Electronic supplementary information for

A facile method to improving the electromagnetic interference shielding of free-standing and foldable carbon nanotube mat

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1. Figures

Fig. S1 The present experimental setup

Fig. S2 SEM images and EDS results of cross section and surface of R1 (a, d), R2 (b, e) and R4 (c, f)

Fig. S3 Raman spectrum of the CNT mats pumped ferrocene/methanol solution (R4)

Fig. S4 Residual F_2O_3 in corundum tube after reheating the CNT mat (sprayed ferrocene/methanol solution on the surface of R1)

2. Movie

Movie S1 The whole CNT mat (R4) can be easily displaced in the presence of mild air currents

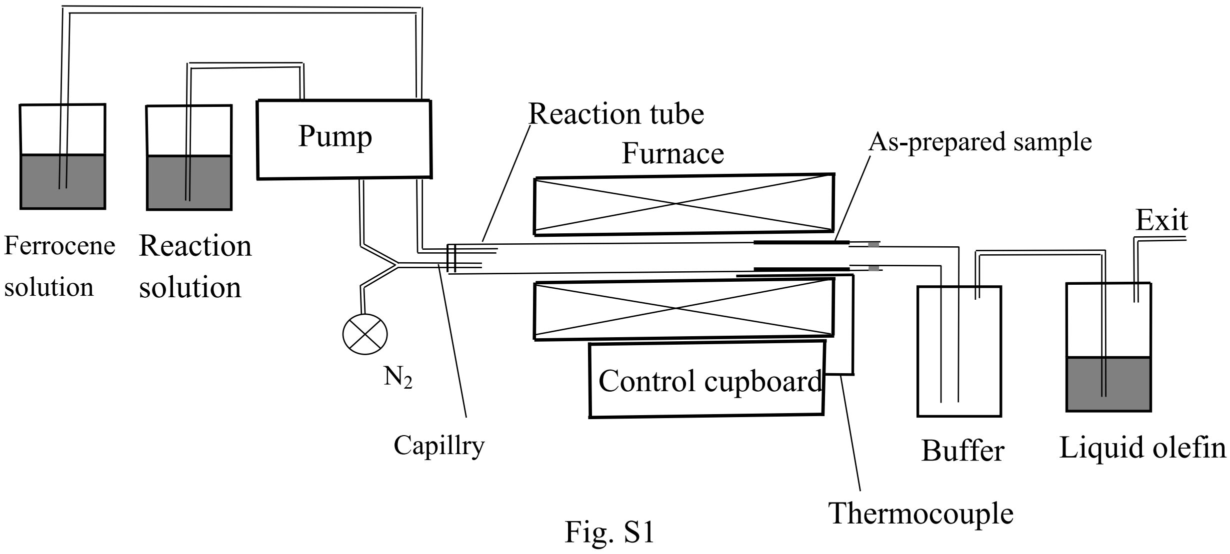
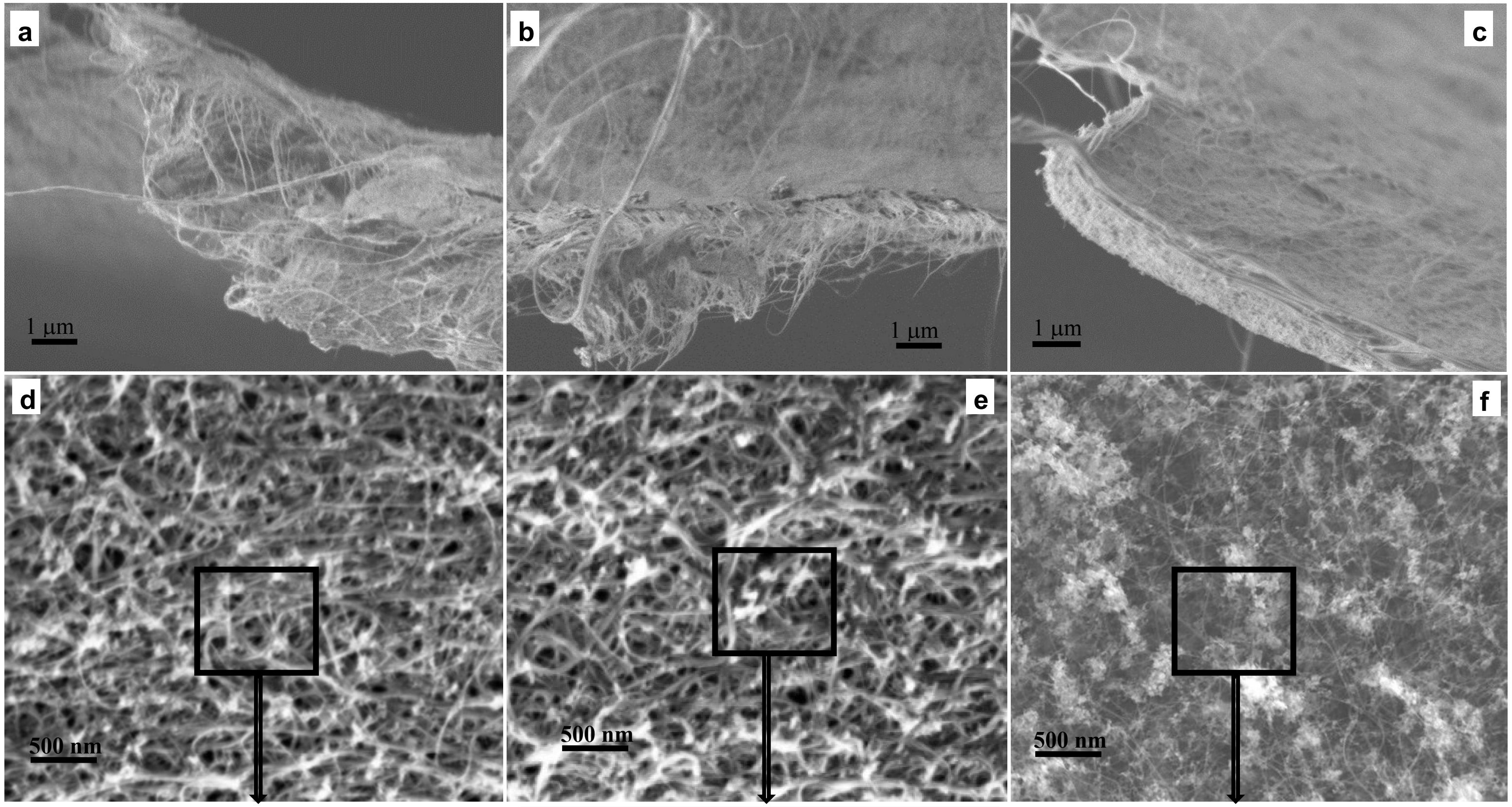


