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Supporting Information

Biotopologically structured composite materials for low temperature energy storage

Yu Wang, Xin Chen, Bo Cui, Cuiping Guo, Yao Li, Qinglei Liu, Hui Pan,* Di Zhang*

State Key Laboratory of Metal Matrix Composites, School of Materials Science and Engineering, Shanghai Jiao Tong University, Shanghai 200240, P. R. China

* Corresponding author. E-mail: panhui115@sjtu.edu.cn; zhangdi@sjtu.edu.cn

Table S1. Characterization of SC, SAC, and SAC/NiCo-LDH.

	SC	SAC	SAC/NiCo-LDH
BET surface area ($m^2\ g^{-1}$)	71.0	2787.5	292.5
Total pore volume ($cm^3\ g^{-1}$)	0.161	1.490	0.218
Average pore diameter (nm)	3.939	2.563	1.410

Table S2. Elements contents from XPS data for SAC.

Sample ID	C	N	O	S	P
	Atomic %	Atomic %	Atomic %	Atomic %	Atomic %
SAC	60.85	1.24	36.80	0.49	0.63

Table S3. Comparison of the specific capacitance of SAC/NiCo-LDH and previous works.

Composites	Biomass carbon materials	Specific capacitance	Electrolyte	Ref.
SAC/NiCo-LDH	*Laminaria japonica*	1985 F g^{-1} at 1 A g^{-1}	6 M KOH	This work
MnO_2/FAFSC	*Faidherbia albida* fruit shell	426.66 F g^{-1} at 1 A g^{-1}	3 M KOH	1
BPC/Fe_2O_3	Wheat straw	987.9 F g^{-1} at 1 A g^{-1}	3 M KOH	2
MnO_2/GPCN-SS	*Salvia splendens*	438 F g^{-1} at 0.5 A g^{-1}	1 M Na_2SO_4	3
ZnCoS@AC	Biowaste litchi seed	320 F g^{-1} at 1 A g^{-1}	6 M KOH	4
$CeCoS_x$-SA/GF	Sodium alginate	873.3 F g^{-1} at 1 A g^{-1}	PVA/KOH hydrogel electrolyte	5
CoNiSi/C	Bamboo leaves	226 F g^{-1} at 0.5 A g^{-1}	3 M KOH	6

Table S4. Comparison of the energy density of SAC/NiCo-LDH//SAC and previous works.

Materials (anode//cathode)	Type	Energy Density (Wh kg^{-1})	Operating temperature	Ref.
SAC/NiCo-LDH//SAC	ASC	43.7	-30	This work
AC//AC	SC	27.8	-20	7
NiO/C//C	ASC	11.8	-18	8
AC//HC	SIC	42	-30	9
AC//Zn	ZIHC	27.8	-40	10

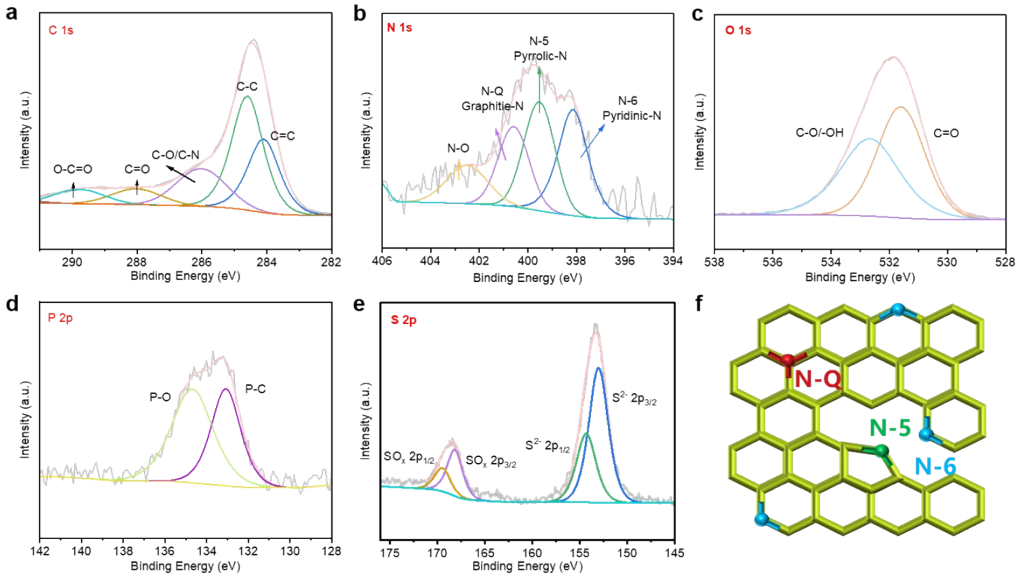

Fig. S1 XPS spectra of SAC. The high resolution XPS spectra of (a) C1s, (b) N1s, (c) O1s, (d) P2p and (e) S2p for SAC.

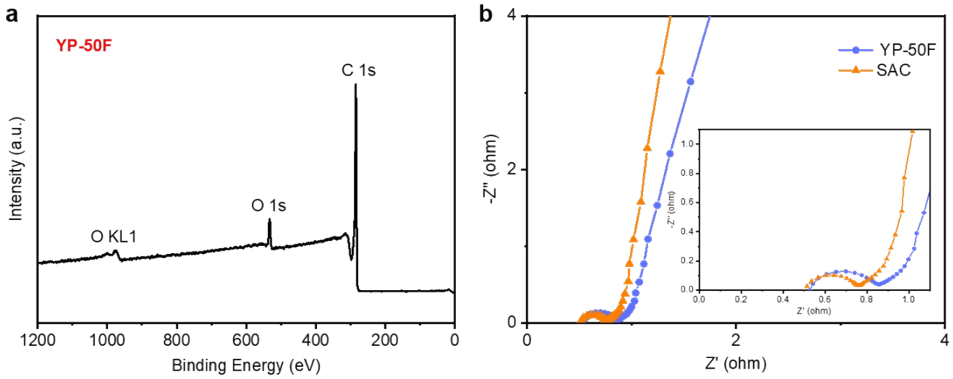

Fig. S2 (a) XPS spectrum survey scan for commercial porous carbon YP-50F. (b) Nyquist plots of YP-50F and SAC.

