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QUANTUM OSCILLATIONS IN TOPOLOGICAL INSULATOR MICROWIRES CONTACTED WITH SUPERCONDUCTING In_2Bi LEADS

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Here we studied the magnetoresistance (MR) of polycrystal Bi_2Te_2Se topological insulator (TI) microwires contacted with superconducting In_2Bi leads. Bi_2Te_2Se has a simple band structure with a single Dirac cone on the surface and a large non-trivial bulk gap of 300 meV. To study the TI/SC interface, the Bi_2Te_2Se glass-coated microwire with a diameter of d = 17 µm was connected to copper leads on one side using superconducting alloy In_2Bi (T_c=5.6 K), and on the other side using gallium. The topologically nontrivial 3D superconductor (SC) In_2Bi has proximity-induced superconductivity of topological surface states. To eliminate conventional contribution to superconductivity from the bulk, the resulting edge states of the TI/SC contact area were studied in magnetic fields above Hc_2 in In_2Bi. The $h/2e$ oscillations of magnetoresistance (MR) in longitudinal and transverse magnetic fields (up to 1 T) at the TI/SC interface were observed at various temperatures (4.2 K–1.5 K) [1,2]. To explain the observed oscillations, we used magnetic flux quantization, which requires a multiply connected geometry where flux can penetrate into normal regions surrounded by a superconductor. The effective width of the closed superconducting area of the TI/SC interface is determined to be 15 nm from an analysis of FFT spectra and the beats of the MR oscillations for two different directions (longitudinal and transverse) of magnetic field.

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