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Helical mode and supercurrent measured on the topological surface states of Bi_2Te_3 nanoribbon field effect devices LUIS A. JAUREGUI, Purdue University, MICHAEL T. PETTES, University of Connecticut, LI SHI, University of Texas at Austin, LEONID P. ROKHINSON, YONG P. CHEN, Purdue University — Topological superconductivity can be proximity induced by coupling s-wave superconductors with spin-helical electron systems, such as the surface of 3D topological insulators (TIs), where the energy bands follow Dirac dispersion and the electronic states possess helical spin-momentum locking. We have grown Bi_2Te_3 nanoribbons (NRs) by vapor liquid solid method and characterized their crystalline structure by TEM and Raman spectroscopy. We fabricate backgated field effect devices where the chemical potential (μ) can be tuned from bulk bands to surface states and ambipolar field effect has been observed. The temperature dependence of the resistance and Shubnikov de Haas oscillations show suppressed bulk conduction with surface conduction dominating and a pi-Berry's phase. The Aharonov–Bohm oscillations (ABO), measured with a magnetic field parallel to the NR axis, have a period equal to one flux quanta with conductance maxima at half flux quanta (pi-ABO), for μ close to the charge neutrality point. Such pi-ABO is a direct evidence of the existence of 1D helical modes at half flux quanta. We have also fabricated Josephson junctions on our TI NR devices with inter-electrode separations up to 200 nm, and measured supercurrent with a proximity induced gap of 0.5meV at 0.25K.

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