Supporting Information

A Hybrid Enrichment Process Combining Conjugated Polymer Extraction and Silica Gel Adsorption for High Purity Semiconducting Single-Walled Carbon Nanotubes (SWCNT)

Jianfu Ding*[1], Zhao Li[1], Jacques Lefebvre[2], Fuyong Cheng[3], Jeffrey L. Dunford[2], Patrick R. L. Malenfant*[2], Jefford Humes[4], Jens Kroeger[4]

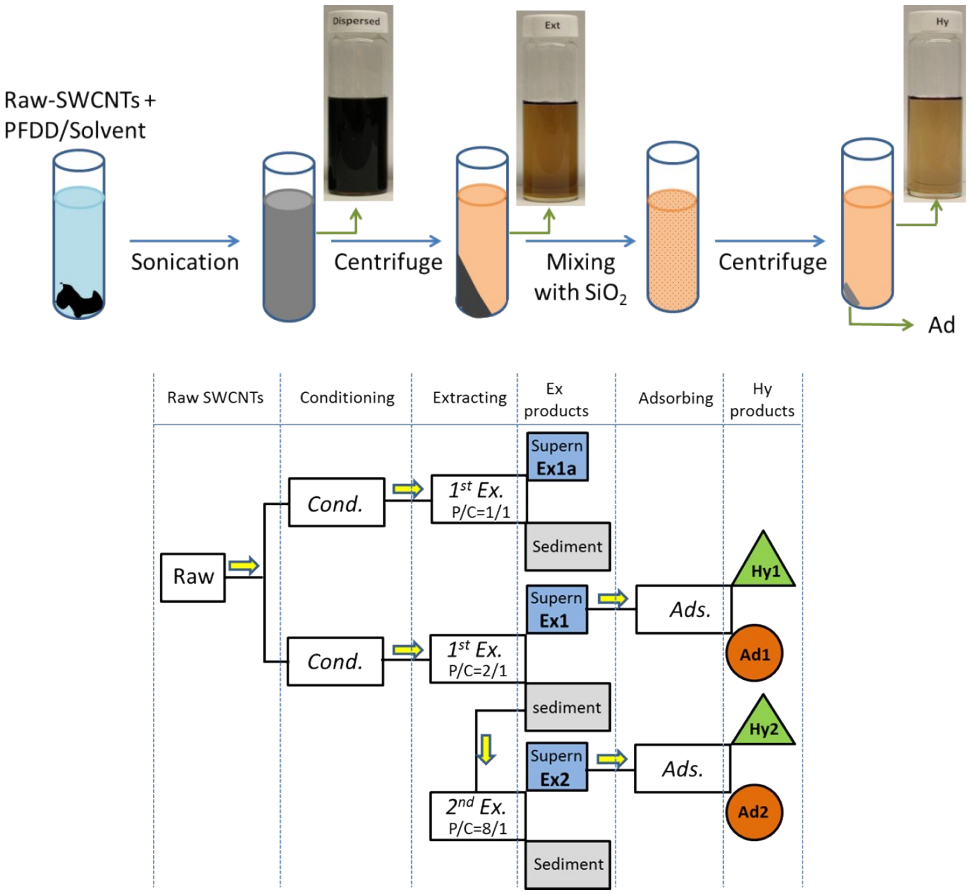

Figure S1. Process scheme that illustrates how various sc-SWCNT samples were generated (Ex1a, Ex1, Ex2, Hy1, Hy2, Ad1 and Ad2).

