt layers. We discuss the possible mechanisms for the unexpected dependence of δ on T. We also show that the SDL is within a factor of 2 of the mean free path, implying that almost every scattering event is spin flipping. This result provides a simple approach to estimate SDL in Pt and other materials with strong spin-orbit interaction.

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