Supporting Information

Hole-doping to aligned single-walled carbon nanotubes from sapphire substrate induced by heat treatment

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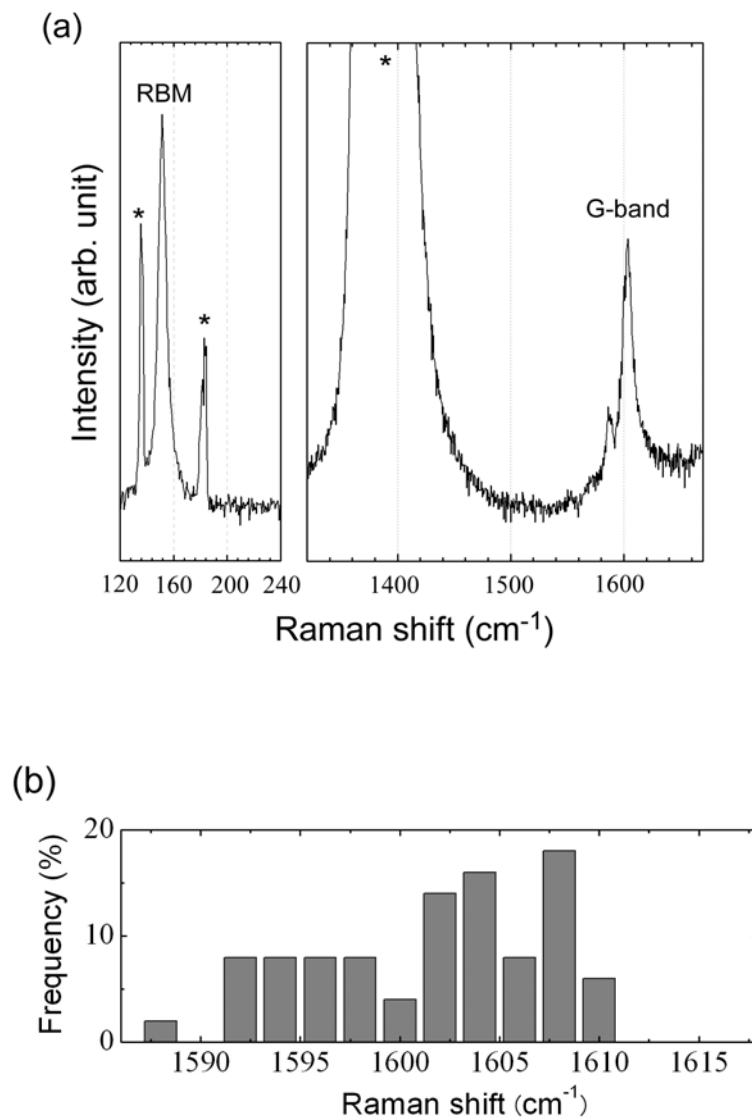## 1. Other excitation wavelength (633 nm)

