Supporting Information

Creative utilization of natural nanocomposites: nitrogen-rich mesoporous carbon for high performance sodium ion battery

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Electrochemical measurements for LIBs:

The carbon active materials were mixed with super P and PVDF binder (in a weight ratio of 80:10:10) in NMP to form a homogenous slurry. The slurry was then coated onto Cu foil and then dried at 120 °C for 12 h in a vacuum oven. All electrodes had a standard size of 0.8 cm^2 and the weight of active materials (NMCs) was controlled in the range between 0.9 and 1.1 mg. Lithium half-cells were assembled in the form of CR2025 coin cells inside the Ar-filled glove box with sub-0.1 ppm water and oxygen contents. Li metal pieces were used as counter/reference electrodes. The electrolyte for lithium half-cells was 1 M $LiPF_6$ in EC/DMC (1:1 by volume). A piece of Celgard 2300 was employed as the separators for LIBs, respectively. The lithium half-cells were galvanostatically charge-discharged between 0.001 and 3.0 V *vs.* Li^+/Li using Land BT2000 battery tester (Wuhan, China). The Cyclic voltammetry (CV) traces were recorded on a CS350 electrochemical workstation.

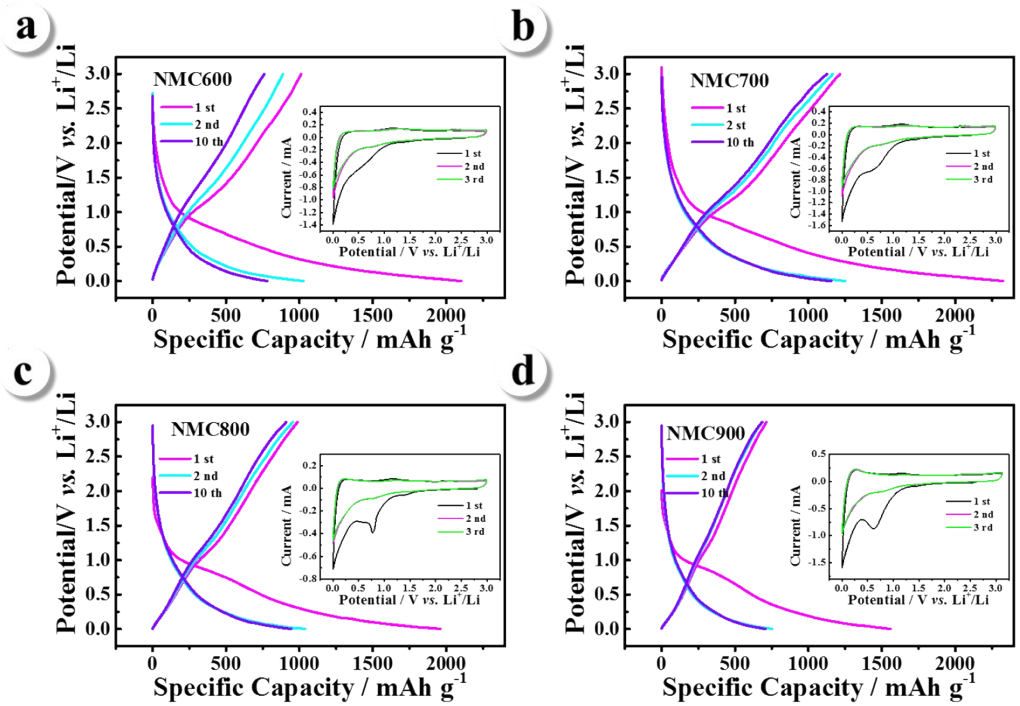

Figure S1. Charge-discharge profile curves between 0.001 and 3.0 V at a rate of 30 mA g^{-1} (inset: CV curves as a scanning rate of 0.1 mV s^{-1}): NMC600 (a), NMC700 (b), NMC800 (c), and NMC900 (d).

Table S1 Porosity parameters and nitrogen content of the shrimp skin-derived carbons.

Sample	d_{002}	S_{BET}	Pore volume	Nitrogen content (at%)				
	(nm)	(m^2 g^{-1})	(cm^3 g^{-1})	Total	N-6	N-5	N-Q	N-oxide
NMC600	0.371	539	0.56	7.96	3.06	3.68	0.74	0.48
NMC700	0.366	531	0.61	7.26	2.24	2.56	1.24	1.22
NMC800	0.363	508	0.71	6.73	1.29	1.60	2.10	1.74
NMC900	0.359	467	0.80	4.90	0.83	2.01	1.03	1.04

Table S2 Performance comparison of NMC700 *versus* carbon anodes of SIBs reported in literature.

Material	Initial coulombic efficiency (%)	Initial reversible capacity	Cyclability (reversible capacity)	Rate capacity	Reference
Carbon nanoparticles	34	249 mAh g^{-1} at 100 mA g^{-1}	203 mAh g^{-1} at 50 cycles	82 mAh g^{-1} at 1 A g^{-1}	1
carbon nanosheet	34.8	349 mAh g^{-1} at 50 mA g^{-1}	200 mAh g^{-1} over 50 cycles	80 mAh g^{-1} at 1A g^{-1}	2
Hollow carbon nanospheres	41	223 mAh g^{-1} at 50 mA g^{-1}	~160 mAh g^{-1} at 100 mA g^{-1} over 100 cycles	100 mAh g^{-1} at 2 A g^{-1}	3
Microporous spherical carbon	67.3	253 mAh g^{-1} at 20 mA g^{-1}	115 mAh g^{-1} over 1000 cycles	115 mAh g^{-1} at 0.2 A g^{-1}	4
Carbon nanofibers	67.5	248 mAh g^{-1} at 20 mA g^{-1}	248.5 mAh g^{-1} over 100 cycles	75 mAh g^{-1} at 1 A g^{-1}	5
Crumpled graphene paper	~36	168.3 mAh g^{-1} at 100 mA g^{-1}	100 mAh g^{-1} over 250 cycles	100 mAh g^{-1} at 1A g^{-1}	6
Hard carbon nanoparticles	51.6	270 mAh g^{-1} at 50 mA g^{-1}	207 mAh g^{-1} at 50 mA g^{-1} over 500 cycles	72 mAh g^{-1} at 1.25 A g^{-1}	7
Expanded graphite	49.5	284 mAh g^{-1} at 20 mA g^{-1}	184 mAh g^{-1} at 100mA g^{-1} over 2000 cycles	91 mAh g-1 at 0.2 A g^{-1}	8
NMC700	40.5	434.6mA h g^{-1} at 30 mA g^{-1}; 69 376 mA h g^{-1} at 50 mA g^{-}	269 mA h g^{-1} at 50 mA g^{-1} over 300 cycles	110 mA h g^{-1} at 2 A g^{-1}	This work

Reference

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