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Supplementary Information

Porous ultrathin carbon nanobubbles formed carbon nanofiber webs for high-performance flexible supercapacitors

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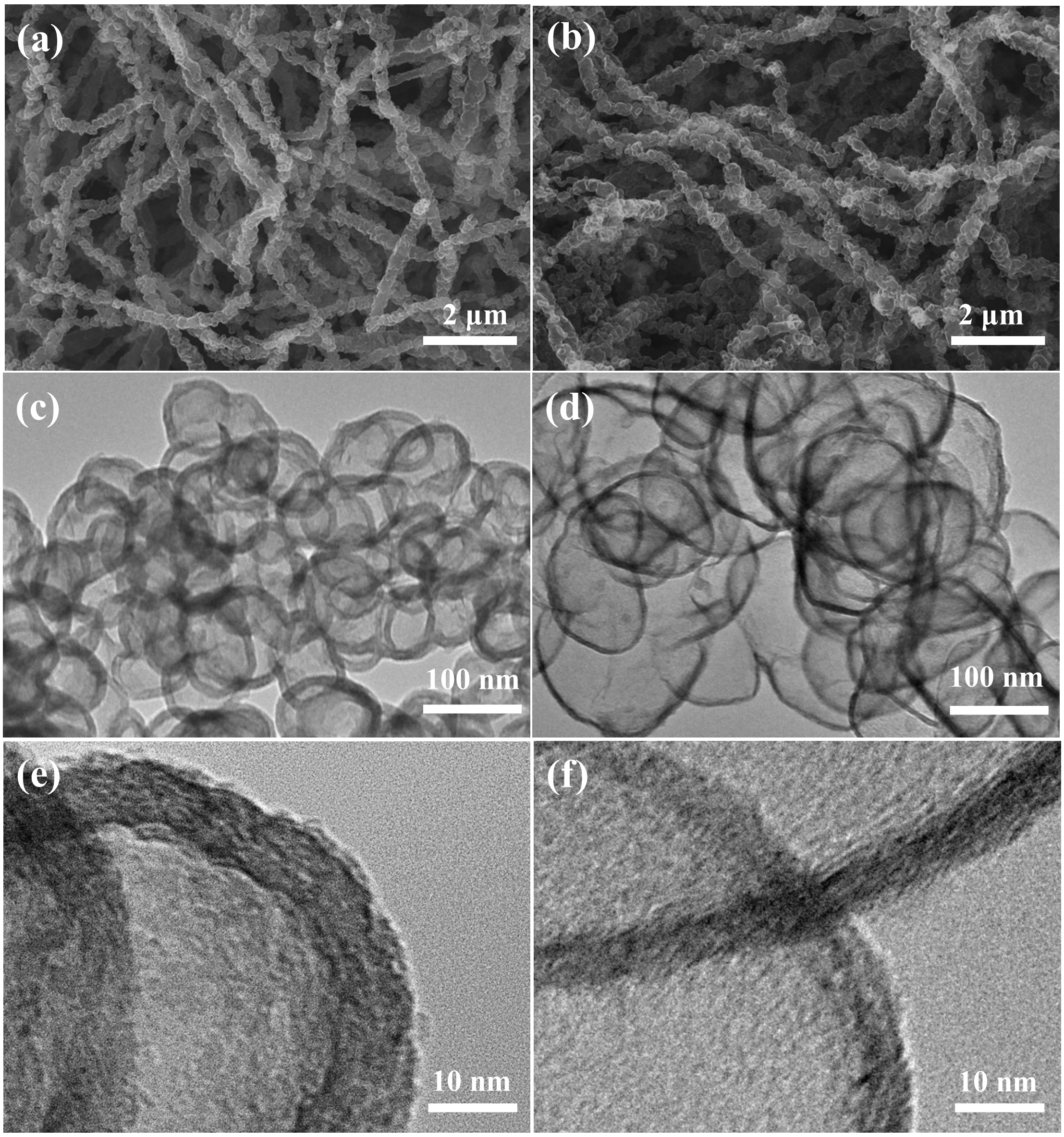

Fig. S1 (a,b) SEM images of the CNFWs-500-5 and the CNFWs-700-2, respectively, (c,e) and (d,f) corresponding TEM images of the CNFWs-500-5 and the CNFWs-700-2, respectively.