Figure S-1. (a) Raman spectrum of the SWNT/sapphire sample heat treated at 1000 $^{\circ}$C.   The excitation wavelength was 633 nm, and semiconducting nanotubes were detected.   The sample is same with that shown in Fig. 3c.   (b) Distribution of G-band frequency measured with an excitation wavelength of 633 nm.   Total number of counted nanotubes is 50.
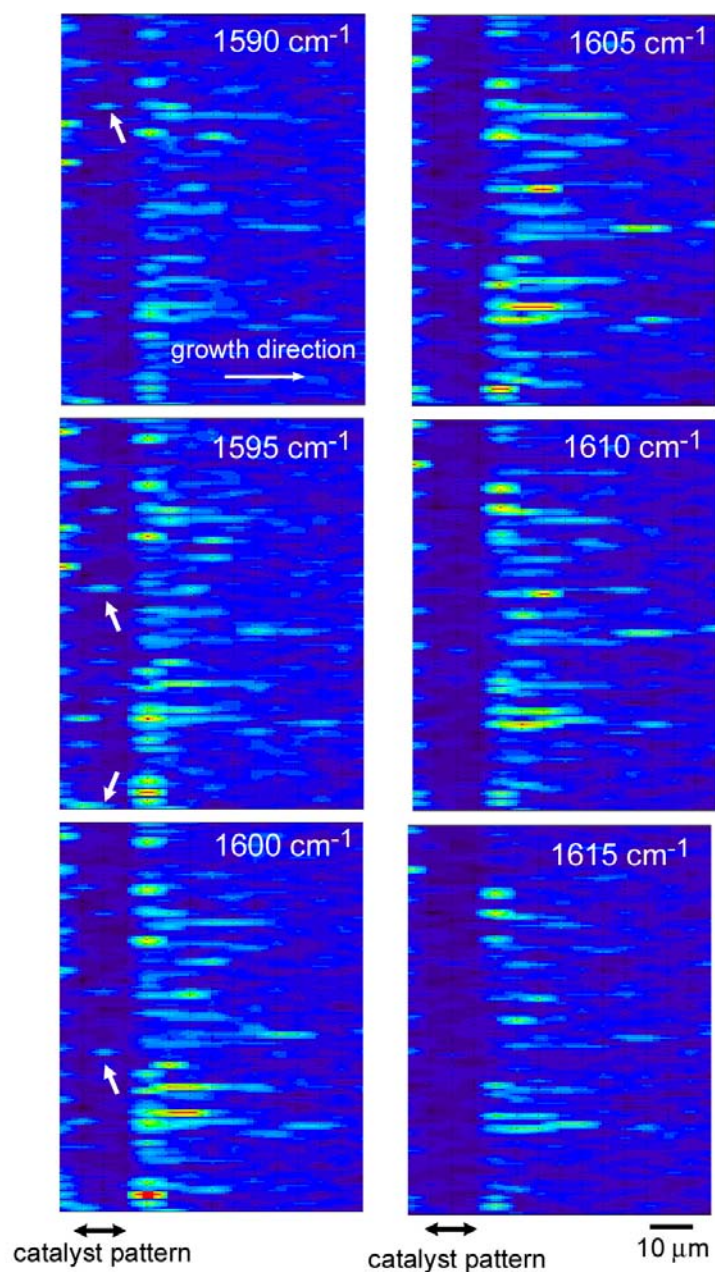
2. Additional Raman mapping images

Figure S-2. Raman G-band mapping images of the SWNTs heat treated at 1000 °C. Inside the catalyst pattern, no significant shift in the G-band was observed (indicated by arrows). The excitation wavelength was 514.5 nm. The scan intervals were 5 and 1 μm for *x* and *y* directions, respectively.
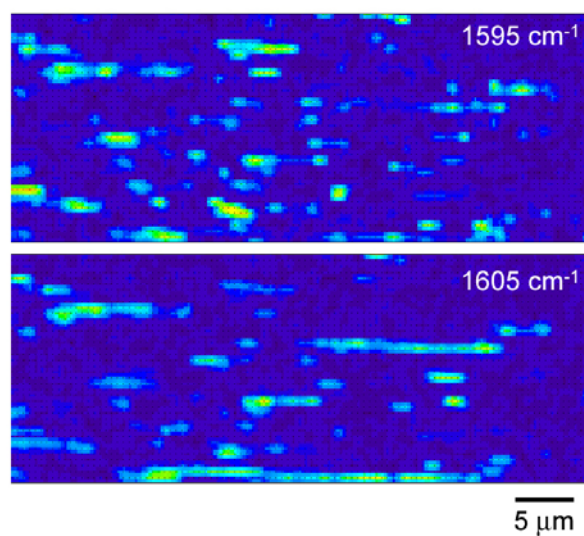
Figure S-3. Raman mapping images of the SWNTs grown over randomly deposited Fe-Mo catalyst, measured after the heat treatment at 1000 °C. The nanotubes were relatively short and showed wide G-band frequencies randomly distributed. The scan intervals were 0.5 μm for both x and y directions.
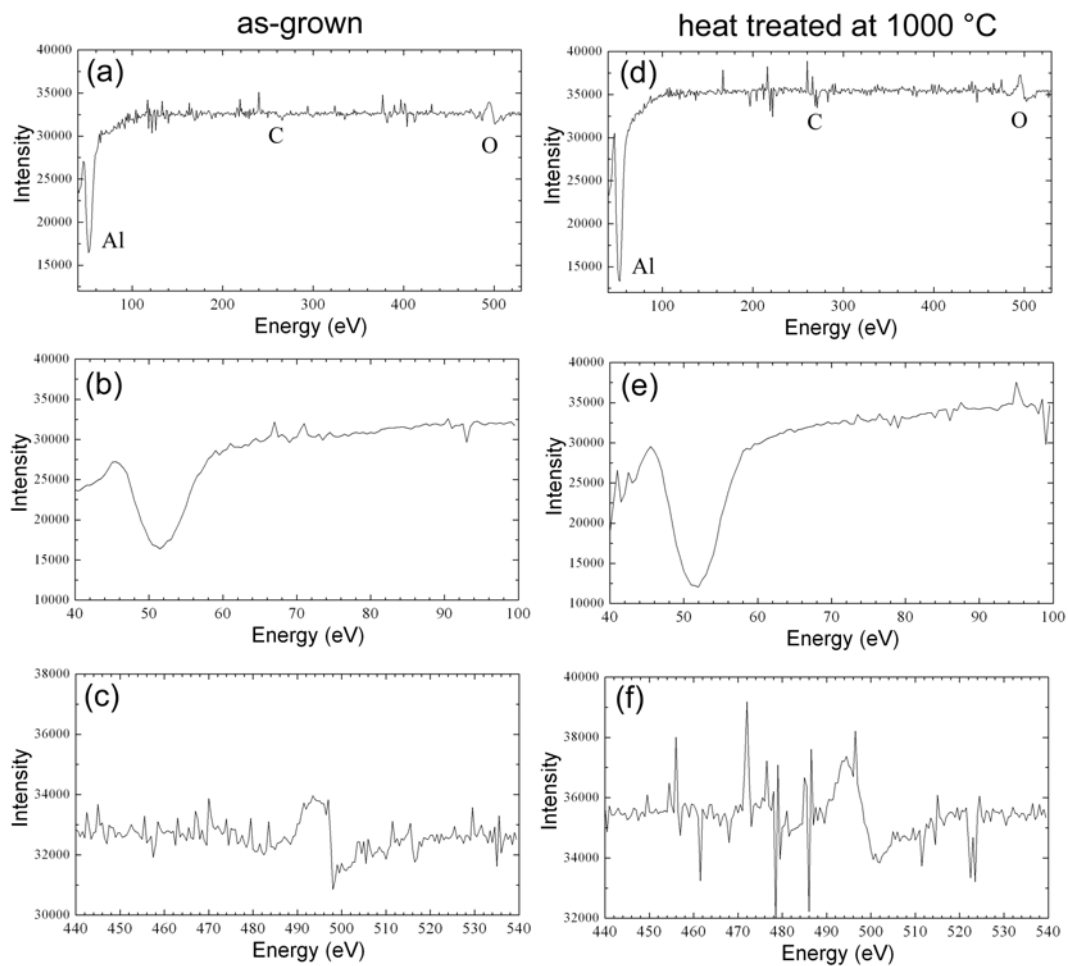
3. Original Auger spectra

