

## Supplementary Material: Near-Field Optical Identification of Metallic and Semiconducting Single-Walled Carbon Nanotubes

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### A. The synthesis process of SWCNTs

An ultra-thin iron film with an approximate thickness of 0.1 nm used as a catalyst precursor was vaped on the SiO<sub>2</sub>/Si wafers. The system was heated to 950 °C in 13 min and a flow of hydrogen (40 SCCM) and argon (25 SCCM) was introduced into the system in the same time frame. The CVD growth of SWCNTs was implemented with a flow of methane (25 SCCM) and hydrogen (40 SCCM) at 950 °C for 20 min. Then argon (25 SCCM) and hydrogen (40 SCCM) was introduced for flushing the chamber to terminate the growth process. As catalyst particles were randomly deposited on the half regions of the substrate chip, the nanotubes became overlapped with each other and formed a nanotube network. While on the other half regions without catalyst, the nanotubes were well-aligned in the direction of the gas flow.

### B.

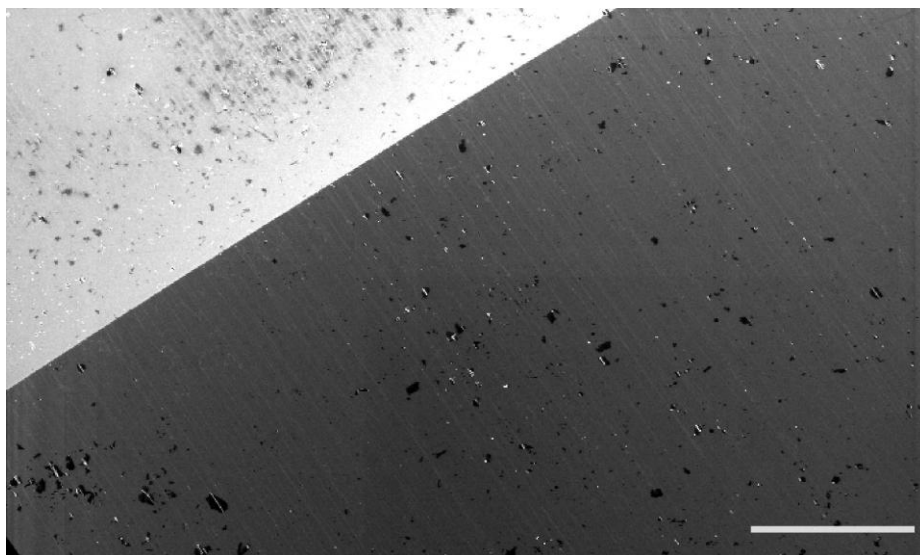


Fig. S1. SEM image showing a representative chip with both SWCNT networks and well-aligned SWCNT arrays. In the upper-left area with catalysts of this substrate chip, the nanotubes became overlapped with each other and formed a nanotubes network. While on the other area without catalyst, the nanotubes were well-aligned in the direction of the gas flow. The scale bar is 500  $\mu$ m.

C.

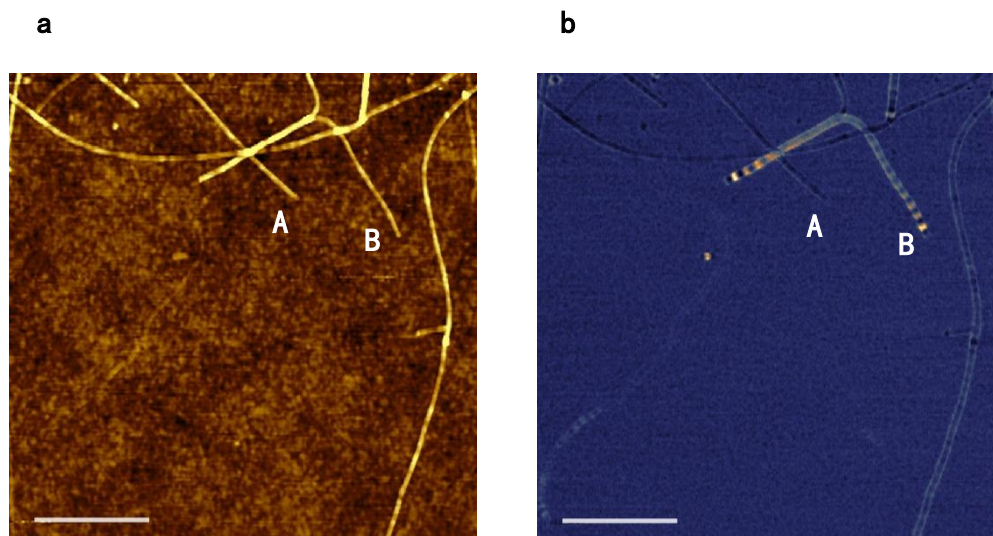


Fig. S2. More representative near-field images could provide the evidence. The semiconducting SWNT (tube A) shows little near-field optical response, whereas the metallic SWNT (tube B) exhibits surface plasmon oscillations. The scale bar is 500 nm.

D.

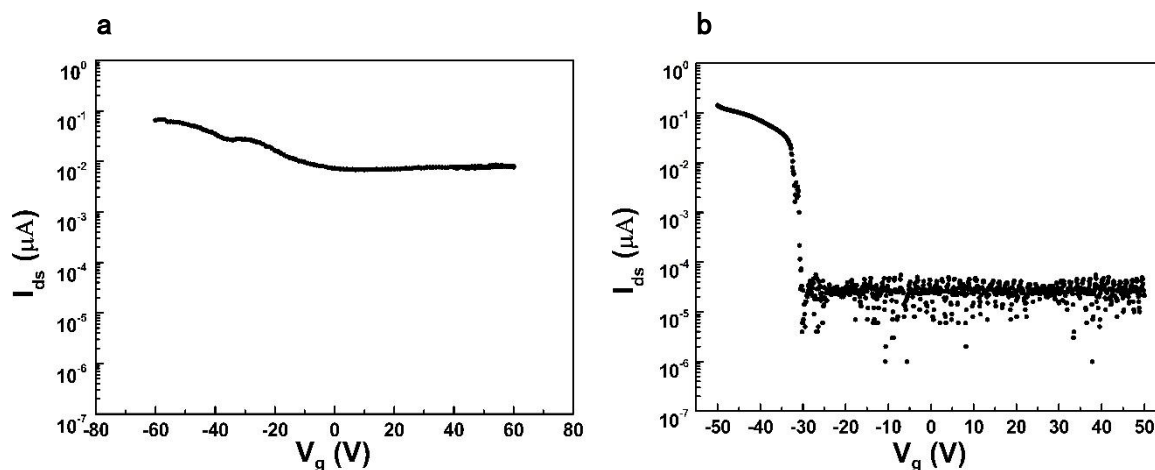


Fig. S3. Transport measurement on individual metallic and semiconducting SWCNTs characterized by near-field optical microscopy and Rayleigh scattering measurements. (a) Transport data of an individual metallic SWCNT (tube shown in Fig. 4b in the main text) with a weak dependence on back gate voltage (on/off < 10). It indicates this is a semiconducting carbon nanotube. (b) Transport data of an individual semiconducting SWCNT (tube shown in Fig. 4(e) in the main text) with a large ON/OFF ratio ( $10^4$ ). It indicates this is a semiconducting carbon nanotube. The FET measurement results of these two tubes are consistent with both SNOM and Rayleigh scattering, respectively. Measurements in (a) and (b) are carried out at room temperature in an atmospheric environment.