In order to demonstrate the thickness of the carbonaceous coating layer can be well controlled by tuning catalytic conversion temperature or time, the corresponding control experiments were carried out. From the TEM images of the CNFWs-500-5 and CNFWs-700-2 and the TEM images of the CNFWs (Fig. 4 and Fig. S5) in the following measurement, different thickness of the carbon walls with about 8 nm, 5 nm and 3 nm were obtain, exhibiting the accurate controllability of the thickness of the carbon layer by our method.

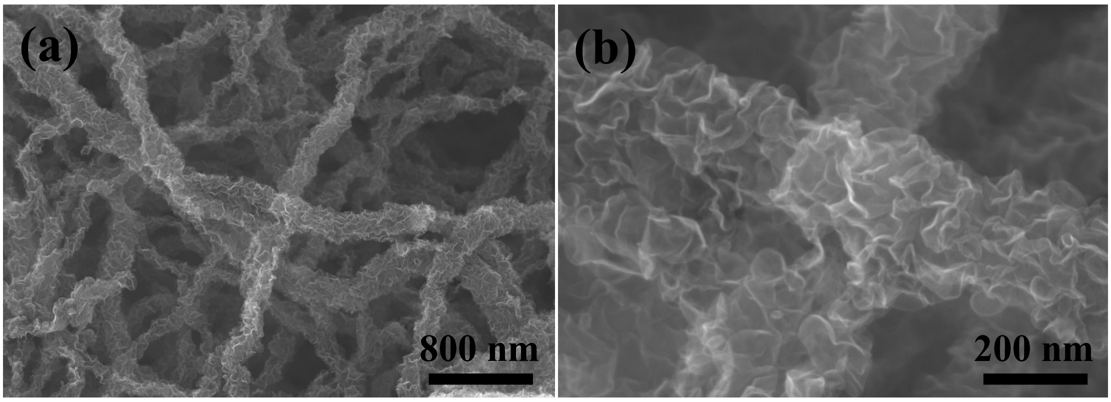

Fig. S2 (a,b) SEM images of the products dried in a conventional vacuum oven after ZnO@C NFWs being immersed in 1 M HCl aqueous solution for 10 h.

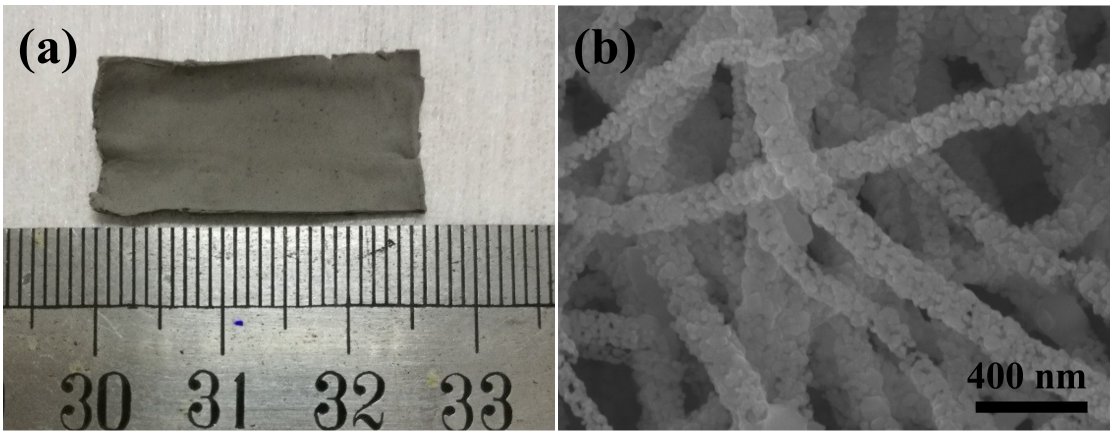

Fig. S3 (a) Digital photograph and (b) SEM image of the ZnO@C NFWs.

