Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Electronic Supplementary information of

Tailoring Pore Structure of Carbon Nanofiber for Achieving Ultrahigh-Energy-Density Supercapacitors Using Ionic Liquid as Electrolyte

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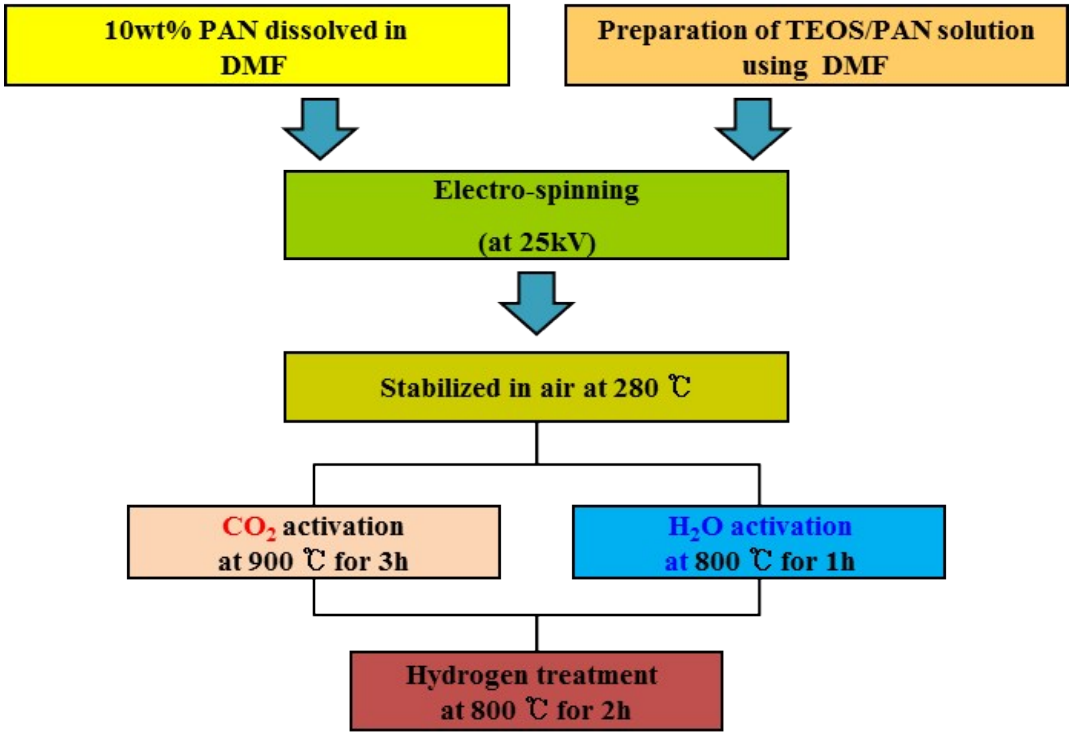
(a)



(b)

Sample I.D.	Conditions
H_2O-PAN	Steam-activated PAN-based CNFs at 800°C
CO_2-PAN	CO_2-activated PAN-based CNFs at 900°C
H_2O-H_2-PAN	Steam-activated and then hydrogen treated (at 800°C, 2h) of PAN-based CNFs
CO_2-H_2-PAN	CO_2-activated and then hydrogen treated (at 800°C, 2h) of PAN-based CNFs
H_2O-TEOS/PAN	Steam-activated TEOS/PAN-based CNFs at 800°C
CO_2-TEOS/PAN	CO_2-activated TEOS/PAN-based CNFs at 900°C
H_2O-H_2-TEOS/PAN	Steam-activated and then hydrogen treated (at 800°C, 2h) of TEOS/PAN-based CNFs
CO_2-H_2-TEOS/PAN	CO_2-activated and then hydrogen treated (at 800°C, 2h) of TEOS/PAN-based CNFs

Fig. S1 (a) Experimental procedure of preparing porous CNFs and (b) the identification of samples including the synthetic conditions.

