Free-standing and Binder-free Sodium-ion Electrodes with Ultralong Cycle Life Based and High Rate Performance on Porous Carbon Nanofibers

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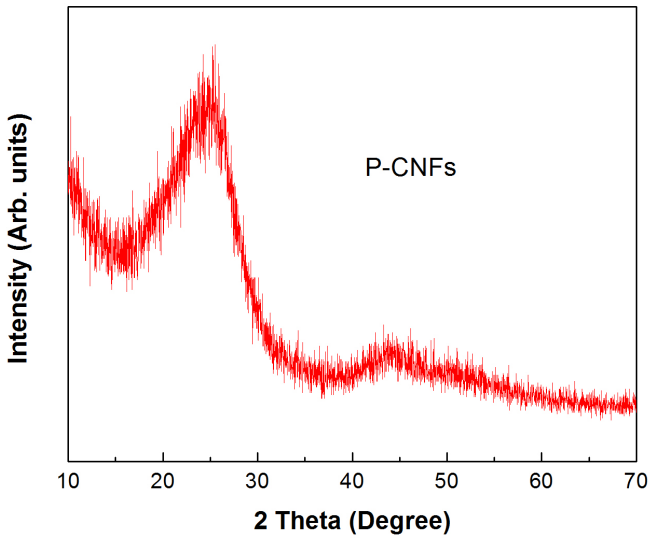

Fig. S1 XRD patterns of the P-CNFs.

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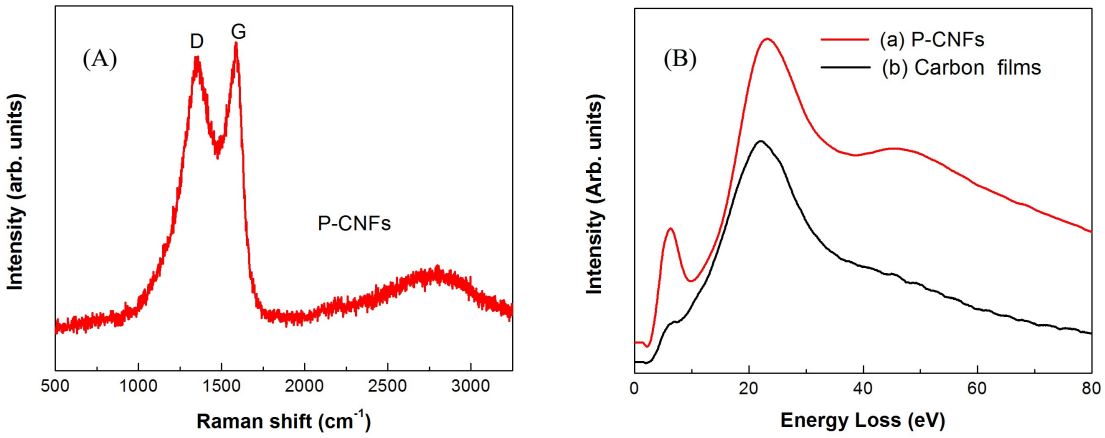

Fig. S2 (A) Raman Spectroscopy of the P-CNFs. The D-band at around 1350 reveals defects and disordered portions, while the G-band at 1600 is related to the ordered graphitic layers. The degree of graphitization of P-CNFs is low. (R_I=0.96, R_I=I_D/I_G). (B) Electro Energy-Loss Spectroscopy (EELS) images taken in the low loss region of P-CNFs (a), and the carbon supporting films used in the test (b). The two peaks at ~6.0 eV and ~26 eV are related to the π—› π* transition and π+σ plasmon peak for graphite. [1]

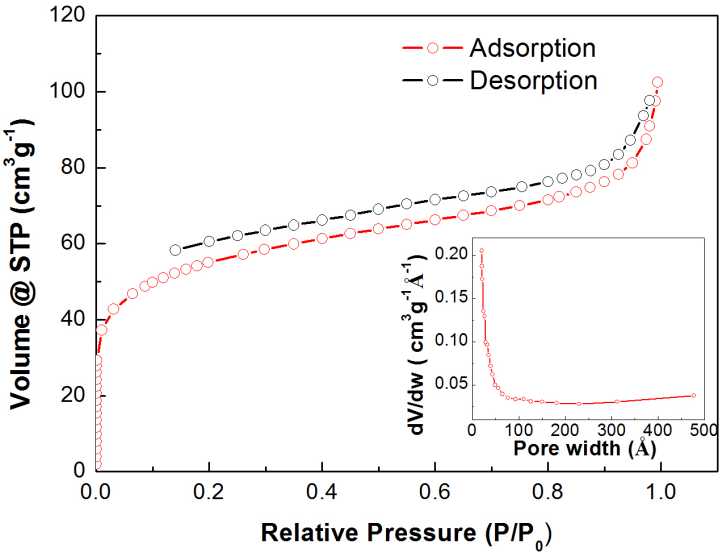

Fig. S3 N_2 sorption/desorption isotherm and micropore-size distribution curve (inset) P-CNFs. The Brunauer-Emmett-Teller (BET) specific surface of the P-CNFs investigated here as 178.69 m^2g^{-1}. The pore size distribution was calculated from the adsorption curve using the BJH method.