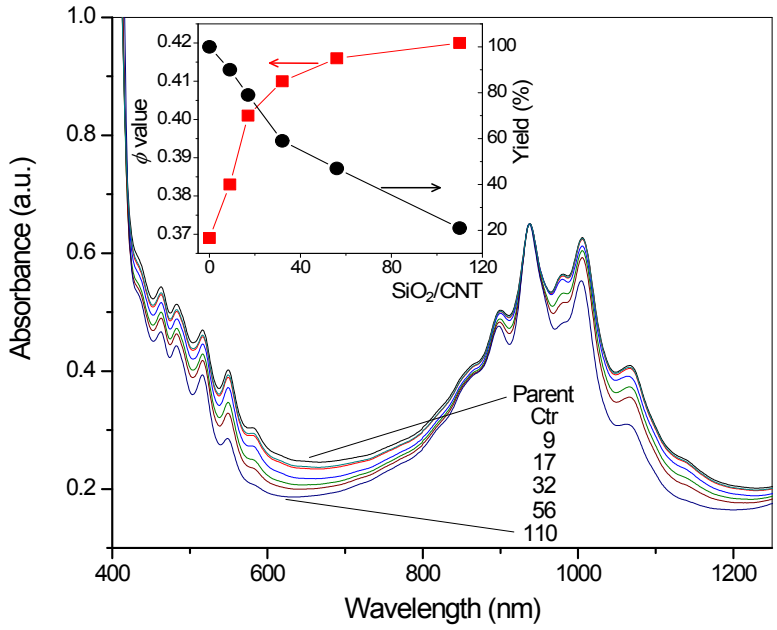

Figure S2. Comparison of UV spectra of the parent solution with the supernatant from the control sample (without adding silica gel) and from silica gel treatment at different SiO_2/SWCNT ratios. The spectra are normalized to the peak at 938 nm. The parent sc-SWCNT solution has a SWCNT concentration of 0.158 mg/mL, PFDD/CNT ratio of 3.0 and ϕ value of 0.369.

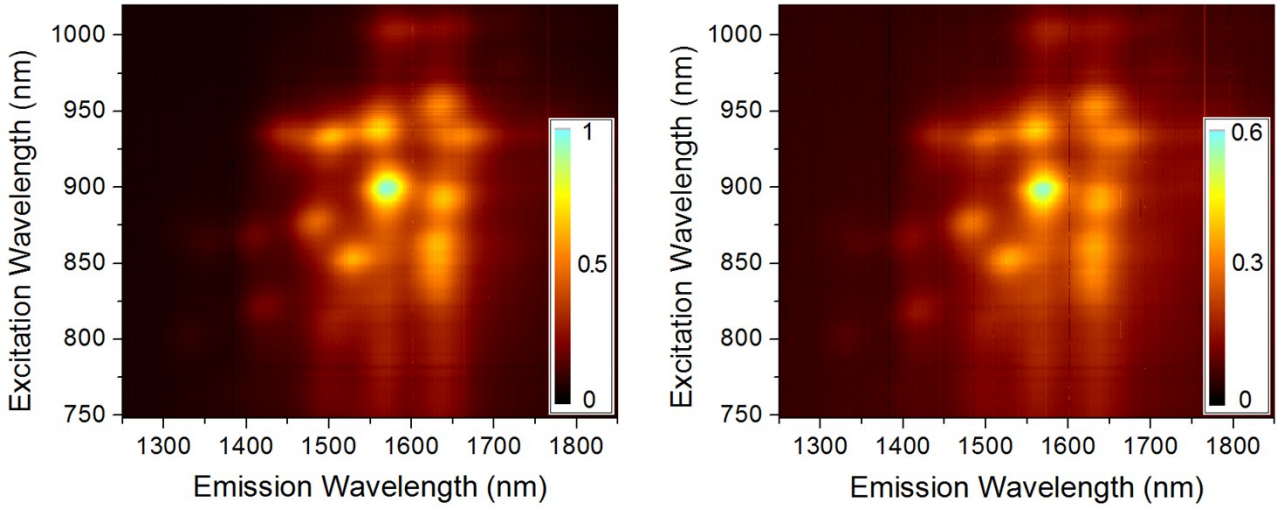

Figure S3. Photoluminescence excitation map of Ex1 (left) and Hy1 (right). Nine chiralities have an intensity higher than 0.5 with the (10,9) species dominating (emission at 1560 nm, excitation at 900 nm).