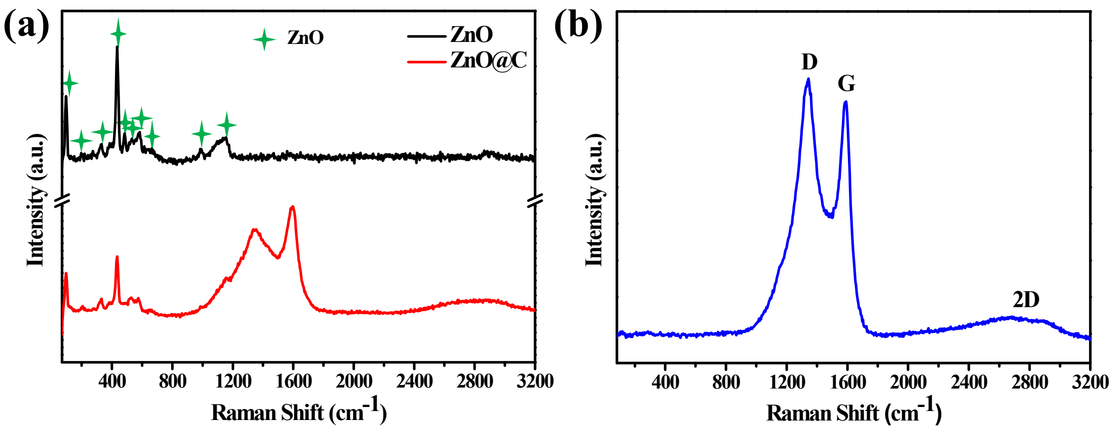

Fig. S4 Raman spectra of (a) ZnO NFWs (black), ZnO@C NFWs (red), and (b) CNFWs.

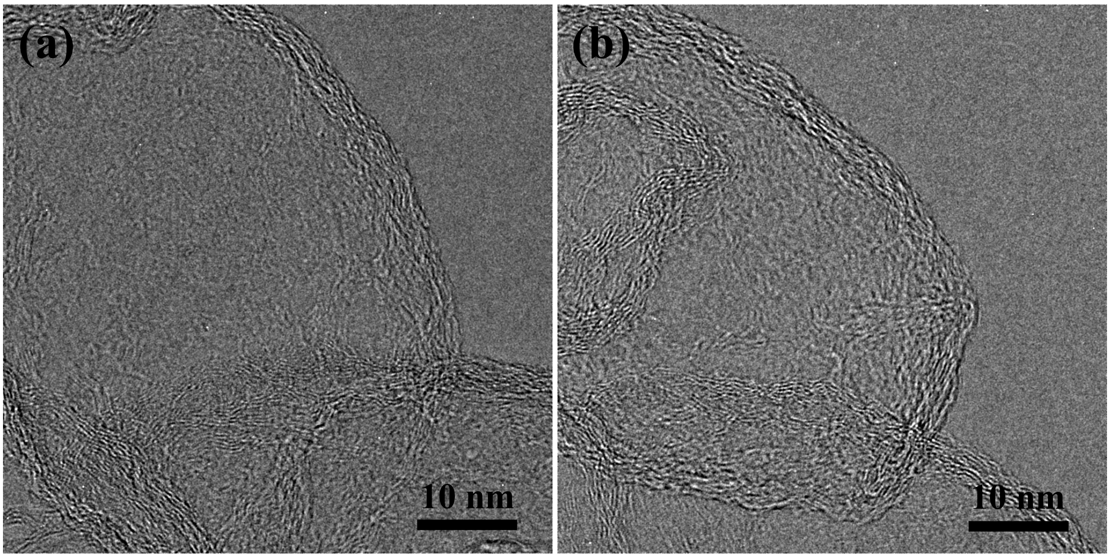

Fig. S5 (a,b) HRTEM images of hollow carbon nanobubbles showing with the ultrathin walls less than 10 layers.

