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Enhanced Spin-Orbit Torques in Pt/Co/Ta Heterostructures MAXWELL MANN, SEONG-HOON WOO, LUCAS CARETTA, AIK JUN TAN, GEOFFREY BEACH, Massachusetts Inst of Tech-MIT — Current-induced torques in heavy-metal/ferromagnet/oxide (HM/FM/Ox) stacks attract attention for efficient magnetization switching and domain wall motion. [1-3] Spin-orbit torques (SOTs) arise by spin-Hall and Rashba effects at the HM/FM interface. [1-2] The oxide layer breaks inversion symmetry but typically does not actively contribute to SOTs. We measure SOTs in Co films sandwiched between Pt and Ta, metals with large, opposite spin Hall angles such that the Slonczewski-like torques (Hsl) at the top and bottom interfaces are anticipated to work in concert. [4] SOTs were characterized by harmonic measurements, and the contribution by the Ta layer was isolated by systematically varying its thickness. Increasing Ta thickness significantly enhances Hsl, giving an effective spin Hall angle of up to 34%. A sizable field-like torque also increases with the addition of Ta. Current-induced switching measurements reveal a corresponding increase in switching efficiency, affirming that engineering both interfaces in trilayer structures significantly improves the SOTs. [4] [1] L. Liu et al, Science, 336, 555 (2012) [2] I. M. Miron et al, Nature, 476, 189 (2011) [3] S. Emori et al., Nat. Mater., 12, 611 (2013) [4] S.-H. Woo, et al., Appl. Phys. Lett. in press (2014)

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