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Topological insulator Bi_2Te_3 nanowire field effect devices LUIS A. JAUREGUI, GENQIANG ZHANG, YUE WU, YONG P. CHEN, Purdue University — Bismuth telluride (Bi_2Te_3) has been studied extensively as one of the best thermoelectric materials and recently shown to be a prototype topological insulator with nontrivial conducting surface states. We have grown Bi_2Te_3 nanowires by a two-step solution phase reaction and characterized their material and structural properties by XRD, TEM, XPS and EDS. We fabricate both backgated (on SiO_2/Si) and top-gated (with ALD high-k gate dielectric such as Al_2O_3 or HfO_2) field effect devices on such nanowires with diameters $\sim$50nm. Ambipolar field effect and a resistance modulation of up to 600% at low temperatures have been observed. The 4-terminal resistance shows insulating behavior (increasing with decreasing temperature) from 300 K to 50K, then saturates in a plateau for temperatures below 50K, consistent with the presence of metallic surface state. Aharonov–Bohm (AB) oscillations are observed in the magneto-resistance with a magnetic field parallel to the nanowire, providing further evidence of the presence of surface state conduction Finally, a prominent weak anti-localization (WAL) feature that weakens with increasing magnetic field and/or temperature is observed in the magneto-resistance with a magnetic field perpendicular to the nanowire.

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