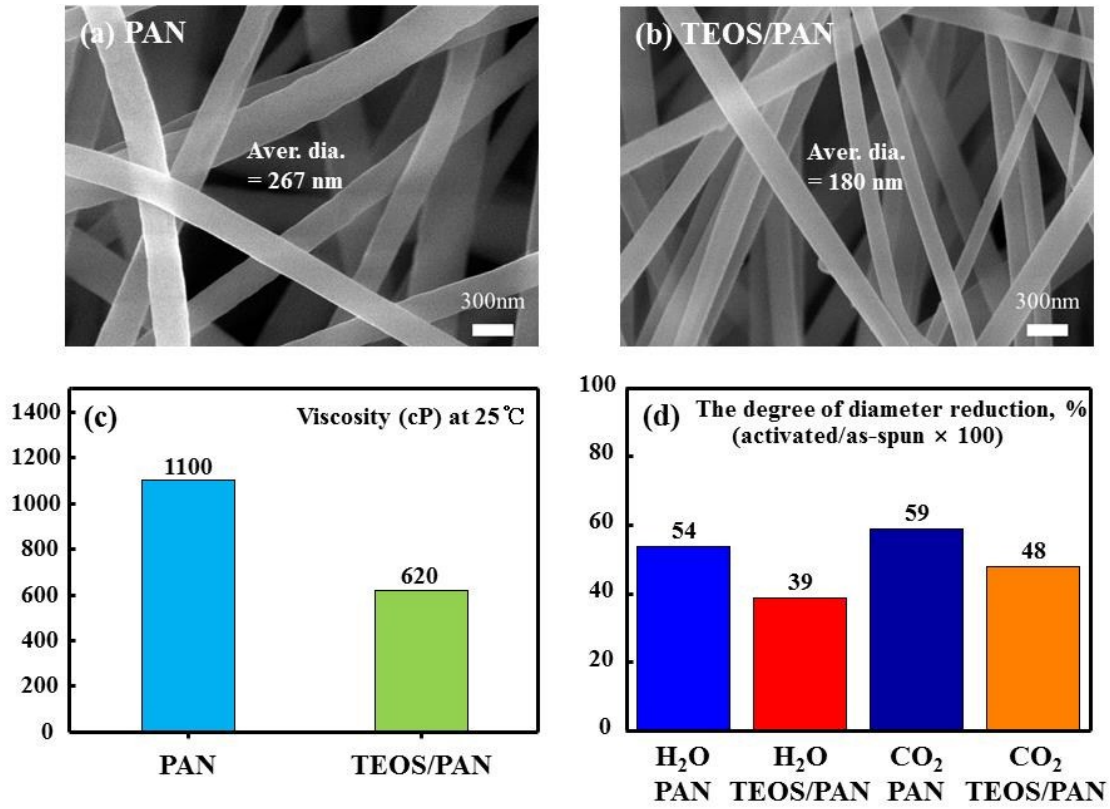


Fig. S2 SEM images of the (a) PAN- and (b) TEOS/PAN-based electrospun organic nanofiber web. (c) The measured viscosity of both the electrospinning dopes using BROOKFIELD viscometer, DV-II+ at 25 °C and d) the degree of the diameter reduction via physical activation process.

