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Effects of thermal magnetic fluctuations on spin transport in Pt.[1]
RYAN FREEMAN, ANDREI ZHOLUD, RONGXING CAO, SERGEI URAZHDIN, Emory University — Despite extensive studies and applications of Pt as a spin Hall material in spintronic devices, its spin-dependent transport properties are still debated. We present a comprehensive experimental study of spin transport in Pt, utilizing measurements of giant magnetoresistance (GMR) in nanoscale Permalloy (Py)-based spin valves with Pt inserted in the nonmagnetic spacer. The spin diffusion length and the interfacial spin flipping coefficients are extracted from the dependence of MR on the Pt thickness. For samples with Pt separated from Py by Cu spacers, the spin diffusion length is 6 nm at 7K, and decreases to 3 nm at room temperature. The interfacial spin flipping decreases with increasing temperature, resulting in nonmonotonic temperature dependence of MR in samples with thin Pt. In contrast, in samples with Pt in direct contact with Py, we do not observe such a nonmonotonic dependence, and the spin diffusion length is significantly larger than in samples with Pt surrounded by Cu spacers. Our results indicate a large effect of the giant paramagnetic fluctuations in the nearly ferromagnetic Pt. These fluctuations are suppressed due to the proximity magnetism when Pt is in contact with Py, resulting in enhanced spin diffusion length and reduced spin flipping at the Pt interfaces. These observations indicate the need for a critical revision of spin transport and spin Hall-related properties of Pt-based structures.

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