

Thin films of topological Kondo insulator SmB₆: strong spin-orbit torque without surface conduction

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The strong spin-orbital coupling (SOC) of topological insulators (TIs) with unique surface states can lead to new applications in spintronics, although demonstration of applicable devices remains few [1]. A promising pathway is to utilize the current-induced spin-orbit torque (SOT) first established in heavy metal (HM)/ferromagnet (FM) heterostructures, where the strong SOT from HM can switch the magnetization of the adjacent FM layer [2].

SmB₆ has recently been proposed as a TI with a truly insulating interior, as suggested from thickness-independent low-temperature resistance plateau observed in bulk specimens with thickness in the 100 μm range [3]. We have synthesized (001) SmB₆/Si epitaxial thin films, 50 nm to 500 nm thick. We have also observed the resistance plateau but the resistance of SmB₆ thin films is distinctively three-dimensional and does not support the notion of surface conducting and interior insulating. However, SmB₆ thin films can generate a strong SOT to switch the magnetization of an adjacent CoFeB or Co layer with perpendicular magnetic anisotropy. The effective SOT generated from SmB₆ is comparable to that of β-W, the material with arguably the strongest SOT.

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[2] I. M. Miron *et al.*, Nature **476**, 189 (2011)

[3] D. J. Kim, J. Xia, and Z. Fisk, Nature Material, **13**, 466 (2014).