In order to eliminate the influence of intensity variation due to thickness fluctuations of the SWCNT network from spot to spot, the G^+ band was taken as a reference and the images were plotted based on the intensity ratio of the G^-_m at 1545 cm^{-1} over the G^+ band at 1592 cm^{-1}. The Raman signal was excited at 633 nm (1.96 eV) where most of the m-SWCNTs are resonant. Indeed, the SWCNT diameter range is centered at 1.3 nm according to the Kataura plot, thus generating the G^-_m band at 1545 cm^{-1} as shown in Figure 5a (main text). A high ratio indicates the possible existence of m-SWCNTs within the examined 1 μm^2 area. The higher the ratio, the higher the possibility of m-SWCNTs located within the area. The instrument allows us to scan large areas and collect Raman spectra for each 1 μm^2 pixel, and all the pixels with the G^-_m/G^+ ratio higher than a threshold value (0.30) are further inspected to determine if the signal is attributed to m-SWCNTs.[30] Figure S4 compares the Raman maps of Ad2, Ex2 and Hy2. A representative Hy2 map showed only 8 pixels in the entire 961 μm^2 area with a G^-_m/G^+ ratio higher than 0.3 that displayed typical m-SWCNT spectra.

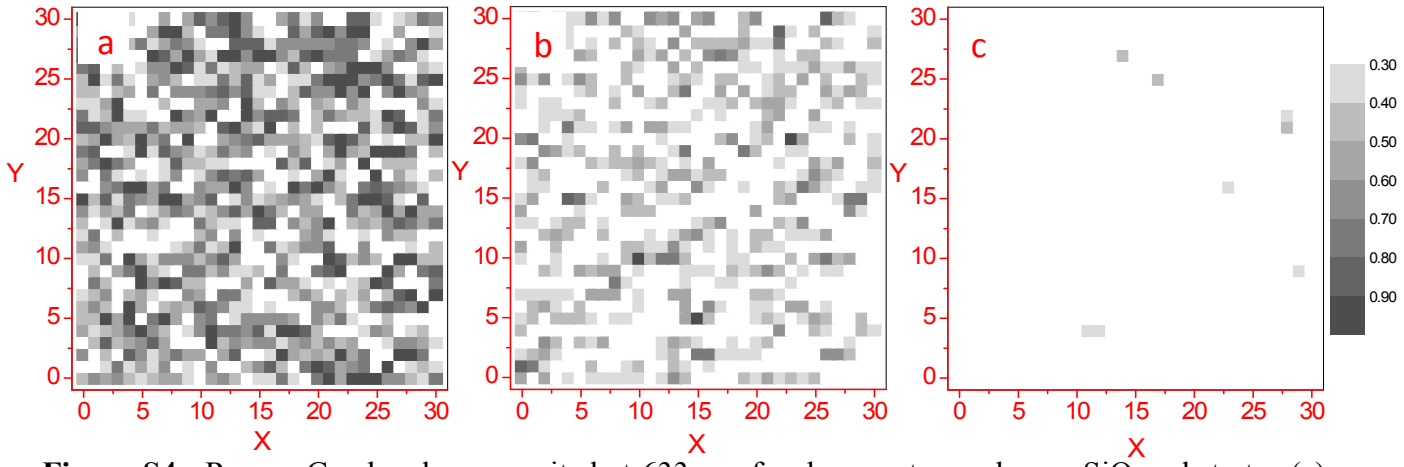

Figure S4. Raman G^-_m band map excited at 633 nm for drop-cast samples on SiO_2 substrates (a) Ad2, (b) Ex2 and (c) Hy2. The grey index on the scale bar represents the intensity ratio of the G^-_m and G^+ bands at 1545 to 1592 cm^{-1}.