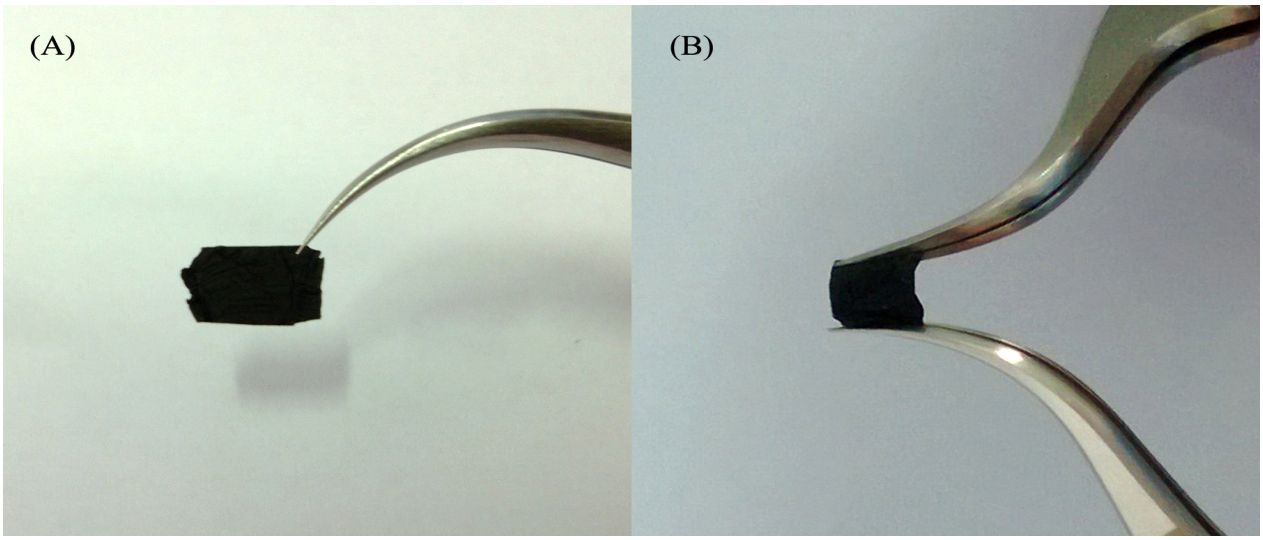

Fig. S4 digital images of P-CNFs electrode (A, B) after 1000 cycles. Note: the cell was disassembled at fully discharged state.

