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Determination of the spin diffusion length via spin pumping and spin Hall effects[1] WEI ZHANG, VINCENT VLAMINCK, JOHN PEARSON, RALU DIVAN, SAMUEL BADER, AXEL HOFFMANN, Argonne National Laboratory — We present an experimental approach for determining the spin diffusion length of various metals by using spin pumping – spin Hall effect via a coplanar waveguide ferromagnetic resonance (CPW-FMR) broadband technique. By studying the ratio of two voltage components (anisotropic magnetoresistance and inverse spin Hall effect) as a function of the metal layer thickness, the spin diffusion length of the material can be directly extracted. As examples, we determined spin diffusion lengths for paramagnetic Pt (1.2 nm), Pd (5 nm), Ir (0.5 nm), and antiferromagnetic IrMn (0.75 nm) at room temperature. In addition, temperature-dependent measurements show only weak dependence of these lengths with temperature. This approach for determining the spin diffusion length at any temperatures has the advantage that it does not require knowing the resistivity value of the metal layer, which changes with both thickness and temperature. Finally, the ratio of the two voltage components can also be used to probe the temperature-dependent proximity effect for metals such as Pt.

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