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Spin-orbit torque induced switching in a magnetic insulator thin film with perpendicular magnetic anisotropy[1] J. X. LI, UC, Riverside, CA, G. Q. YU, UC, Los Angeles, CA, C. TANG, UC, Riverside, CA, K. L. WANG, UC, Los Angeles, CA, J. SHI, UC, Riverside, CA — Spin-orbit torque (SOT) has been demonstrated to be efficient to manipulate the magnetization in heavy-metal/ferromagnetic metal (HM/FMM) heterostructures. In HM/magnetic insulator (MI) heterostructures, charge currents do not flow in MI, but pure spin currents generated by the spin Hall effect in HM can enter the MI layer to cause magnetization dynamics. Here we report SOT-induced magnetization switching in $Tm_3Fe_5O_{12}$/Pt heterostructures, where $Tm_3Fe_5O_{12}$ (TmIG) is a MI grown by pulsed laser deposition with perpendicular magnetic anisotropy. The anomalous Hall signal in Pt is used as a probe to detect the magnetization switching. Effective magnetic fields due to the damping-like and field-like torques are extracted using a harmonic Hall detection method. The experiments are carried out in heterostructures with different TmIG film thicknesses. Both the switching and harmonic measurements indicate a more efficient SOT generation in HM/MI than in HM/FMM heterostructures. Our comprehensive experimental study and detailed analysis will be presented.

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