Electronic Supplementary Information

for

Hybrid Energy Storage Mechanism of Carbonous Anodes Harvesting Superior Rate Capability and Long Cycle Life for Sodium/ Potassium Storage

Jian Qin[a,b], *Hirbod Maleki Kheimeh Sari*[a,b], *Chunnian He*[c], *Xifei Li*[*,a,b]

[a] Institute of Advanced Electrochemical Energy & School of Materials Science and Engineering, Xi'an University of Technology, Xi'an, Shaanxi 710048, China.

[b] Shaanxi International Joint Research Centre of Surface Technology for Energy Storage Materials, Xi'an, Shaanxi 710048, China

[c] School of Materials Science and Engineering and Tianjin Key Laboratory of Composites and Functional Materials, Tianjin University, Tianjin, 300072, China.

* Corresponding author: xfli@xaut.edu.cn

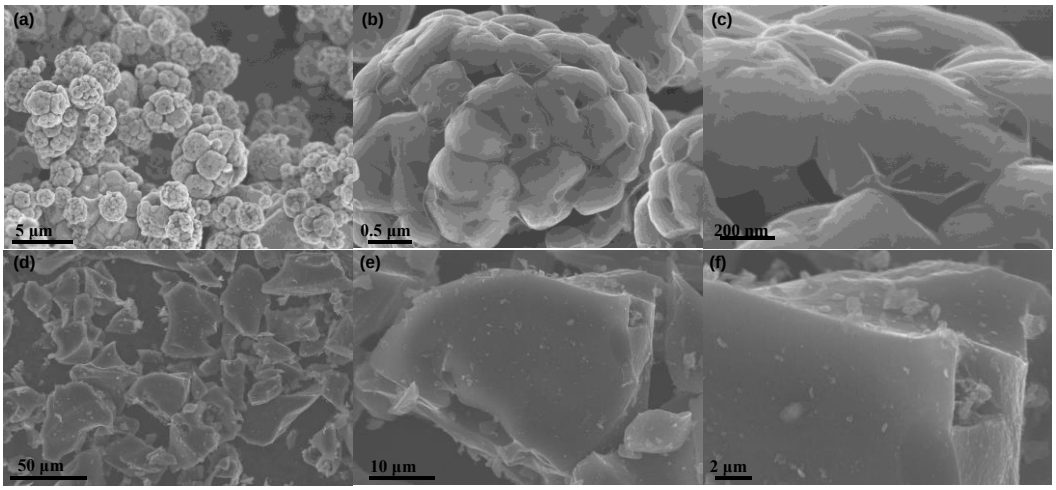

Fig. S1 SEM images of (a) the UNCns precursor, (b, c) the calcined product [NaCl@$C_6H_{17}N_3O_7$], (d-f) the NCbs.

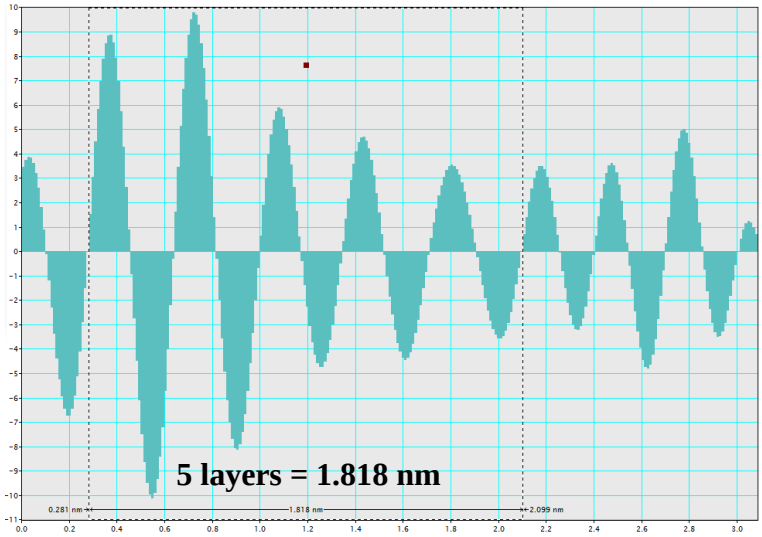

Fig. S2 Line profile obtained from the framed area in Fig. 2f.

