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Observation of Robust Surface States in Highly-Disordered Topological Insulator Nanotubes RENZHONG DU, WEIWEI ZHAO, XIN LIU, CHAOXING LIU, JAINENDRA JAIN, MOSES CHAN, QI LI, Dept of Physics, Penn State University, SHIH-YING YU, SUZANNE MOHNEY, Dept of Materials Science and Engineering, Penn State University, DUKSOO KIM, SRINIVAS TADIGADAPA, Dept of Electrical Engineering, Penn State University, YUEWEI YIN, SINING DONG, XIAOGUANG LI, Dept of Physics, University of Science and Technology of China, JIAN WANG, ICQM, School of Physics, Peking University
— We have studied electrical transport properties of candidate topological insulator (TI) Bismuth Telluride (Bi_2Te_3) nanotubes at low temperatures and high magnetic fields. Bi_2Te_3 nanotube samples were synthesized by solution phase method, with the outer diameters in the range of 90 $\sim$ 200 nm and wall thickness 10 $\sim$ 15 nm, and typical length of over 10 μm. Focused ion beam (FIB) assisted deposition and e-beam lithography were applied to fabricate Ohmic contacts. Thermal conductivity measurements show the nanotubes have similar carrier concentration to other metallic nanowires and ribbons, while the nanotubes have insulating behavior, which is due to disorder. For the highly disordered samples, strong quantum oscillations in magnetoresistance were observed in parallel field, with an h/e period associated with the outer surface of the nanotubes. Detailed analysis indicates that the oscillations are due to Anomalous Aharonov-Bohm Effect originating from Dirac-like TI surface states. The relationship between oscillation and disorder will be discussed.

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