Supporting Information for "Boron Carbide Nanowires: Low Temperature Synthesis, Structural and Thermal Conductivity Characterization"

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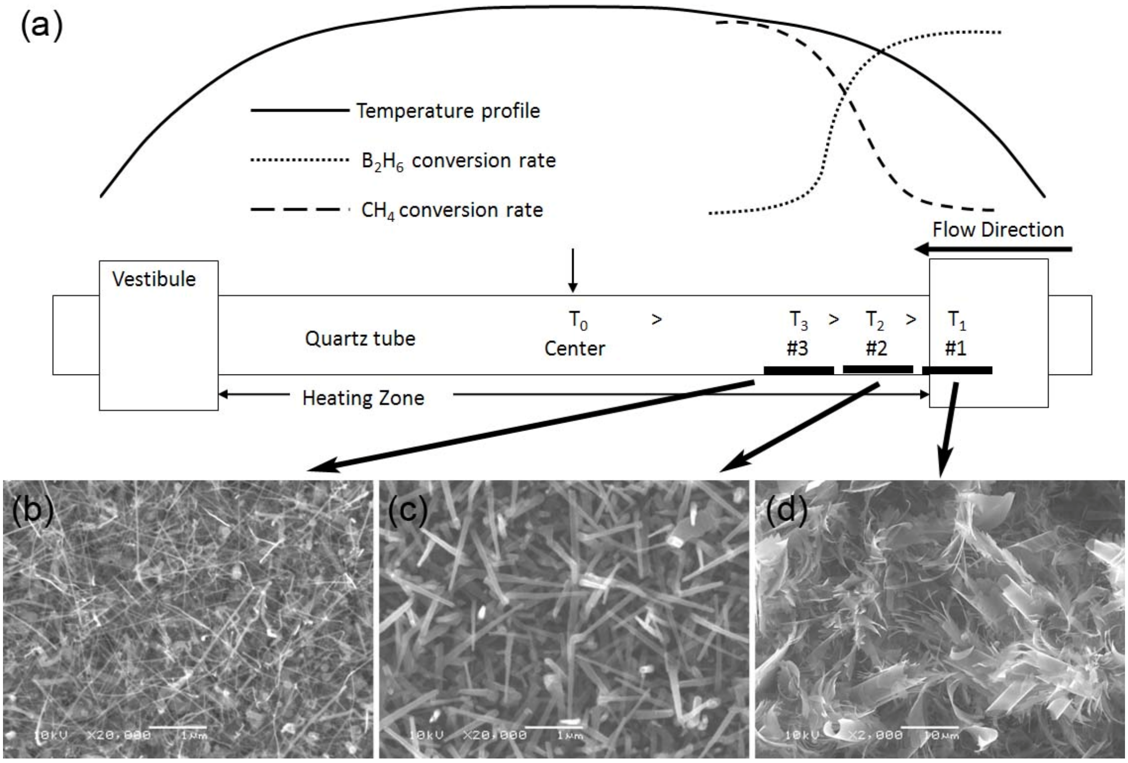

Figure S1. (a) A schematic drawing of the furnace tube, temperature profile and concentration profile of reaction species. Since the heating temperature is measured and controlled by a thermocouple at the center of the tube furnace, the reaction temperature inside the tube is the highest at the center and drops to the lowest at the ends of the tube, as shown by the solid curve. Source gases (B_2H_6 and CH_4) and carrier gas (Ar) are introduced from the right inlet. Most of the B_2H_6 gets decomposed when entering the heated tube, resulting in the higher concentration of boron-containing species at the inlet (dotted curve). The concentration profile of carbon-containing species produced by decomposition of CH_4 is shown by the dashed curve. Substrates are put close to the right inlet in different temperature regions. Due to the unique combination of temperature and the decomposition rate of B_2H_6 and CH_4, three different types of crystalline nanostructures could be synthesized: (b) boron carbide nanowires with high aspect ratio in the temperature range of 964–977 °C; (c) tapered short boron carbide nanostructures in the temperature range of 908–931 °C; and (d) α-tetragonal boron nanoribbons and nanoplatelets in the temperature range of 630–750 °C.

