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Room-temperature extraction of spin lifetimes in metallic thin films via determination of the spin-pumping contribution to damping in ferromagnetic resonance experiments CARL BOONE, MARTIN SCHOEN, JUSTIN SHAW, HANS NEMBACH, THOMAS SILVA, NIST - Boulder — Recent room-temperature measurements yield spin diffusion lengths for Pt and Pd that are smaller than the bulk electron mean free path at room temperature. One proposed explanation is the thickness-dependence of conductivity that results in shorter momentum lifetimes at small Pt/Pd thicknesses. We measured spin transport properties in Pd and Pt thin films at room temperature via fitting of ferromagnetic resonance (FMR) damping vs. NM thickness with the spin pumping model for ferromagnet (FM)/normal metal (NM) multilayers. We use a broadband, perpendicular FMR system to obtain high-precision values for the damping. The fits are based upon spin diffusion equations that include both momentum and spin scattering processes. By measuring thickness-dependent conductivity of the same films, we correlate the charge and spin transport parameters, permitting us to test multiple models for spin scattering. We explicitly show that the spin scattering time τ_{sf} must be shorter than the momentum scattering time tau over some range of NM thicknesses to adequately fit the data. Invocation of a simple monotonic proportionality between τ_{sf} and τ fails to fit the data. However, an inverse proportionality $\tau \sim 1/\tau_{sf}$ can fit the data, and $\tau < \tau_{sf}$ for sufficiently thin NM layer.

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