Supporting Information

Assembly of Highly Aligned Carbon Nanotubes Using an Electro-Fluidic Assembly Process

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When the size of a working electrode is significantly smaller than that of a counter electrode, the electric field strength around the working electrode would be much higher than that around the counter electrode due to the effect of localized electric field (Figure S1 (a)).

For parallel plate capacitor, the electric field strength is higher near the edges of the capacitor because of the fringing electric field (Figure S1 (b)).

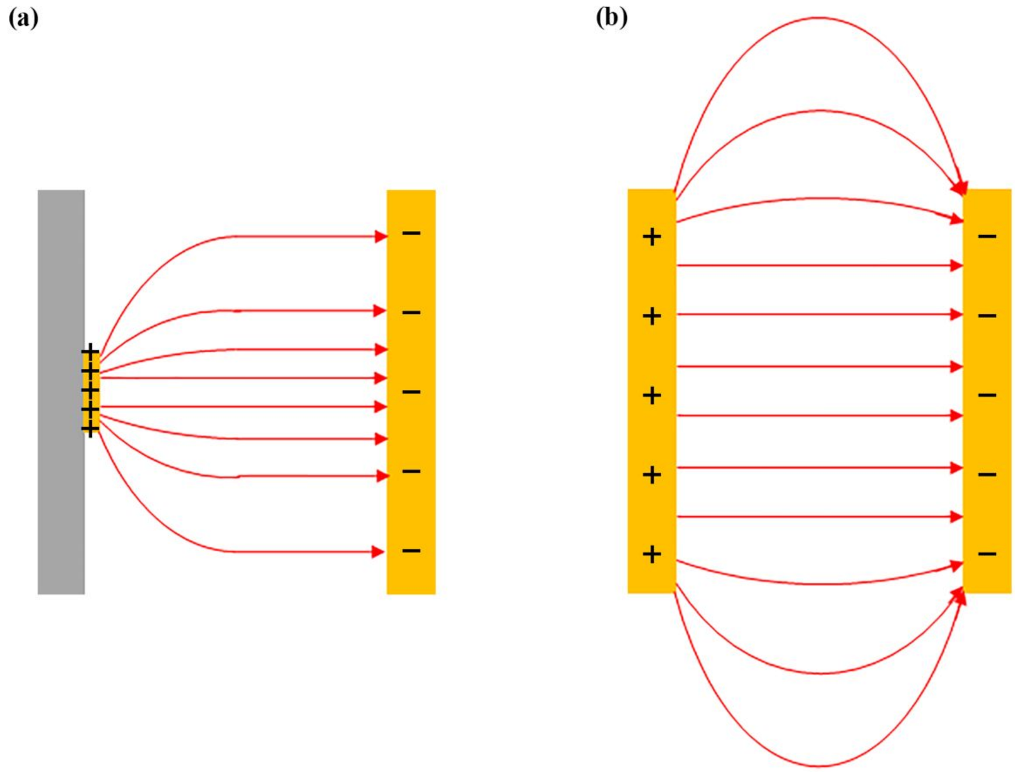

Figure S1. Schematic illustration of the localized electric field (a) and the fringing electric field (b).

Figure S2 shows SEM images of CNTs assembled under a DC voltage of 2 V at pulling speeds from 1 to 50 mm/min in channels 3 μm wide and 40 μm long. For all the pulling speeds investigated, the assembled CNTs show good alignment. At a high pulling speed of 50 mm/min, only one monolayer of CNTs is assembled at one end of the channel, as seen in Figure S2 (f).