Fig. S1

After the reactor was flushed with Nitrogen (at a flow rate of 400 ml min^{-1}) and heated to 1300 °C. A mixed soultion of n-hexane, methanol, ferrocene and thiophene (n-hexane and methanol with a volume ratio of 10:90, ferrocene: 20 mg ml^{-1}, thiophene: 3 μl ml^{-1}) as carbon source, mediator, catalyst precursor and growth promoter, respectively was pumped into reaction tube by one quartz capillary. In addition, another quartz capillary was added to pump ferrocene and methanol solution with different concentration (10-20 mg ml^{-1}) into reactor. Then, a piece of aluminum foil was used as the substrate for deposition. The foil was cleaned in ethanol and futher dipped in 10% HCl to remove the oxidative surface. This foil was rolled up to form a cylinder with a diameter close to inner-diameter of reaction tube. Such cylinder was then inserted into the quartz tube and placed in the low-temperature region (about 150-300 °C) of the quartz reactor for CNT deposition.

After reaction 10 min, 1 μm thick CNT mat with high electric conductivity and magnetic performance can be obtained from the low-temperature region of the reactor.



Element	Weight %	Atomic %
C	70.66	77.3
Fe	20.21	22.1
Cu	8.55	0
S	0.56	0.6

Element	Weight %	Atomic %
C	67.82	76.06
Fe	20.91	23.45
Cu	10.83	0
S	0.44	0.05

Element	Weight %	Atomic %
C	57.79	62.96
Fe	33.49	36.49
Cu	8.21	0
S	0.51	0.05

Fig. S2

From Fig. S2a-f, the mats (R1, R2 and R4) composed of long entangled bundles can be seen clearly. And the cross section images indicated the spatial uniformity of the mats, The CNT packing in R4 and that in R1 and R2 is not too different from the images. Surface images showed in Fig. S2d-f also demonstrated long entangled bundles in mats clearly and lots of particles are dispersed in the entangled bundles randomly. And homogenous morphologies of the CNT mats were displayed. The selected area in Fig. S2d-f (with nanoparticles) was carried out by EDS to analyze chemical compositions. The results show that the selected area is composed of C, Fe and S elements with minor Cu resulting from SEM sample platform. The results indicated more Fe nanoparticles in R4, and that corresponding to the results shown in SEM images.

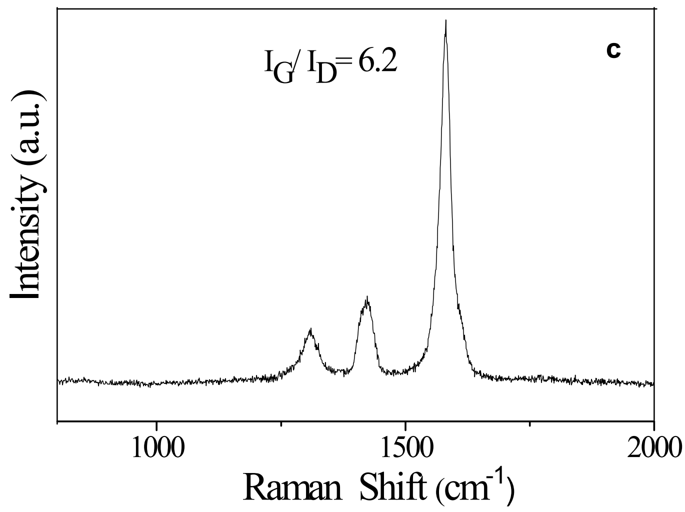


Fig. S3

The perfection of the nanotubes in R4 sample (R1, R2 and R3 showed similar value of I_G/I_D) was examined by using Raman spectroscopy with a 514.5 nm excitation wavelength laser. The G-band at about 1580 cm^{-1} is associated with tangential modes in pure sp^2 hybridized graphitic carbon, while the first peak of D-band at about 1350 cm^{-1} is due to disordered sp^3 type defects. The intensity ratio of the G and D bands, I_G/I_D, is a crude measure of the perfection of the nanotube. The high intensity ratio ($I_G/I_D = 6.2$) of Raman spectroscopy indicates high graphitic structure of CNTs.

Fig. S4

The same volume of ferrocene/methanol solution was sprayed on surface of R1. And then reheat the sample for decomposition of ferrocene. However, most of ferrocene would evaporate outside, thus lead to a slight increase of iron particles in the mat. The reactor's color of the mat after sprayed ferrocene/methanol solution and reheated can be demonstrated. Iron particles will form and move onto the surface of the rear of corundum reactor with evaporating of ferrocene. Red brown of the reactor showed the formed iron particles have oxidized into Fe_2O_3 for open reactor.

Movie S1

The area of the as-prepared CNT mat (R4) can reach more than 2000 cm^2 area (the area of the mat can be increased further, not limited this value), and it can be bent, folded and tailored easily, thereby indicating a good structural uniformity and flexibility. The whole mat is of negligible weight and can be easily displaced in the presence of mild air currents. Owing to their ultra-lightweight and outstanding EMI SE, the mats are expected to find a potential application in EMI shielding.