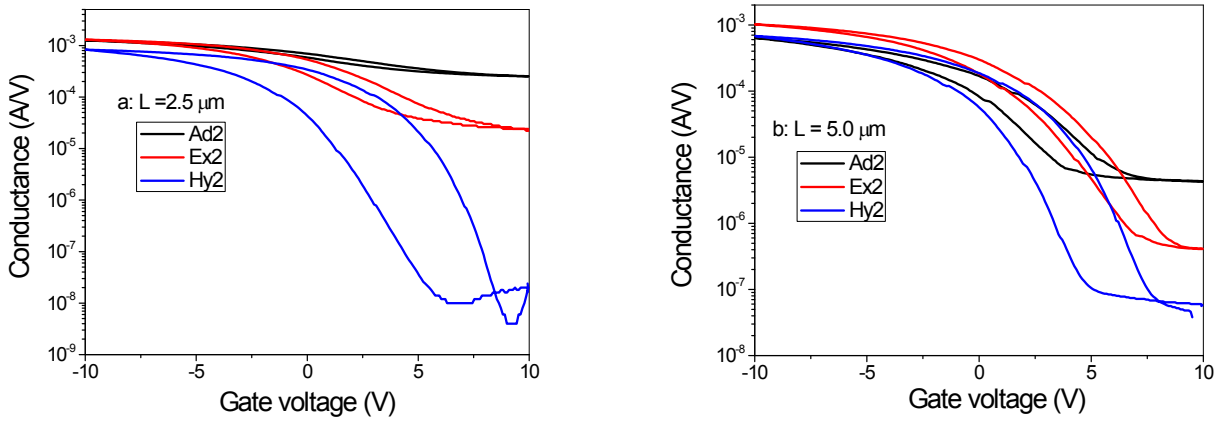

Figure S5. Representative transfer curves of the devices with channel lengths of (a) 2.5 μm and (b) 5.0 μm for samples Ad2, Ex2 and Hy2.

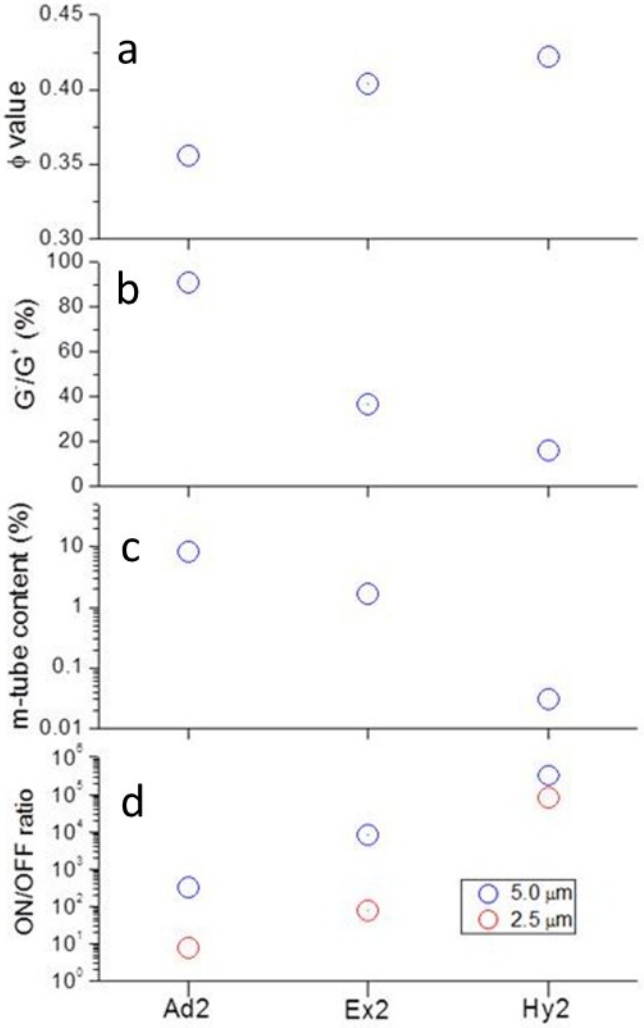

Figure S6. Comparison of the (a) ϕ value from absorption spectra, (b) G^-/G^+ ratio from Raman scattering excited at 633 nm, (c) m-SWCNT content counted by Raman mapping, (d) current ON/OFF ratio from TFT devices for the sample before (Ex2) and after the adsorption treatment (Hy2), and the material adsorbed on silica gel (Ad2).