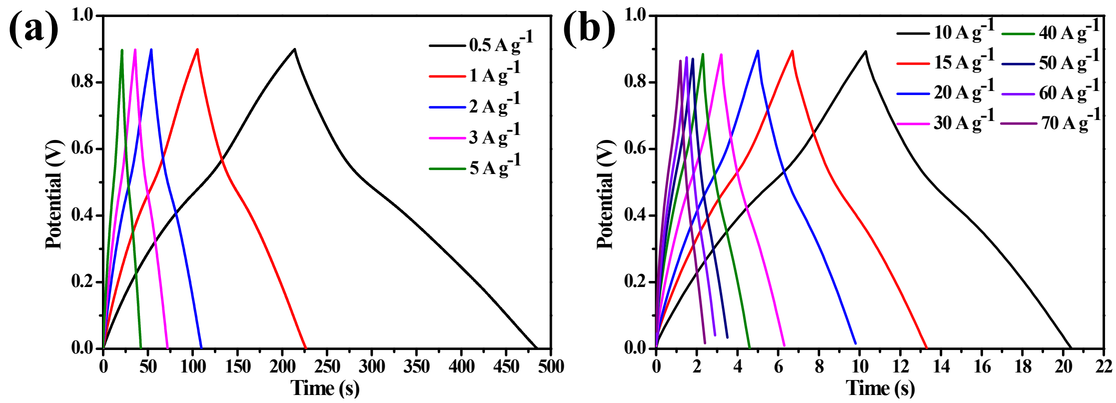

Fig. S6 (a,b) The GCD curves of the CNFWs electrode at various current densities measured using a three-electrode system in 1 M H_2SO_4 aqueous electrolyte.

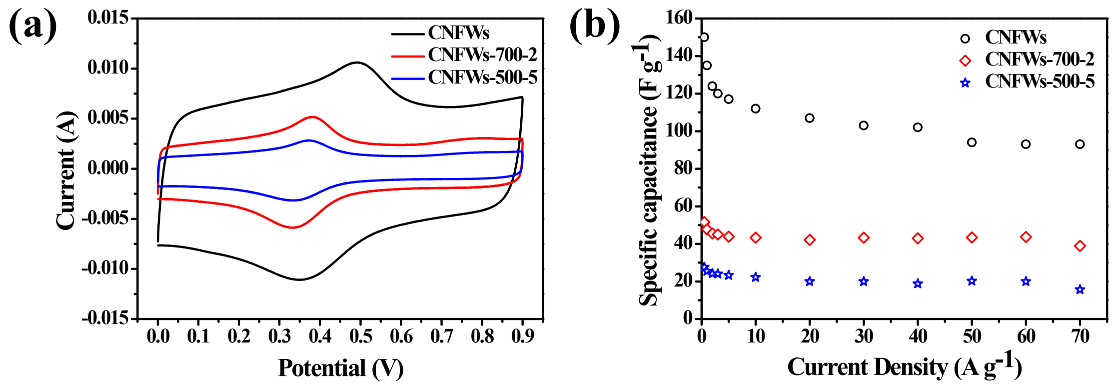

Fig. S7 Comparison of electrochemical performance of the carbon electrodes with different carbon wall thickness in a three-electrode system. (a) CV curves of the CNFWs, CNFWs-700-2 and CNFWs-500-5 at the scan rate of 100 mV s^{-1}, and (b) the specific capacitances of the CNFWs, CNFWs-700-2 and CNFWs-500-5 at various discharge current densities.