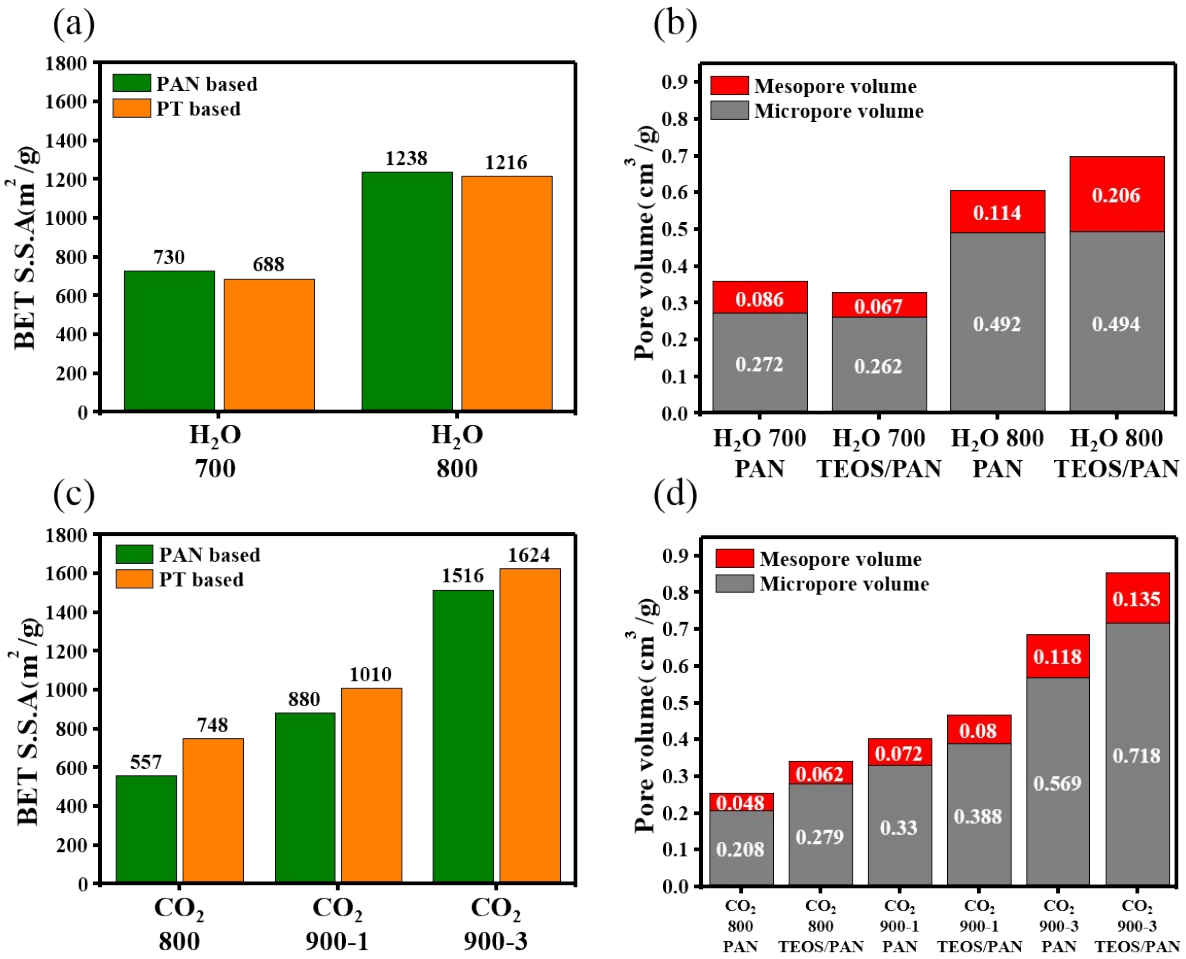


Fig. S3 Variations of the BET surface area and pore volume for (a) and (b) H_2O- and (c) and (d) CO_2- activated CNFs as a function of activation temperature and time.