Figure S-4. Auger spectra of as-grown SWNTs (a-c) and those after the heat treatment at 1000 °C (d-f). (a, d) full range, (b, e) Al, (c, f) O. It is seen that relative intensity of [Al]/[O] increased after the heat treatment.
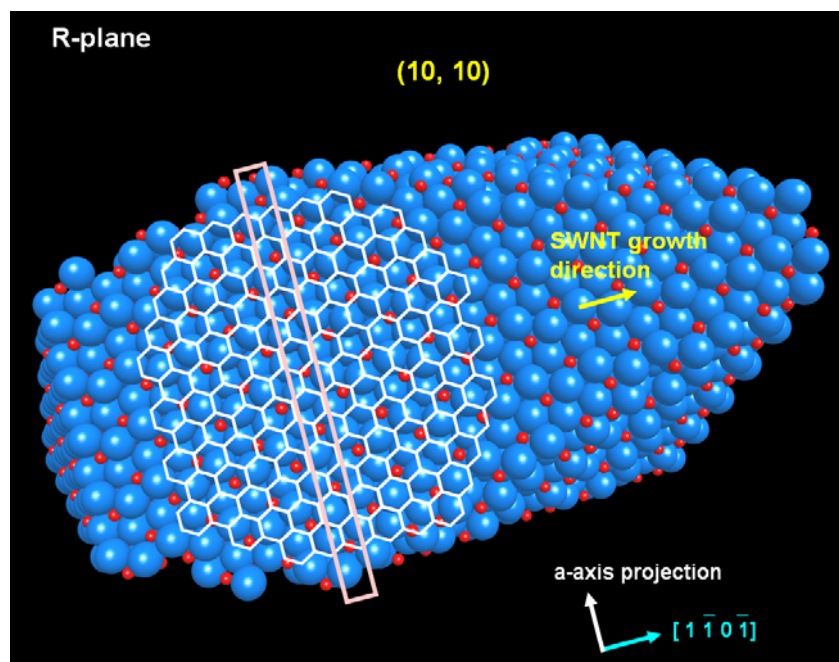
4. Atomic model

Figure S-5. Atomic model of *r*-plane sapphire surface overlapped with a developed (10, 10) SWNT structure. Red and blue show Al and O atoms, respectively. Although (10, 10) nanotube is metallic, we use it as a model nanotube here because of its simple structure.