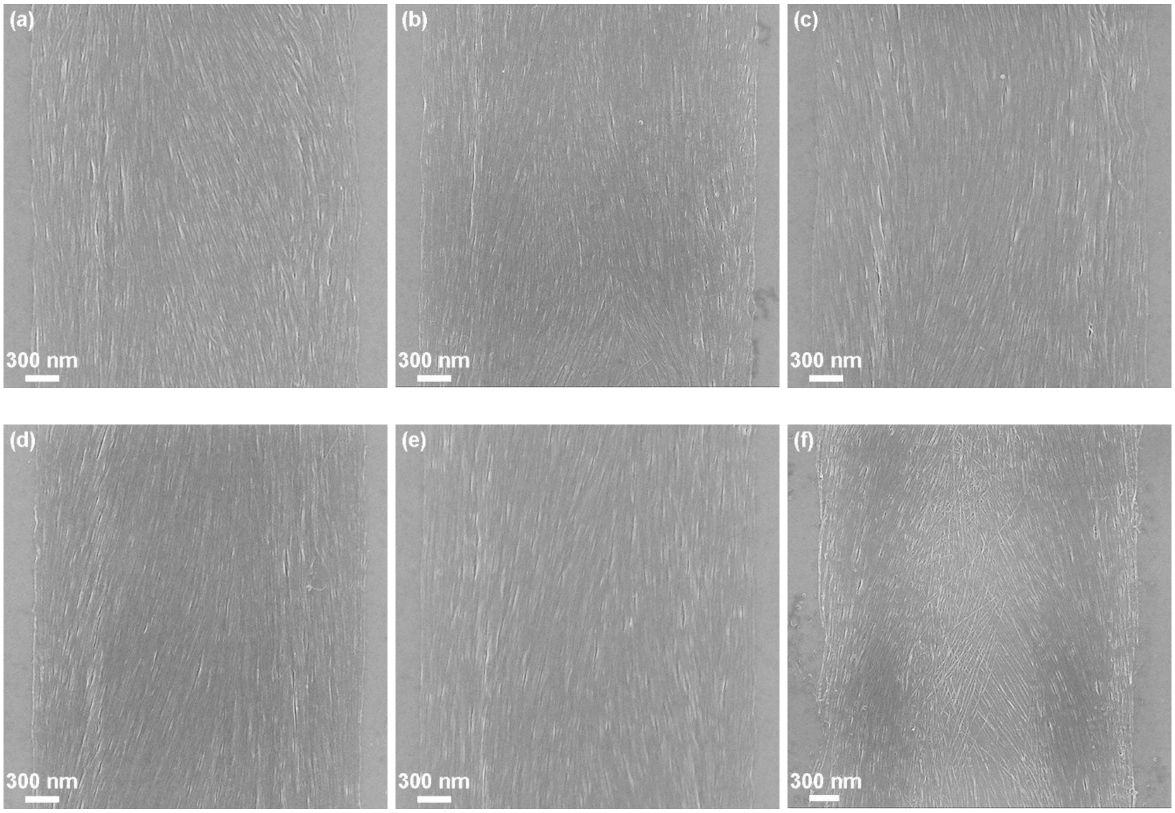

Figure S2. SEM images of CNTs assembled under a DC voltage of 2 V at pulling speeds of (a) 1 mm/min, (b) 5 mm/min, (c) 10 mm/min, (d) 20 mm/min, (e) 30 mm/min and (f) 50 mm/min.

