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Measurements of current-induced spin polarizations in topological insulators Bi_2Te_2Se and Bi_2Se_3 thin flakes. JIFA TIAN, IRENEUSZ MIOTKOWSKI, Department of Physics and Astronomy, Purdue University, SEOK-MIN HONG, SUPRIYO DATTA, Birck Nanotechnology Center, Purdue University, YONG CHEN, Department of Physics and Astronomy, Purdue University — Topological insulators (TIs) possess nontrivial spin-momentum-locked topological surface states (TSS). Real TI can also host trivial surface 2DEG with strong Rashba spin-orbit coupling derived from the bulk states. Both TSS and Rashba 2DEG can generate current induced spin polarization, although the dominant helicities of their spin-momentum locking (SML) are expected to be opposite. Here, we report spin potentiometric measurements in exfoliated bulk-insulating Bi_2Te_2Se and bulk-metallic Bi_2Se_3 thin flakes. In both materials, the voltage measured by a FM electrode shows a hysteretic step-like change when the FM magnetization is switched by an in-plane magnetic field. The trend of the voltage change can be reversed by reversing the direction of the dc current, and the amplitude of the spin signal increases linearly with increasing bias current. Such a spin signal is consistent with a current induced spin polarization arising from a helical SML. However, the observed trend of the voltage change is opposite between Bi_2Te_2Se and Bi_2Se_3, suggesting opposite signs of dominant spin helicity that we attribute to TSS and Rashba 2DEG respectively.

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