

SUPPORTING INFORMATION

Controlling Carbon Nanotube-to-Medium Conductivity Ratio for Dielectrophoretic Separation

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Sample Preparation Methods

Five nanotube suspensions were prepared using different dispersing agents as summarized in Table 1. Firstly, three samples were prepared by dispersing raw HiPco SWNTs (purchased from Carbon Nanotechnology Inc.) in aqueous solutions using anionic SDS (C₁₆), cationic CTAB (C₁₈), and nonionic Pluronic F-127, respectively. For SDS-SWNTs, raw SWNTs (50 mg) were dispersed in 100 ml of deionized water with anionic SDS (0.79 wt %, 27.4 mM). The solution was homogenized for 20 min at 4 W and further ultra-sonicated using a probe-tip for 15 min at 490 W. The dispersed SWNT solution

was ultra-centrifuged for 4 h at 22600 rpm, and the supernatant containing individual nanotubes was carefully decanted [S1]. CTAB-SWNTs and Pluronic-SWNTs were prepared using CTAB (1 wt %, 27.4mM) and Pluronic F-127 (1 wt %, 0.8 mM), respectively. Other procedures were identical. Figure S1a shows Pluronic-SWNTs.

Two more nanotube suspensions were prepared by mixing surfactants to modulate the surface charge of colloidal nanotubes. For the first mixture, CTAB solution (w/o SWNTs) was added in a 1:1 molar ratio to the SDS-micellized nanotube suspension (CTAB|SDS-SWNTs) as shown in Figure S1b. The equimolar mixture of CTAB and SDS is expected to form an ion-paired complex, hexadecyltrimethylammonium dodecyl sulfate (CTADS) [S2]. The surfactant forms large diameter vesicles and crystallites due to the reduced electrostatic repulsion of the head group, leading to a turbid solution (Fig. S1c) [S3, S4]. The mixture of SDS and CTAB without nanotubes was also prepared as a control. The samples were additionally centrifuged for 2 hours at 16000 rpm, and most of the large vesicles and crystallites could be removed (Fig. S1d). The second mixture was made by switching the mixing order. SDS solution (w/o SWNTs) was added to the CTAB-micellized SWNTs (SDS|CTAB-SWNTs). [S3, S4]

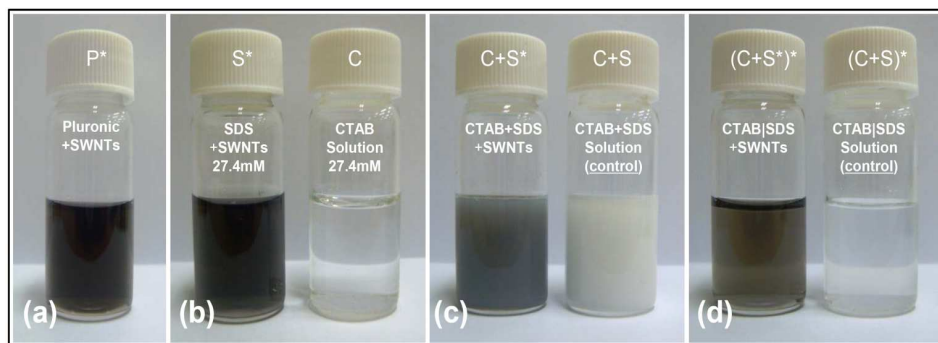


Figure S1. (a) Pluronic-SWNTs (b-d) The sample preparation process for CTAB|SDS-SWNTs (b) SDS-SWNTs (0.79 wt %, 27.4 mM) and a CTAB solution (1 wt %, 27.4 mM) without nanotubes. (c) CTAB|SDS-SWNTs right after mixing. An equimolar mixture of SDS and CTAB without nanotubes was also prepared as a control. (d) CTAB|SDS-SWNTs after centrifugation. The surfactant mixture

without nanotubes was also centrifuged under the identical condition.