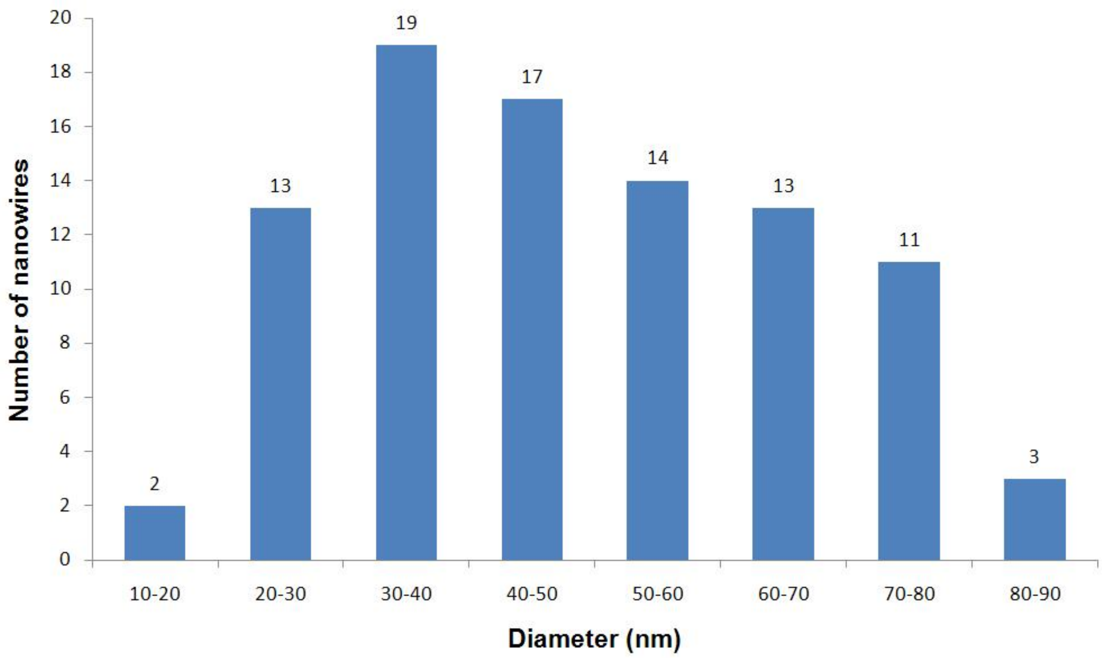

Figure S2. A histogram of diameters of as-synthesized boron carbide nanowires. A total of 92 nanowires were analyzed by TEM characterization. Their diameters were between 15 and 90 nm. The average diameter was ~48.5 nm, and the standard deviation was ~17.6 nm.

