Supporting Information

Sn-doped Bismuth Telluride Nanowires with High Conductivity

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This file contains:

Methods, and Supporting Figures S1—S2

Methods

Materials and Synthesis. Sn-doped Bi_2Te_3 nanowires were prepared in a horizontal tube furnace equipped with a 1-inch diameter quartz tube (Linderberg Blue M, Model TF55030KC-1, Thermal Fisher Co., USA). The Si/SiO_2 wafer was first thermally evaporated a 2 nm Sn layer, and then cut into 1×1 cm^2 size as growth substrates. Right before use, the growth substrate was coated with 0.1% w/v aqueous poly-*L*-lysine solution (Ted Pella Inc., USA) for 1 min, followed by functionalization with 13-nm-diameter home-made Au colloid solution for 15 s. In a typical reaction, 0.2 g Bi_2Te_3 powder (99.999%, Alfa Aesar, USA) was loaded in a porcelain boat and placed at the center of furnace. The growth substrate was placed ~ 16 cm away from the source materials. Argon (99.99%) and hydrogen (99.99%) were used as carrier gases. The quartz tube was first pumped to a base pressure of ~ 10^{-2} Torr and flushed with carrier gases for 3 times to remove O_2 residue. Then the temperature and the growth pressure were raised to 480 °C and 70 kPa within 5 min, under 25 standard cubic centimeters (sccm) Ar and 25 sccm H_2 gas flow. The reaction was kept for 30 min, before the furnace was quickly pumped and cooled down.

Structural characterization. The as-grown NWs were directly characterized with a Hitachi S4800 SEM (Japan). For TEM and EDX characterization, the growth substrate were sonicated in 100 μL ethanol for 10 s to disperse the as-grown NWs, and the ethanol suspension was dropped onto a Cu grid (Lacey Formvar/Carbon #01883-F, Ted Pella Inc., USA). TEM and SAED analysis were performed with a JEOL-2100F TEM (Japan). Raman spectra were collected on a Horiba-Jobin-Yvon LabRam-1B Raman spectrometer equipped with a He-Ne laser with a wavelength of 632.8 nm and a 700 nm laser spot. The samples were placed on a silicon wafer

with a 300-nm-thick silica layer. The spectra were recorded in the range of 50−250 cm^{-1}. All spectra were collected through a 100X objective lens in the backscattering mode with a 1800 grooves/mm grating and a CCD detector.

Electrical measurement. The electrodes were defined by a shadow mask, followed by the thermal deposition of 5 nm Cr and 30 nm Au. The electrical transport measurement was carried out in helium, with a current pre-amplifier (1211, DL Instruments LLC., USA), a lock-in amplifier (SR8300, Stanford Research Systems, USA), and a temperature control system (Lakeshore 340, USA). Low temperature atmosphere was provided by Oxford Integra TM AC Recondensing liquid helium cryostat.

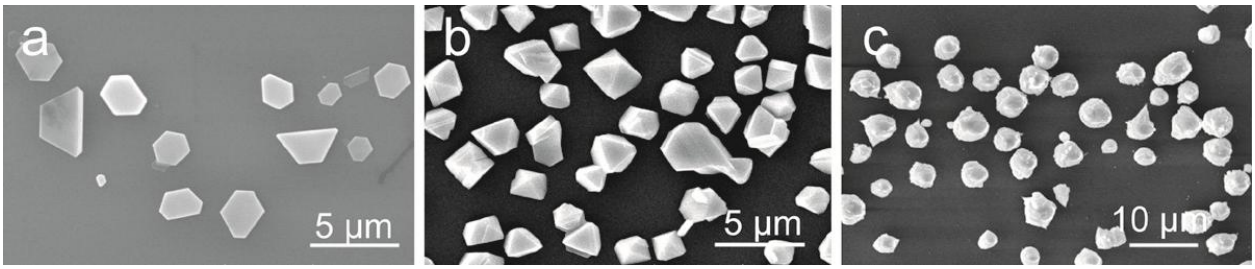

Figure S1. SEM images of different morphologies of bismuth telluride grown at different temperatures and pressures: (a) 480 ^{o}C and 3 kPa, nanoplates, (b) 540 ^{o}C and 3 kPa, nano-octahedrons, and (c) 600 ^{o}C and 3 kPa, nanospheres.

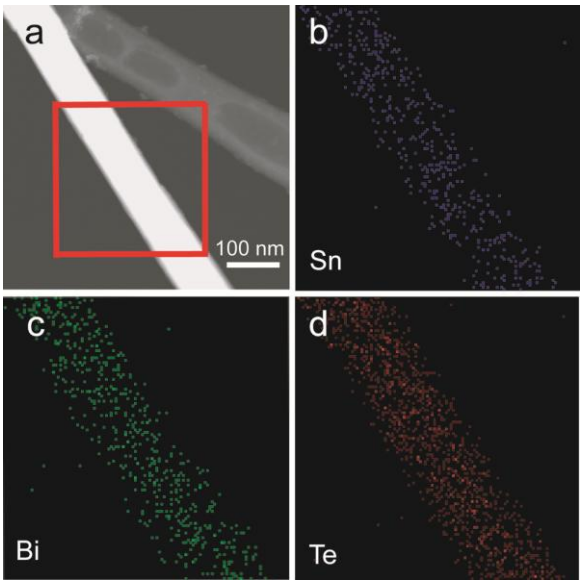

Figure S2. (a) STEM image of a Bi_2Te_3 NW; (b−d) Elemental mapping of (b) Sn, (c) Bi, and (d) Te in the middle segment of this NW, as highlighted in the red box in (a).