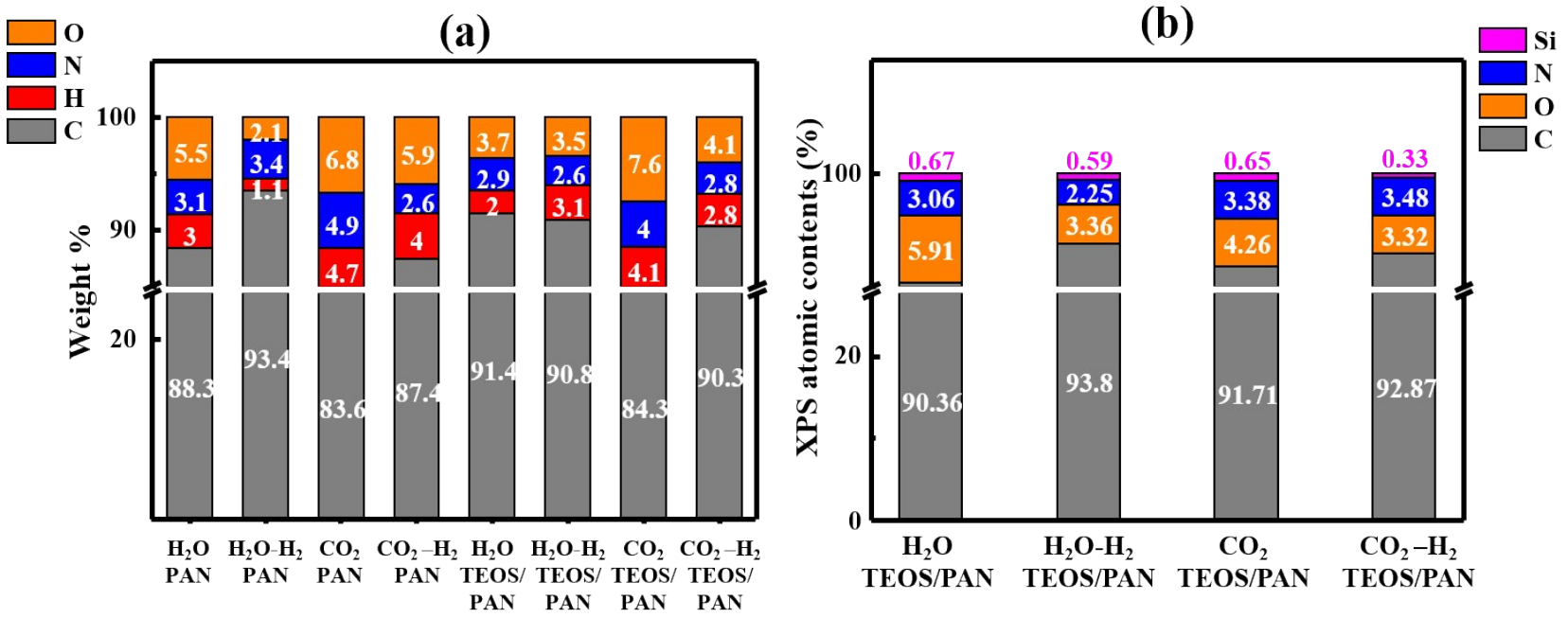


Fig. S4 (a) Atomic composition of the porous CNFs from elemental analysis and (b) atomic composition of TEOS/PAN-based CNFs from X-ray photoelectron spectroscopy.

