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**Role of transparency of platinum-ferromagnet interface in determining intrinsic magnitude of spin Hall effect** WEIFENG ZHANG, Stanford Univ, WEI HAN, International Center for Quantum Materials, Peking University, XIN JIANG, Western Digital, SEE-HUN YANG, STUART PARKIN, IBM Research - Almaden — The spin Hall effect (SHE) converts charge current to pure spin currents in orthogonal directions in materials that have significant spin-orbit coupling. The efficiency of the conversion is described by the spin Hall Angle (SHA). The SHA can most readily be inferred by using the generated spin currents to excite or rotate the magnetization of ferromagnetic films or nano-elements via spin-transfer torques. Some of the largest spin torque derived spin Hall angles (ST-SHA) have been reported in platinum. By using spin torque ferromagnetic resonance (ST-FMR) measurements, we show that the transparency of the Pt-ferromagnet interface to the spin current plays a central role in determining the magnitude of the ST-SHA. We measure a much larger ST-SHA in Pt/cobalt (0.11) compared to Pt/permalloy (0.05) bilayers when the interfaces are assumed to be completely transparent. Taking into account the transparency of these interfaces, as derived from spin–mixing conductivities, we find that the intrinsic SHA in platinum has a much higher value of 0.19 as compared to the ST-SHA. The importance of the interface transparency is further exemplified by the insertion of atomically thin magnetic layers at the Pt/permalloy interface that we show strongly modulates the magnitude of the ST-SHA.

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