

Supporting Information

Electrostatically controlled isolation of debundled single-walled carbon nanotubes from nanoplatelet dispersant

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Element maps

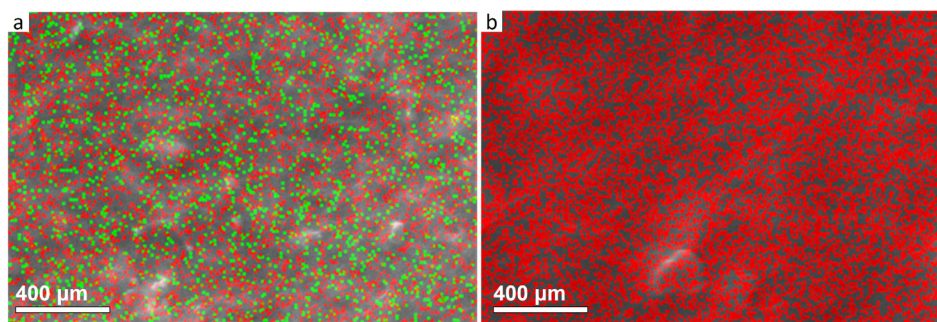


Fig. S1 Element maps of (a) SWCNT/ZrP hybrid and (b) SWCNTs isolated from SWCNT/ZrP/TX-100 mixture. The mapping was performed on an area of 1.3 mm x 2 mm to obtain overall chemical composition of the samples. Green dots: phosphorus; red dots: carbon; and gray background: aluminum substrate.

Quantification of concentration of well-dispersed SWCNT in aqueous solution

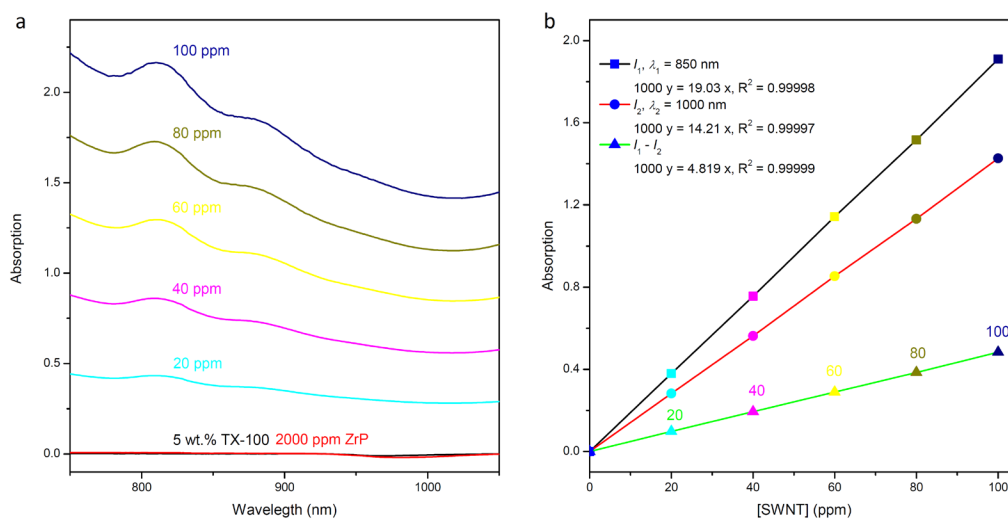


Fig. S2 (a) UV-vis spectra of aqueous solutions of TX-100, ZrP exfoliated by TBA^+OH^- , and SWCNT/ZrP/TX-100 at various concentrations. (b) Linear fit of absorption intensity at different wavelengths versus [SWCNT].

According to Beer–Lambert law, at a fixed wavelength (λ) of excitation light:

$$I = \epsilon lc$$

where I = absorption intensity, ϵ = scaling constant, l = light path length, and c = solute concentration.

The equation describes the linear dependence of absorption intensity on solute concentration. Assuming that SWCNT remains well dispersed before and after ZrP removal and at $l = 10$ mm, we have

$$I_1 = \epsilon_1 [\text{SWCNT}], \text{ at } \lambda_1$$

$$I_2 = \epsilon_2 [\text{SWCNT}], \text{ at } \lambda_2$$

$$I_1 - I_2 = (\epsilon_1 - \epsilon_2) [\text{SWCNT}] = \epsilon' [\text{SWCNT}], \epsilon' = \epsilon_1 - \epsilon_2$$

Here, the difference between the absorption intensity at two different wavelengths is used to compensate the zero line shift of the spectrometer. Absorption spectra of aqueous solutions of TX-100, ZrP dispersion, and SWCNT/ZrP/TX-100 mixture with [SWCNT] = 20, 40, 60, 80 and 100 ppm are shown in Figure S2a. The linear fit of absorption intensity at $\lambda_1 = 850$ nm, denoted as I_1 , absorption intensity at $\lambda_2 = 1000$ nm, denoted as I_2 , and their intensity difference, denoted as $I_1 - I_2$, to [SWCNT] is shown in Figure S2b. The above wavelengths were chosen because the ZrP

dispersant, TX-100 and the accompanied ion species exhibit zero absorption at those wavelengths. The linear fit of I_1 , I_2 and $I_1 - I_2$ as a function of [SWCNT] yield $R^2 = 0.99998$, 0.99997 , and 0.99999 , respectively. Thus, this method is reliable for measuring [SWCNT].

After centrifugation, the SWCNT-enriched supernatant does not possess the same volume before salt addition because the precipitated ZrP contains trapped water. Therefore, pure water was added to the supernatant to reach a known volume. By comparing the [SWCNT] (after SWCNT-ZrP separation) multiplied by the volume of the diluted supernatant against [SWCNT] (before separation) multiplied by the volume of the SWCNT/ZrP/TX-100 dispersion, the yield of SWCNT in the supernatant can be quantified precisely.