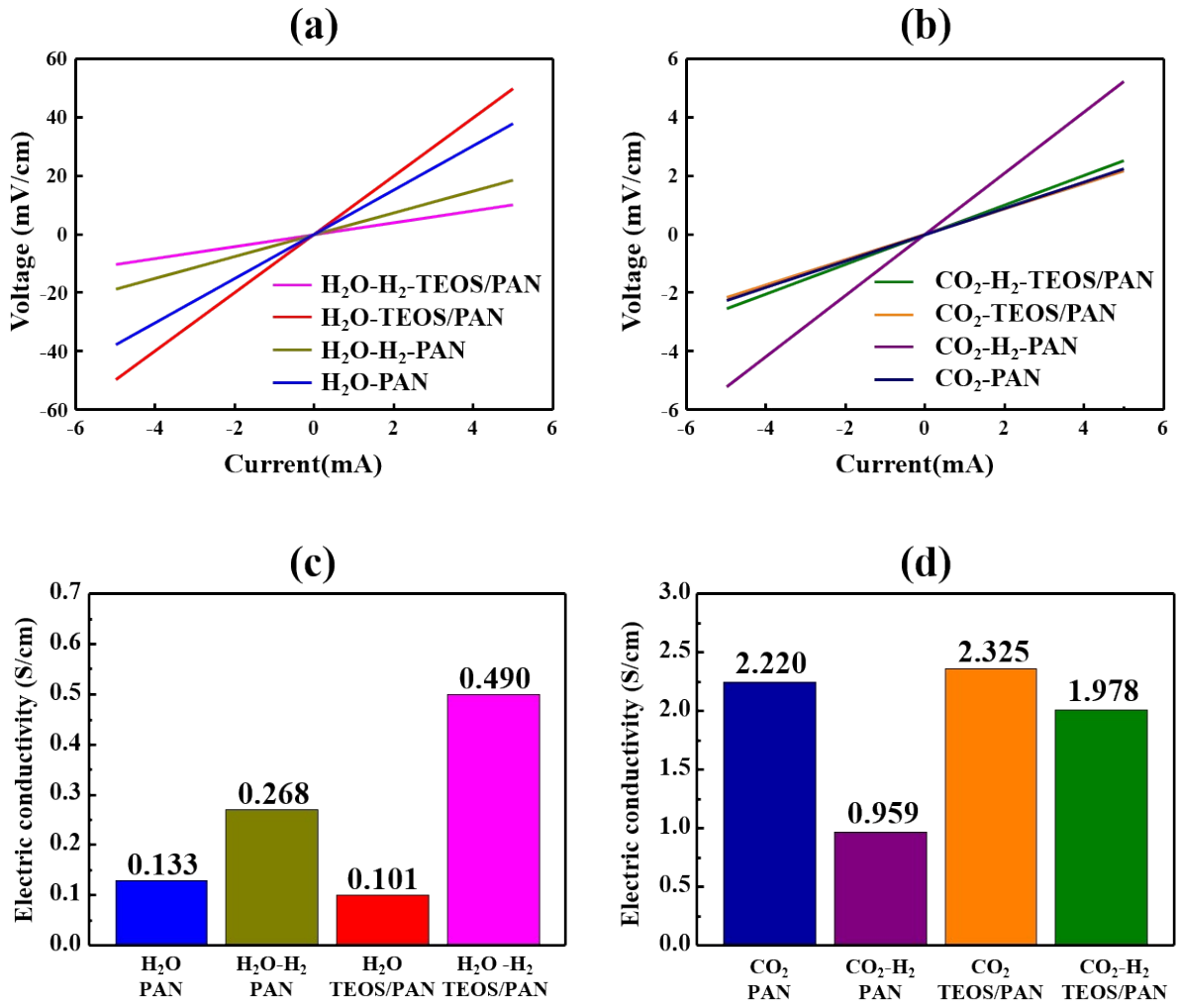


Fig. S5 Specific current-voltage curves of (a) H_2O- and (b) CO_2-activated CNF webs (1.5 × 3.5 cm^2) and (c, d) their corresponding electric conductivity.

