MAR15-2014-020088

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Magnetization switching through giant spin-orbit torque in the magnetically doped topological insulators[1]

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Recent demonstrations of magnetization switching induced by in-plane current in heavy metal/ferromagnetic heterostructures (HMFHs) have drawn great interest to spin torques arising from the large spin-orbit coupling (SOC)...[1-3] in heavy metals. Considering the intrinsic strong SOC, topological insulators (TIs) are expected to be promising candidates for exploring spin-orbit torque (SOT)-related physics...[4, 5]. In this talk, we report the magnetization switching through giant SOT in the magnetically doped TI structures. In particular, we demonstrate the magnetization switching in a chromium-doped TI bilayer heterostructure, and the current induced SOT possibly has contribution from the spin-momentum locked surface states of TI. The critical current density for switching is below $8.9 \times 10^4 \mathrm{A/cm}^2$ at 1.9 K. Moreover, we use second-harmonic methods to measure the spin torque efficiencies which are more than three orders of magnitude larger than those reported in heavy metals. The giant SOT and efficient current-induced magnetization switching exhibited by the bilayer heterostructure may lead to innovative spintronics applications such as ultralow power dissipation memory and logic devices.

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[1]We are grateful to the support from the DARPA Meso program under contract No.N66001-12-1-4034 and N66001-11-1-4105. We also acknowledge the support from the Western Institute of Nanoelectronics (WIN) and the support from the FAME center.