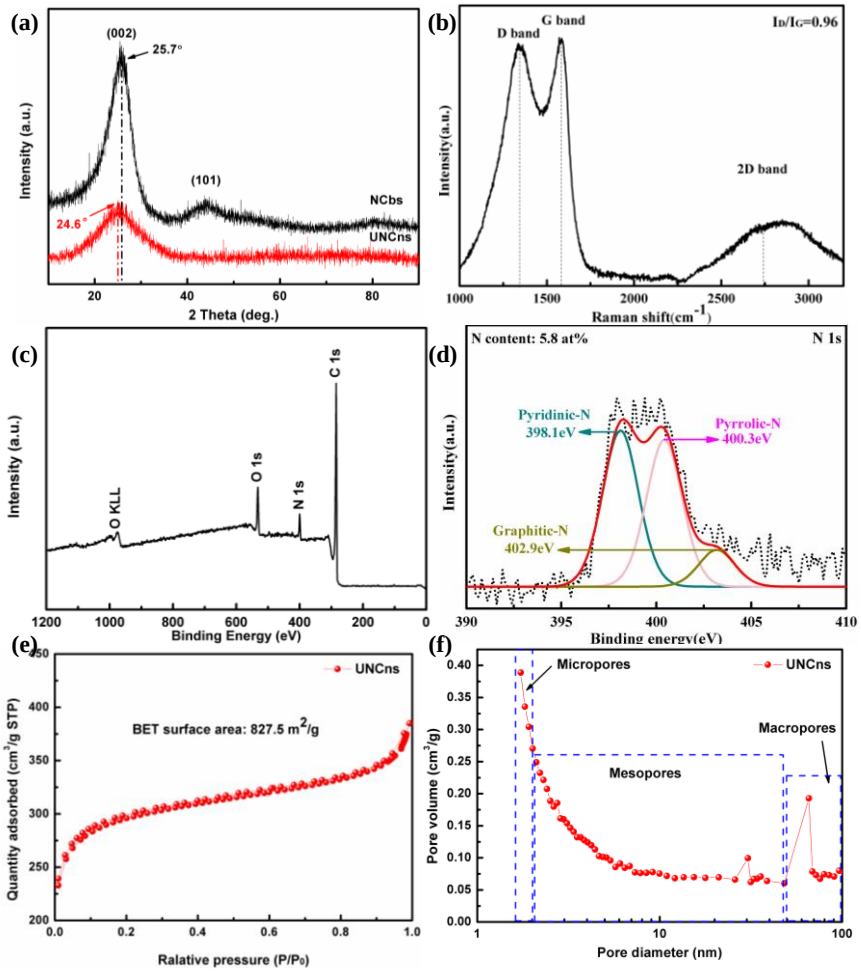

Fig. S3 (a) XRD patterns of the UNCns and NCbs. (b) Raman spectra, (c) XPS spectra, (d) N 1s spectra and the corresponding fitting result, (e) N_2 adsorption-desorption isotherms, (f) pore size distribution of the UNCns.

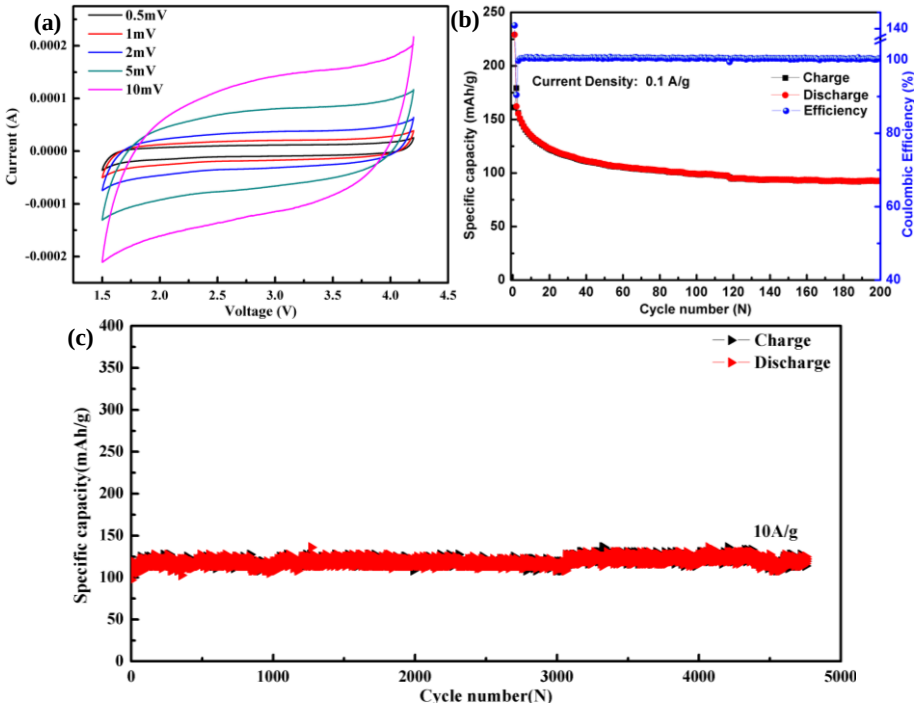

Fig. S4 (a) CV curves, (b) cyclic performance of the UNCns electrode as cathode for SIC. (c) cyclic performance of the UNCns electrode as anode for SIB at the high current density of 10 A/g.