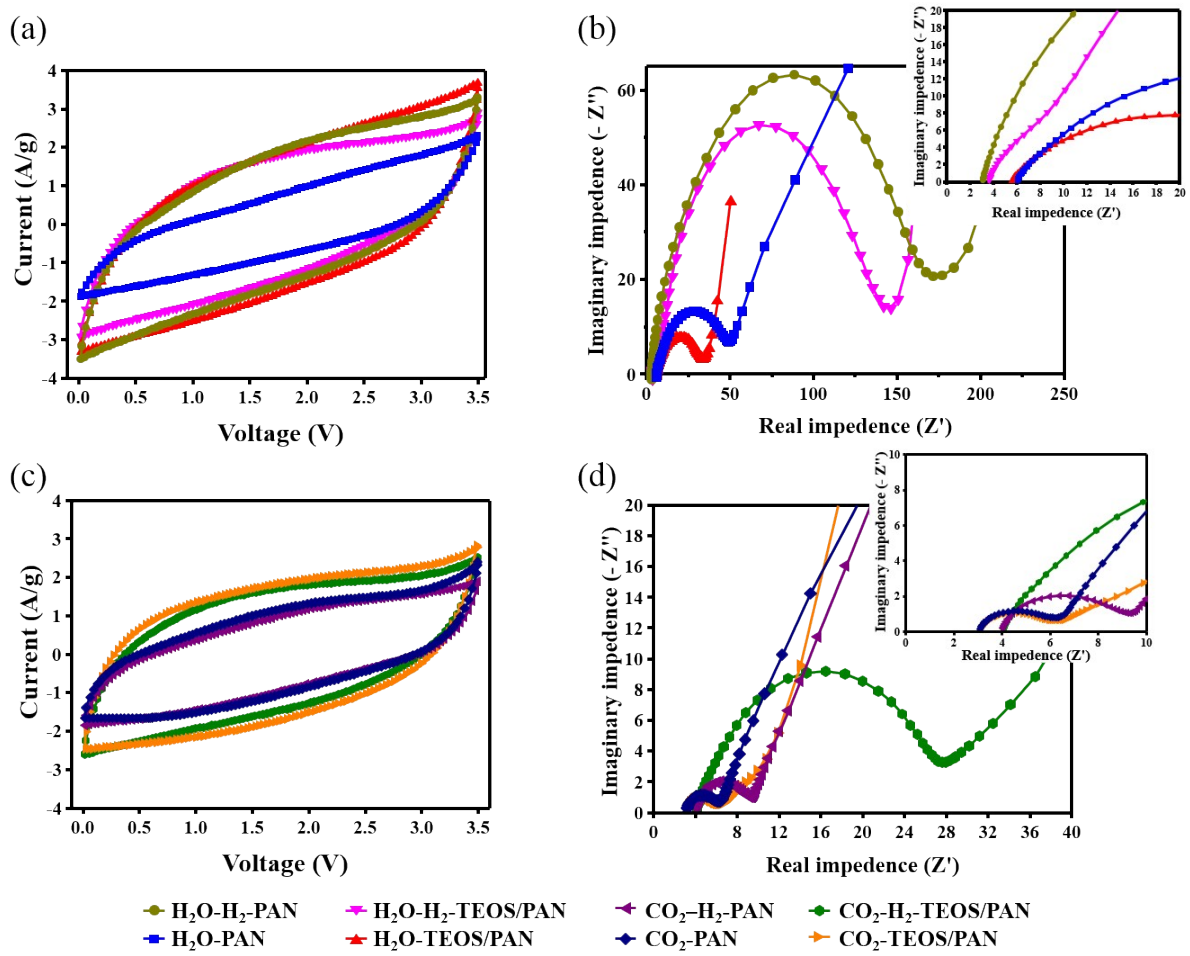


Fig. S6 Cyclic voltammograms and impedance spectra of (a) and (b) H_2O- and (c) and (d) CO_2-activated CNFs. Insets in Fig. S5 (b) and (d) are the magnified high frequency region.

