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Detection of Current Induced Spin Polarization in Topological Insulators via Four-Probe Spectroscopy SABAN HUS, XIAOGUANG ZHANG, GIANG NGUYEN, Oak Ridge National Laboratory, YONG CHEN, Purdue University, AN-PING LI, Oak Ridge National Laboratory — Charge currents carried by the nontrivial surface states (SS) of topological insulators (TIs) exhibit a net spin polarization due to spin-momentum locking. Electrical detection of this spin polarization usually relies on measurements with lithographically defined contacts. However, this method has several drawbacks. First, it is difficult to detect the ratio of current carried by SS versus the coexisting bulk states in TIs using fixed contacts. Second, the ex-situ lithographic processes used during the preparation of contacts may significantly affect the topological SS. Here we report in-situ, spin sensitive four-probe spectroscopy measurements which address both drawbacks. In a multi-probe scanning tunneling microscopy system a ferromagnetic probe detects the net spin accumulation on the SS of TI single crystals, while a set of four-probe spectroscopy measurement is used for a quantitative separation of 2D and 3D conduction. Using this method we measured the density and the net spin polarization of the current carried by the SS of pristine, as cleaved Bi_2Te_2Se single crystals. This research was conducted at the Center for Nanophase Materials Sciences, which is a DOE Office of Science User Facility.

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