Carbon nanotube synthesis and observation:

Double-wall carbon nanotubes studied here were grown directly on a gold grid for transmission electron microscopy (TEM) by chemical vapor deposition (CVD). Catalyst was prepared following the approach reported in reference S1. Catalyst was either spun or spread onto the TEM grid then dried in a vacuum oven at 80 °C for 10 minutes before being loaded into the CVD reactor. CNT growth was performed in a hot wall reactor fitted with a 3-inch horizontal quartz tube at 700 °C – 900 °C. Growth duration was 15 minutes with the reaction pressure at 100 Torr and the flow rate of methane and hydrogen was fixed at 60 sccm/min and 40 sccm/min, respectively. Fig. S1 shows a typical area of the sample. TEM observation shows that the sample has a mixture of single and double-walled nanotubes with mostly single wall tubes at low growth temperature (700 °C) and a high percentage of double-wall tubes at 800 °C or above. TEM observation was carried out in a JEOL2010F TEM with a high voltage of 200 keV in the nanodiffraction mode. Diffraction patterns were recorded on imaging plates with the camera length of 80 mm and exposure time 11 s.

Fig S1. A typical area of sample showing two carbon nanotubes and catalysts spun on a gold TEM grid. Carbon nanotubes grow from small catalyst particles. Microscope resolution at this imaging condition was not sufficient to resolve the double walls of the tube. For the electron diffraction experiment, only a section of the tube over vacuum was used.