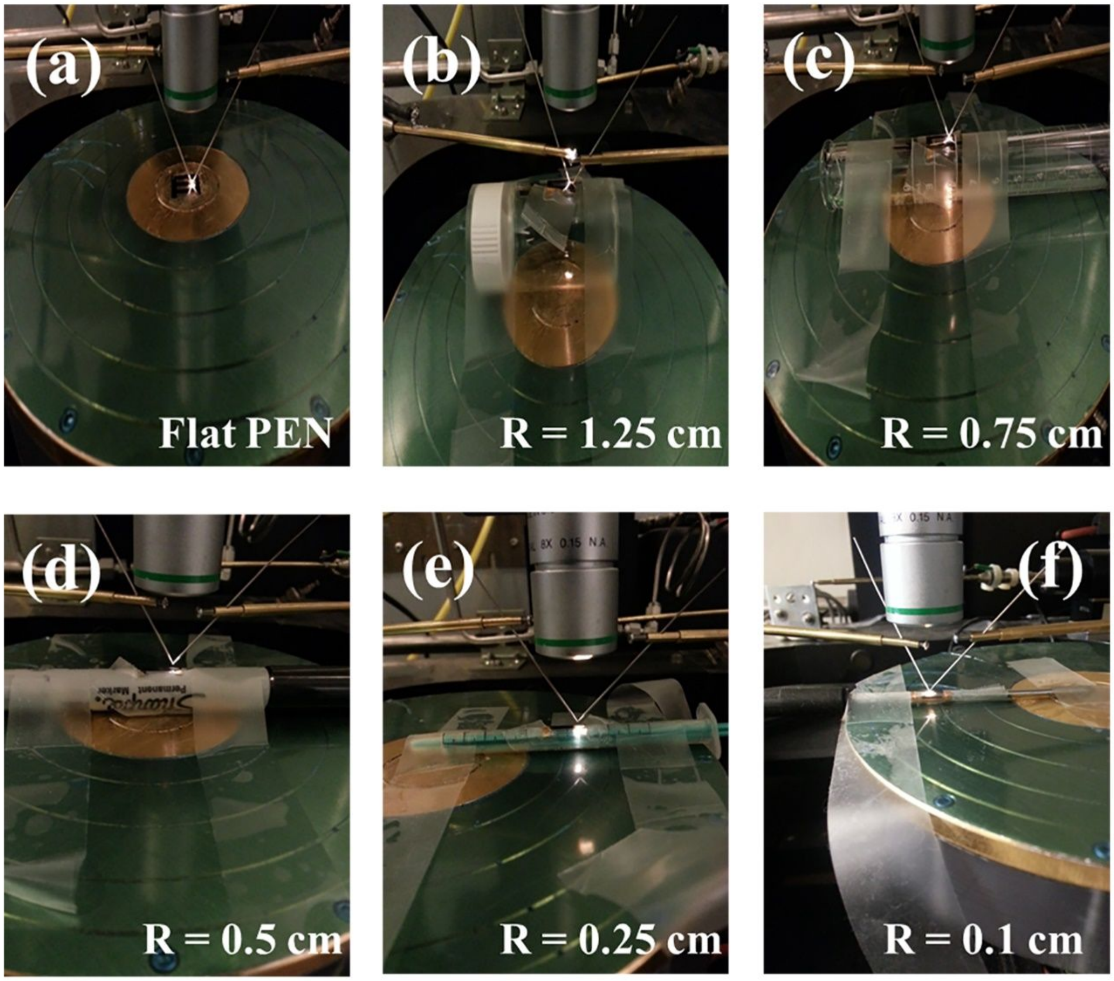

Figure S3. The flexible CNT devices are wrapped around objects with various radii to generate various tensile strains. (a) Flat PEN, (b) Vial (R = 1.25 cm), (c) Cylinder (R = 0.75 cm), (d) Pen (R = 0.5 cm), (e) Syringe (R = 0.25 cm), and (f) Iron rod (R = 0.1 cm).

When a flat substrate is bent, a tensile strain and a compressive strain develop at its outer and inner surfaces, respectively. At the same time, no tensile or compressive strain develops at the midplane (neutral surface). The tensile strain at the outer surface can be calculated by

$$\varepsilon = \frac{L_\mathrm{o} - L_\mathrm{n}}{L_\mathrm{n}} = \frac{R_1\theta - r\theta}{r\theta} = \frac{R_1 - r}{r} = \frac{t/2}{R_1 - t/2}$$

where L_o is the length at the outer surface, L_n is the length at the neutral surface, R_1 is the radius of curvature of the outer surface, r is the radius of curvature of the neutral surface, θ is the bending angle and t is the thickness of the substrate.

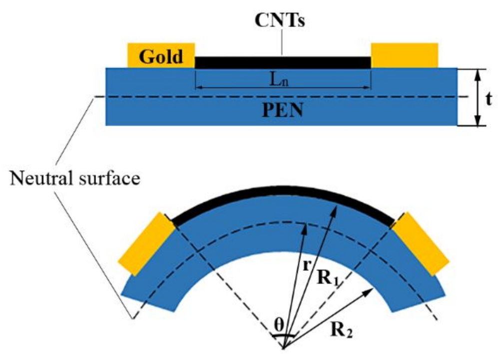

Figure S4. Schematic illustration of the setup to generate tensile strain in the CNTs assembled on the PEN substrate.