Non-local transport in multi-terminal nanostructure patterned of a 3-dimensional topological crystalline insulator SnTe

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Recently, *IV-VI* semiconductor materials are actively studied because many of them belong to a new class of the so-called 3-dimensional topological crystalline insulators (3D TCI) [1,2]. This unusual quantum state of matter is characterized by the presence of conducting surface states, which are protected against backscattering by the symmetry of the crystal lattice. In particular, it is predicted [1] that the 2D Dirac fermion states reside on highly symmetric crystalline planes (100), (110), (111), in agreement with photoemission observations [2]. However, transport studies of 2D surface states in this system are strongly hindered by the intrinsic *p*-type conductivity of bulk material. In order to separate both contributions, we have performed the non-local transport measurements on multi-terminal Hall bar structures, patterned from CdTe/SnTe/CdTe quantum well.

Our devices have been prepared from a 20 nm thick SnTe epilayer that was grown on (100) GaAs substrate with 4 µm CdTe buffer and then covered by 100 nm cap of CdTe. The 6- and 8-terminal Hall bar samples have been patterned using the low-temperature electron beam lithography method [3]. The separating grooves have been wet etched down the CdTe substrate and the macroscopic electrical contact were made with silver paint or Indium. One of the fabricated devices is shown in Fig. 1, where the sizes of conducting channels and depth of etched trenches are indicated.

We have studied the local- and non-local quantum transport using a low-frequency lock-in technique. The measurements have been performed in ^{3}He cryostat (*Heliox VL*) at temperatures down to 250 mK and magnetic fields up to 7 T. We have observed a very strong non-local magnetoconductance signal for several current-voltage contact configurations. We attribute the observed features to quasi-ballistic transport via topologically protected surface states, since the contribution of diffusive (bulk) conductivity to the non-local transport and to the magnetic field-focusing effect, is negligible.

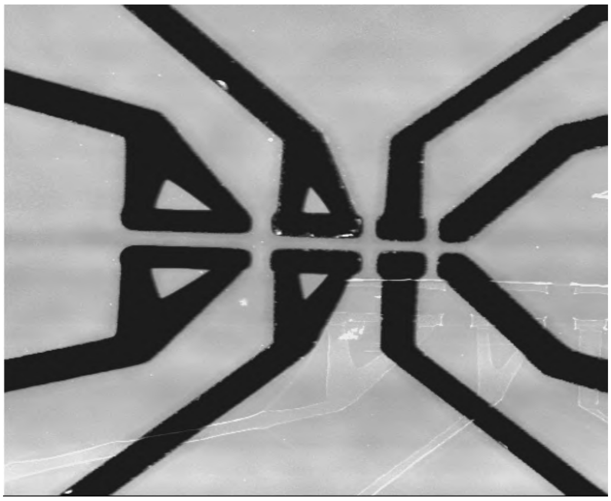

Figure 1: Atomic Force Microscope (AFM) micrograph of wet etched 8-terminal microstructure. The width of conducting channel is about 450 nm and the depth of separating grooves is about 320 nm (size of scan 30x30μm)

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