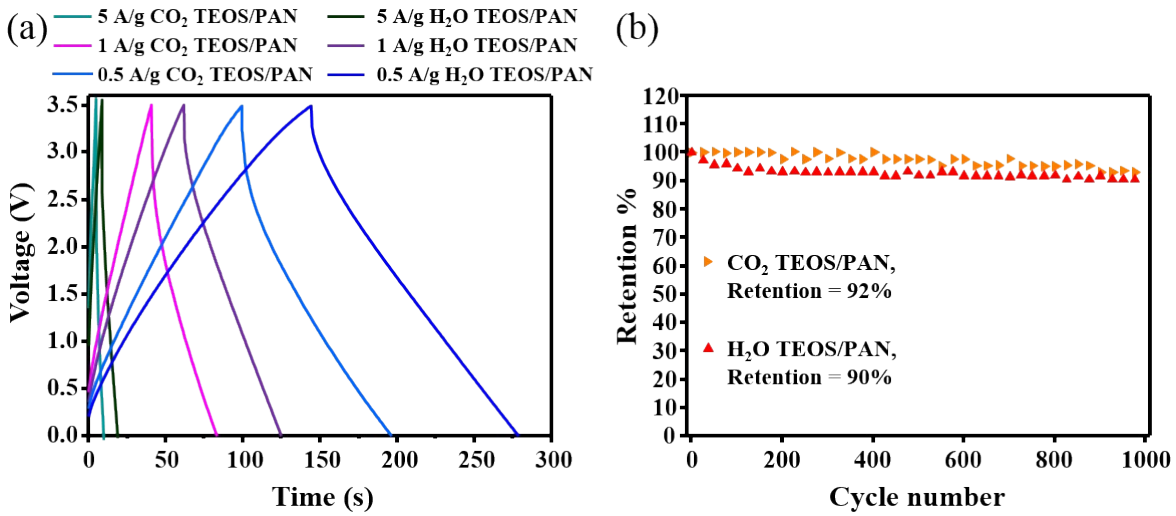


Fig. S7 (a) Galvanostatic charge/discharge voltage profile and (b) cycle stability (1mA/cm^2 discharge rate) of H_2O- and CO_2-activated TEOS/PAN CNFs

Table S1. Comparison of specific capacitances, energy density and BET surface area of electro-spun based activated CNFs and other reported electro-spun activated CNFs in EMIm-TFSI.

	Electrode	**Activation**	**Electrolyte**	**Capacitance (F/g), method**	**Energy density (Wh/kg)**	**BET S.S.A (m^2/g)**
This work	Electrospun PAN/TEOS blended CNFs	H_2O or CO_2	EMIm-TFSI	161 F/g, 3.5V, Charge/discharge	246 Wh/kg, 3.5V	1169 ~ 1624
Ref.[12]	Electrospun PAN/Nafion blended CNFs	KOH	EMIm-TFSI	180F/g, 4V, Cyclic voltammetry	80 Wh/kg, 4v	339 ~ 2282
Ref.[58]	Electrospun PBI/Matrimid blended CNFs	H_2O	EMIm-TFSI	126 F/g, 4V, Cyclic voltammetry	49 Wh/kg, 4V	470 ~ 940
Ref.[59]	Electrospun PIM-1 CNFs	H_2O	EMIm-TFSI	120 F/g, 4V, Cyclic voltammetry	60 Wh/kg, 4V	546 ~ 1162
Ref.[60]	Electrospun PAN/Nafion blended CNFs	KOH	EMIm-TFSI	150 F/g, 3.5V, Cyclic voltammetry	-	1219 ~ 2282
Ref.[61]	Electrospun PAN/PMMA blends CNFs	CO_2	EMIm-TFSI	140 F/g, 4V, Cyclic voltammetry	101 Wh/kg, 4V	2178 ~ 2419

Table S2. Structural parameters of the PAN and TEOS/PAN based carbon nanofibers.

	PAN				TEOS/PAN			
	H_2O	**H_2O-H_2**	**CO_2**	**CO_2-H_2**	**H_2O**	**H_2O-H_2**	**CO_2**	**CO_2-H_2**
Average fiber diameter (nm)	123	103	110	105	109	83	93	92
BET S.S.A (m^2/g)	1238	1382	1516	1544	1216	1160	1624	1568
Average pore diameter (nm)	1.957	2.039	1.883	1.932	2.303	2.212	2.101	2.088
*Average micro pore diameter (nm)	0.734	0.789	0.743	0.790	0.787	0.781	0.814	0.831
Pore volume (cm^3/g)	0.606	0.704	0.714	0.746	0.700	0.641	0.853	0.819
**Electric conductivity (S/cm)	0.133	0.268	2.220	0.959	0.101	0.490	2.325	1.978
***R value	0.938	0.968	0.950	0.997	0.960	0.961	0.941	0.980
****L_a (nm)	4.639	4.492	4.580	4.365	4.533	4.526	4.622	4.440

* Average micro pore diameter calculated by alpha-s method

** Electric conductivity measured by using 4 probe method. Note that CNF webs size is 1.5 cm × 3.5 cm.

*** R value = intensity of D band / intensity of G band

*** $L_a = R$ value / 4.35