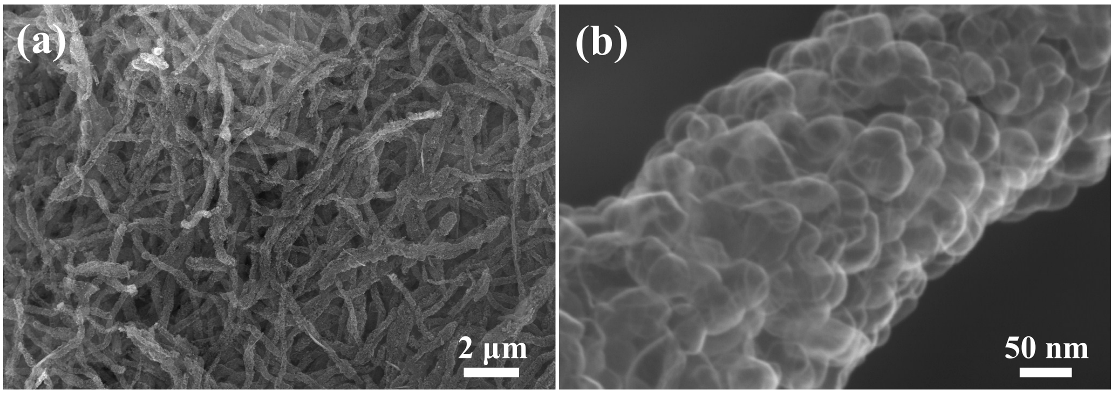

Fig. S8 (a,b) SEM images of the CNFWs electrode after 35,000 cycles at the current density of 10 A g^{-1} under three-electrode testing.

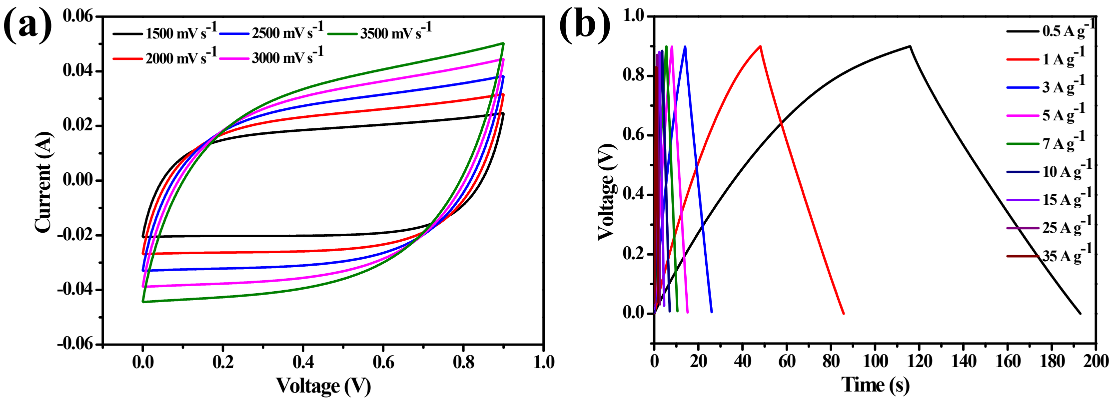

Fig. S9 (a) CV curves with the scan rates from 1,500 to 3,500 mV s^{-1} and (b) GCD curves at various current densities of the symmetric SCs.

Table S1. The comparison of the electrochemical performance of our CNFWs with that of one-dimensional carbon-based web electrodes in the previous literatures.

Materials	Electrolyte	Test cell	Capacitance ($F\ g^{-1}$)	Cycling performance	Reference
CNFWs	1 M H_2SO_4	3-electrode	155 at 10 A g^{-1}	35,000 at 10 A g^{-1} (94.1%)	This work
		2-electrode	85 at 10 A g^{-1}	15,000 at 5 A g^{-1} (80%)	
Nitrogen-enriched meso-macroporos carbon fiber network	1 M H_2SO_4	3-electrode	176 at 2 A g^{-1}	5,000 at 1 A g^{-1} (99%)	1
		2-electrode	98 at 100 mV s^{-1}	–	
Mesoporous carbon nanofibers	6 M KOH	2-electrode	103 at 1 A g^{-1}	4,250 at 150 mV s^{-1}	2
single-walled carbon nanotube films	1 M $LiClO_4$	3-electrode	140 at 0.75 A g^{-1}	-	3
		2-electrode	35 at 0.75 A g^{-1}	-	
Functionalizing few-walled carbon nanotube film	0.1 M KOH	3-electrode	133 at 10 mV s^{-1}	100 at 10 mV s^{-1}	4
Hybrid nanomembranes of carbon nanotube sheets coated with poly (3,4-ethylenedioxythiophene)	1 M H_2SO_4	3-electrode	67 at 10 mV s^{-1}	-	5
		2-electrode	-	5,000 at 500 mV s^{-1} (94%)	
Active carbon wrapped carbon nanotube buckypaper	6 M KOH	3-electrode	110 at 5 mV s^{-1}	-	6
		2-electrode	-	4,000 at 5 A g^{-1} (98%)	

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