

Supporting Information

Micrometer-size double helical structures from phospholipid modified carbon nanotubes

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Experimental Section

Materials: Hydrophobic carbon nanotubes with different sizes (short CNTs (diameter, $d=50-200$ nm; length, $L=1-2$ μm), medium ($d=40-180$ nm, $L=6-15$ μm), and long ($d=50-200$ nm, $L=20-134$ μm)) were purchased from Aladdin (China). 1,2-dioleoyl-sn-glycero-3-phosphoserine, sodium salt (DOPS), 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC), and 1,2-dioleoyl-sn-glycero-3-phosphoethanolamine (DOPE) were purchased from Avanti polar lipids (USA). Chloroform was purchased from Sigma (China). (N-(7-Nitrobenz-2-Oxa-1,3-Diazol-4-yl)-1,2-Dihexadecanoyl-sn-Glycero-3-Phosphoethanolamine (NBD PE) was obtained from Invitrogen (China). Millipore Milli-Q water with a resistivity of 18.0 $\text{M}\Omega\cdot\text{cm}$ was used for solution preparation in all experiments.

Characterizations: Fluorescence images were taken under a fluorescence microscope (Olympus IX73, Japan) and a confocal laser scanning microscope (Olympus FV3000, Japan). In order to obtain the 3D morphologies of the phospholipid modified carbon nanotube springs, several images were taken at every 0.35 and 0.3 μm of thickness in z-axis. The morphologies of the springs were also characterized by the scanning electron microscopy (Quanta 200 FEG; Netherlands).

Phospholipid modified CNTs helical structure preparation: The short, medium, or long CNTs (0.1 mg) was mixed with 5 mg NBD PE/DOPS (1:99) or NBD PE/DOPC (1:99) in 1 ml of chloroform with sonication for two hours. The consequent solution (5 μL) was spread on a glass surface with a needle to ensure a complete and uniform CNT-lipid film. The CNT – lipid coated

glass was sealed with a spacer and a coverslip containing pure water. The sample was incubated at room temperature.

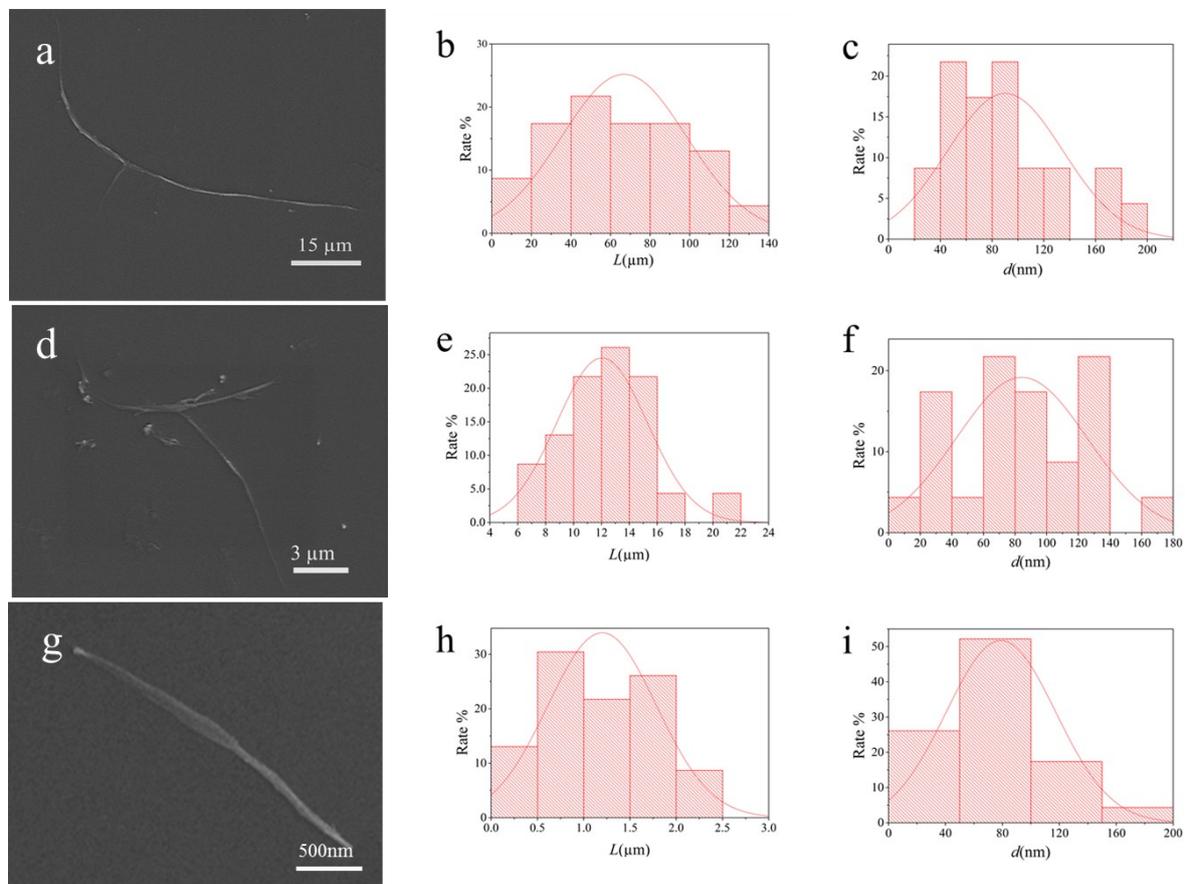


Figure. S1: SEM images and corresponding length/diameter analysis of three types of carbon nanotubes. SEM image (a), length distribution (b), and diameter distribution (c) of long CNTs. SEM image (d), length distribution (e), and diameter distribution (f) of medium CNTs. SEM image (g), length distribution (h), and the diameter distribution (i) of short CNTs.

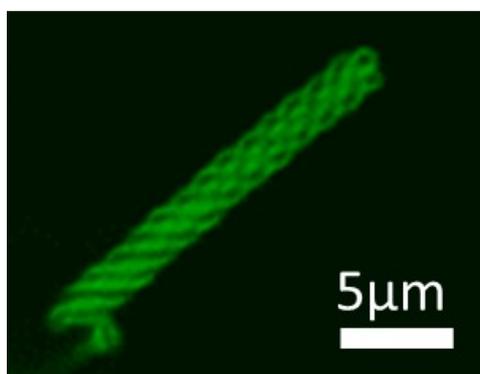


Figure. S2: Fluorescence image of double helical structure from DOPE phospholipid and long CNTs.

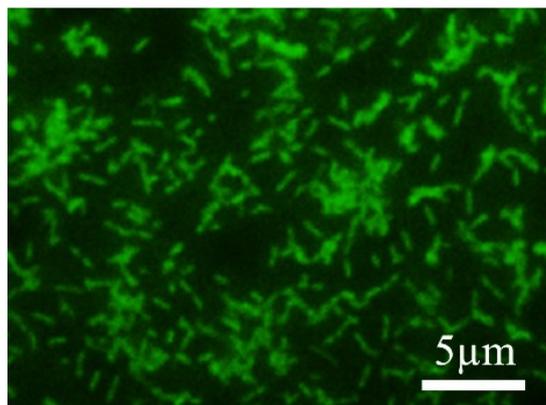


Figure. S3: Fluorescence image of DOPC phospholipid modified short CNTs (50:1, w/w).