We also tried mixing the two surfactants first (27.4 mM each), and then suspending SWNTs in the dual-surfactant system. The sonication parameters were almost identical. The surfactant mixture was bath-sonicated for 10min followed by homogenization (10 min, 4 W). In the next step, SWNTs were added (50 mg). The solution was homogenized for 20 min at 4 W and further ultra-sonicated using a probe tip for 15 min at 490 W. As shown in figure S2a, nanotubes could not be well-dispersed and aggregates were observed. Most of the tubes were deposited after the centrifugation (16,000 rpm, 2 h). The supernatant looks transparent as shown in Figure S2b.

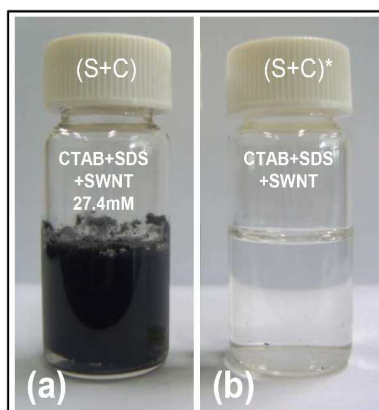


Figure S2. The two surfactants were mixed first, and then SWNTs were added. (a) Before centrifugation
(b) After centrifugation

Scanning Electron Microscopy (SEM) image

Figure S3 shows an SEM image of the dielectrophoretically deposited SWNTs. Deposited nanotubes were rinsed before characterization.

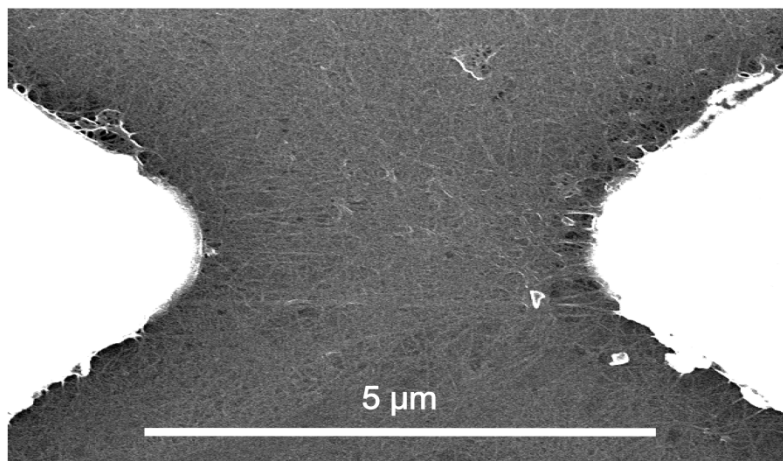


Figure S3. SEM image of the dielectrophoretically deposited SDS-SWNTs between micro-electrodes with a gap size of 4 μm .

Air-dried Control Samples

Control samples were also prepared by air-drying drops of nanotube suspensions on a glass substrate without applying electric fields. As shown in Figure S4, both metallic and semiconducting modes were clearly observed on the control samples.

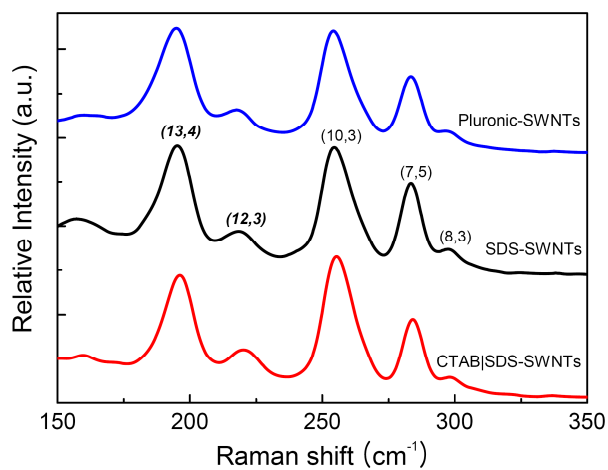


Figure S4. The RBMs of three control samples.

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