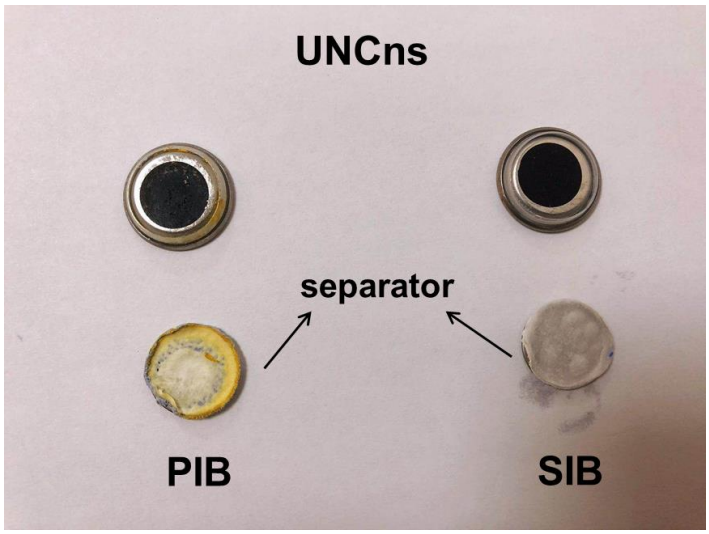

Fig. S5 Photos of the separators for PIB and SIB after cycling.

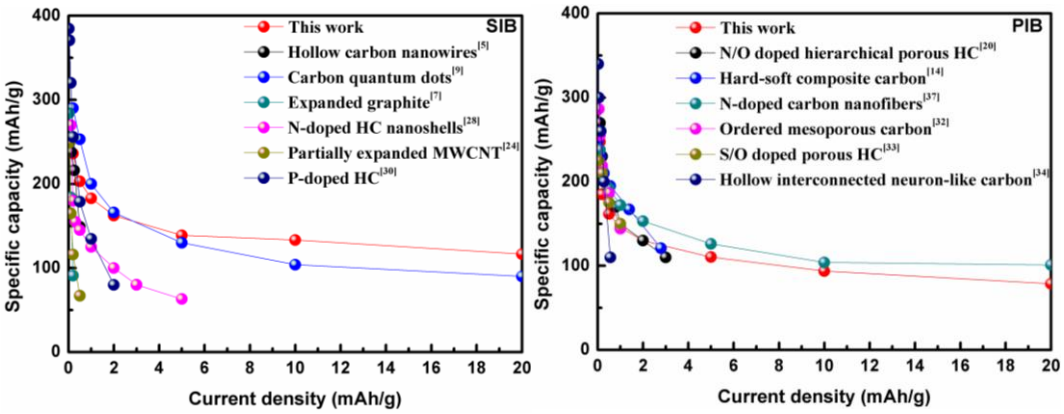

Fig. S6 Comparison of specific capacity at different rates for the UNCns electrode with those of carbonous anodes previously reported.

Table S1. Comparison of specific capacity and capacity retention at different rates for the UNCns electrode with those of carbonous anodes previously reported.

System	Materials	Current density ($A\ g^{-1}$)	Specific capacity after (N) cycles ($mAh\ g^{-1}$)	Capacity retention (%)
SIB	**UNCns [this work]**	**0.1**	**217 (600)**	**76.1 %**
		1	**163 (9500)**	**85.9 %**
		10	**122 (4700)**	**98 %**
	Hollow carbon nanowires [5]	0.05	206 (400)	82.2 %
	Carbon quantum dots [9]	0.5	257 (500)	100 %
		2.5	150 (3000)	80 %
		5	99.8 (10000)	87.6 %
	Expanded graphite[7]	0.1	~140 (2000)	77.8 %
	Nitrogen-doped laser-scribed graphene[40]	10	136 (500)	88 %
	Lithium-pretreated hard carbon[27]	0.5	~180 (1000)	~92 %
		1	~150 (1000)	~91 %
	N-doped HC nanoshells[28]	0.1	174 (200)	53.5 %
	Partially expanded MWCNT[24]	0.2	120 (100)	68.5 %
	P-doped HC[30]	0.02	386.4 (100)	98.2 %

PIB	**UNCns [this work]**	**0.1**	**200 (440)**	**64.7 %**
		1	**117.3 (3000)**	**80.1 %**
	N/O doped hierarchical porous HC [20]	0.05	230.6 (100)	76.1 %
		1.05	~110 (1100)	69.5 %
	Hard-soft composite carbon[14]	0.056	257 (440)	89 %
		0.278	~160 (200)	93 %
	N-doped carbon nanofibers[37]	0.5	205 (1000)	~100 %
		1	164 (2000)	86.3 %
		2	146 (4000)	85.9 %
	Ordered mesoporous carbon[32]	0.2	197.8 (200)	~82.4 %
		0.5	185.7 (200)	~74.3 %
		1	146.5 (1000)	~70 %
	S/O doped porous HC[33]	0.2	201 (200)	~74.4 %
		1	~108.4 (2000)	~54.2 %
	Hollow interconnected neuron-like carbon[34]	0.14	250 (150)	>90 %
		0.279	~140 (500)	~75 %