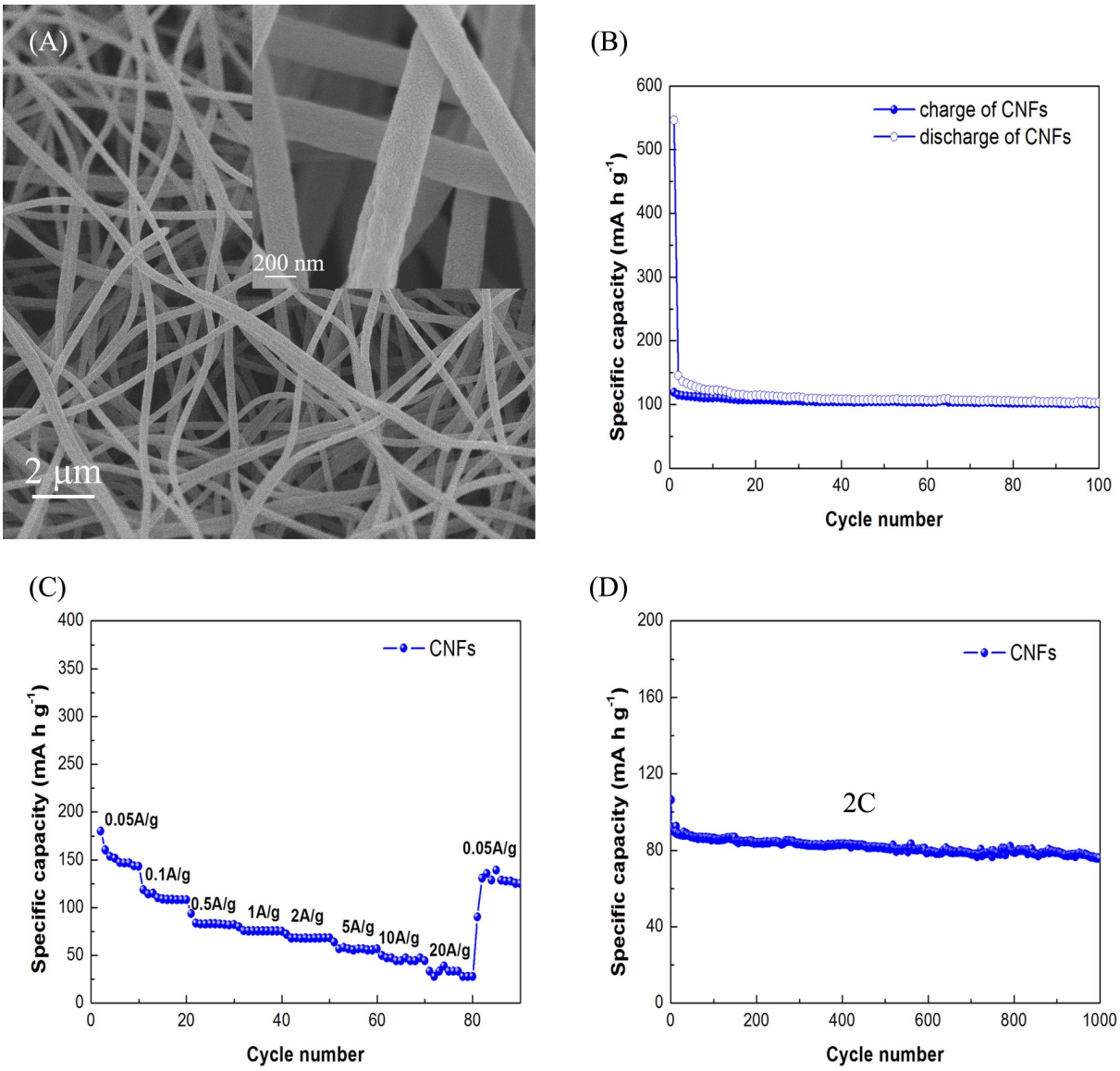

Fig. S5 (A) FESEM micrographs of as-electrospun CNFs. The inset picture is one corresponding high magnification image. (B) Capacity-cycle number curves of CNFs electrode at a cycling rate of 0.2 C (C) Discharge capacity of CNFs electrode as a function of discharge rate (0.05 $A.g^{-1}$~20 $A.g^{-1}$). (D) Long-term cycling performance of CNFs electrode at 500 $mA.g^{-1}$ (2C) for 1000 cycles. (The batteries were activated firstly at a cycling rate of 50 $mA.g^{-1}$ for five times).

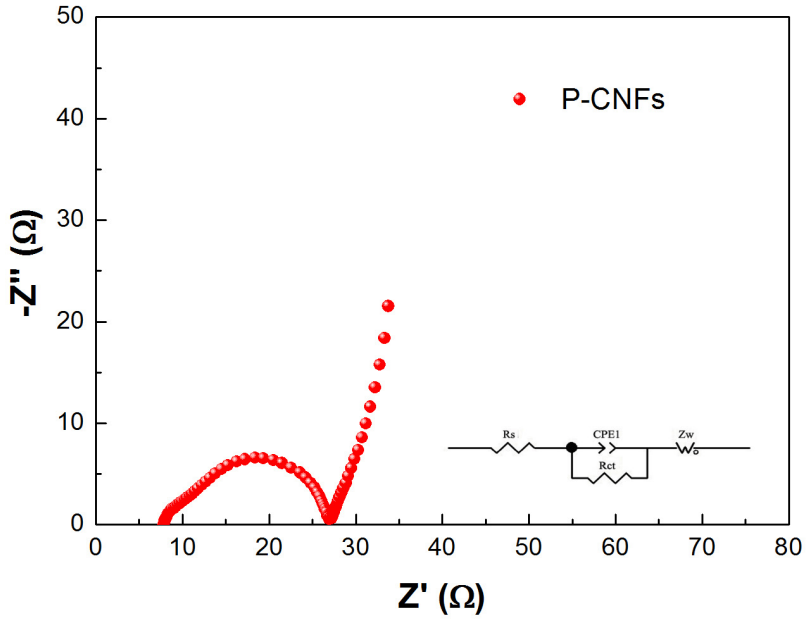

Fig. S6 AC impedance spectra of P-CNFs/Na cells after 10 cycles with the equivalent circuit as the inset. The open-circuit-voltage of electrode was controlled similarly (~ 0.02V), and the weight of electrode was 1.29 mg.

Table S1 The parameters of equivalent circuit element after fitting:

P-CNFs

Element	Value	Error	Error%
R_s	7.926	0.081516	1.0285
CPE1-T	0.00026465	4.2794E-5	16.17
CPE1-P	0.69543	0.028039	4.0319
R_{ct}	19.62	3.4571	17.62
Z_{w}-R	0.11733	10.126	8630.4
Z_{w}-T	0.019145	2.0577	10748
Z_{w}-P	0.40129	0.0074077	1.846

References:

[1]M. H. Gass, U. Bangert, A. L. Bleloch, P. Wang, R. R. Nair, and A. K. Geim, *Nat Nanotechnol, 2008, 3, 676-681.*