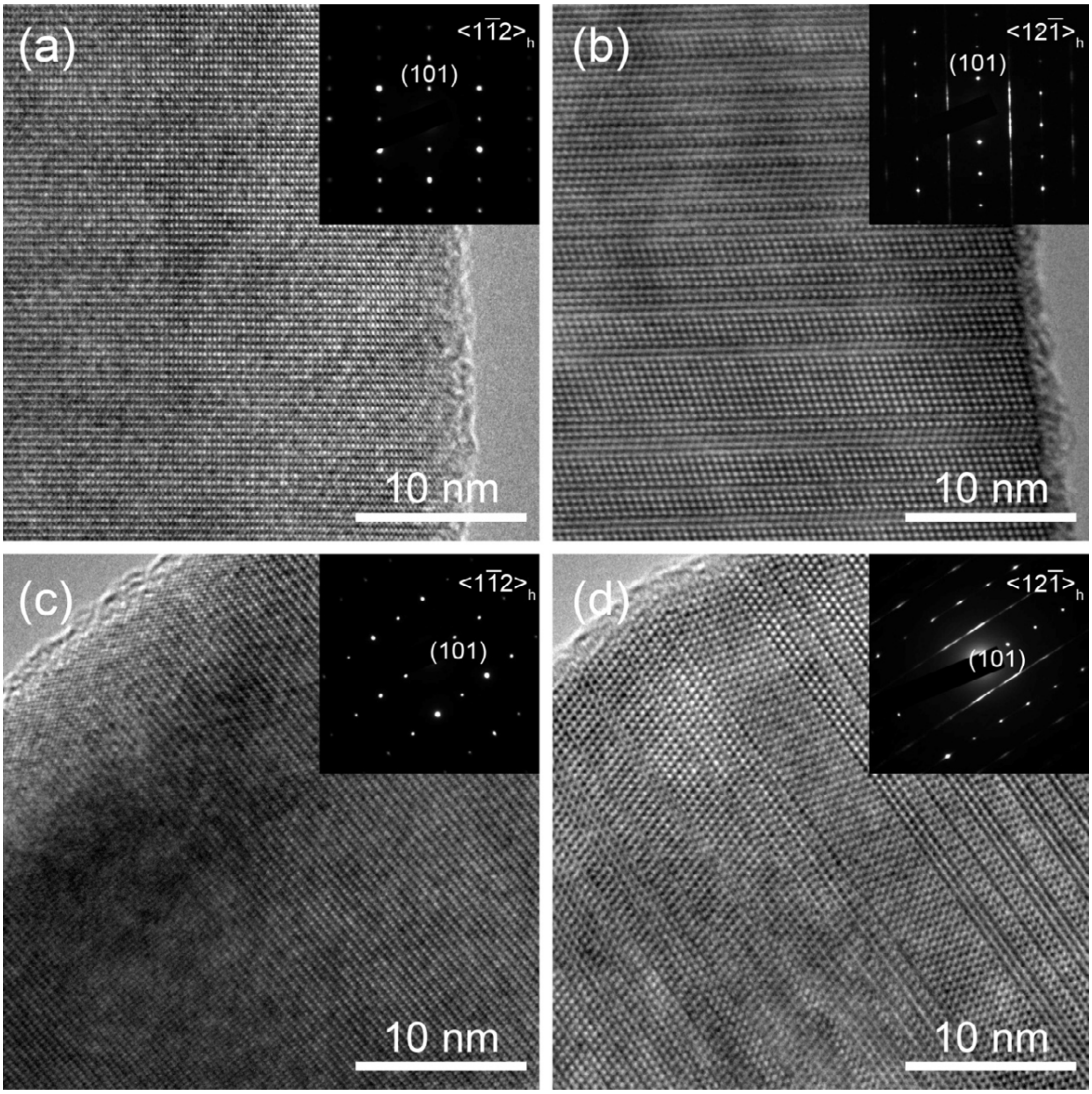

Figure S3. The appearance of planar defects is related to tilting angles of the TEM sample holder. Images (a) and (b) were taken from the same nanowire at different tilting angles: (-2.9, 1.1) and (27, 15.6), respectively. Analysis of the corresponding diffraction patterns (insets) reveals that the images were taken when the electron beam was parallel along $<1\bar{1}2>_h$ and $<12\bar{1}>_h$ zone axes, respectively. Viewed from the $<1\bar{1}2>_h$ axis, the nanowire seems to be defect-free and have straight side walls. However, a ~30 degree tilting leads to results from a new zone axis: $<12\bar{1}>_h$ zone. The new results clearly reveal that the nanowire has planar defects and zigzag side walls. Without examination at different tilting angles, one could easily be deceived and conclude that the nanowire is defect-free. Same phenomenon was observed for the other nanowire (c) and (d) with the tilting angles of (5.2, -5.1) and (-25.3, 9.4), respectively.