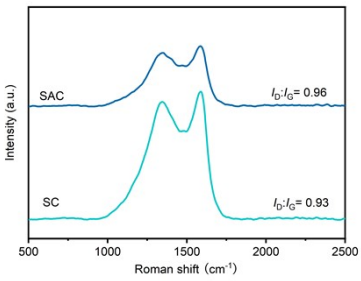

Fig. S3 Raman spectra of SC and SAC.

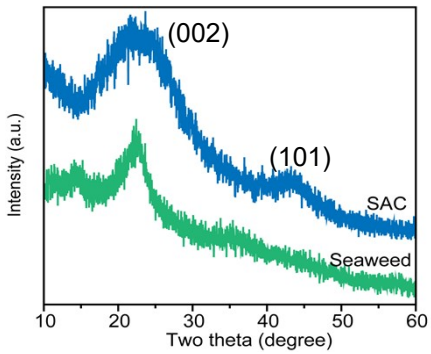

Fig. S4 XRD spectra of seaweed and SAC.

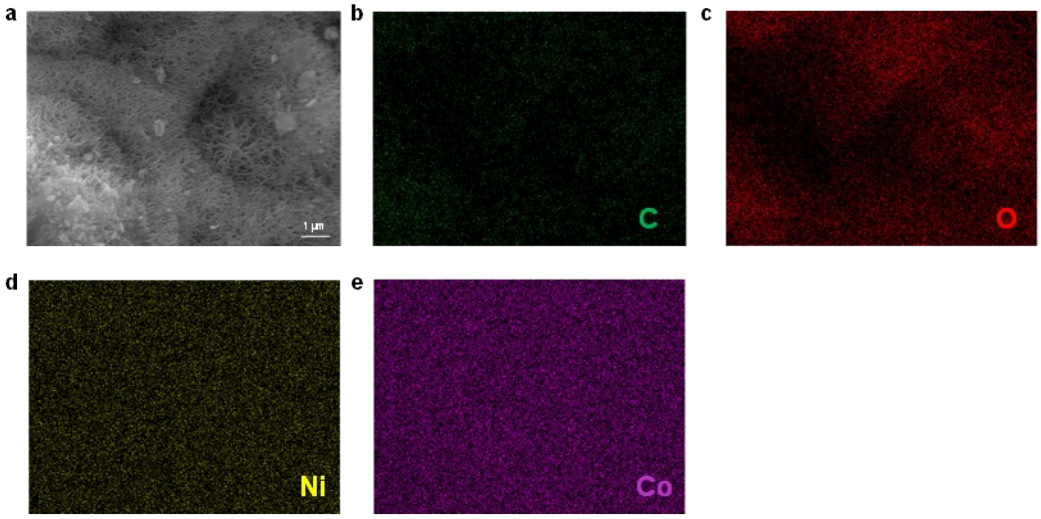

Fig. S5 EDS mapping by SEM for SAC/NiCo-LDH.

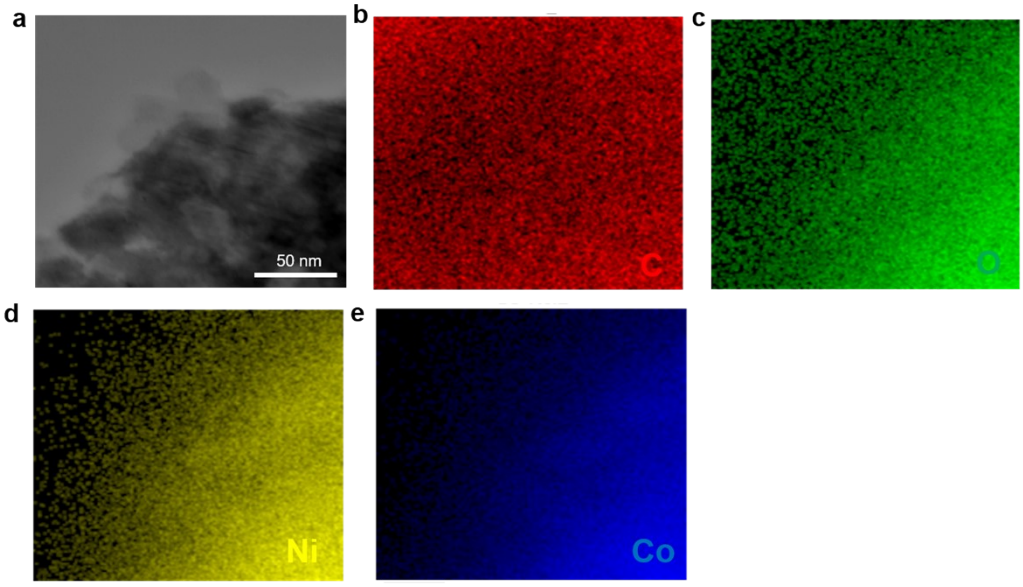

Fig. S6 EDS mapping by TEM for SAC/NiCo-LDH.

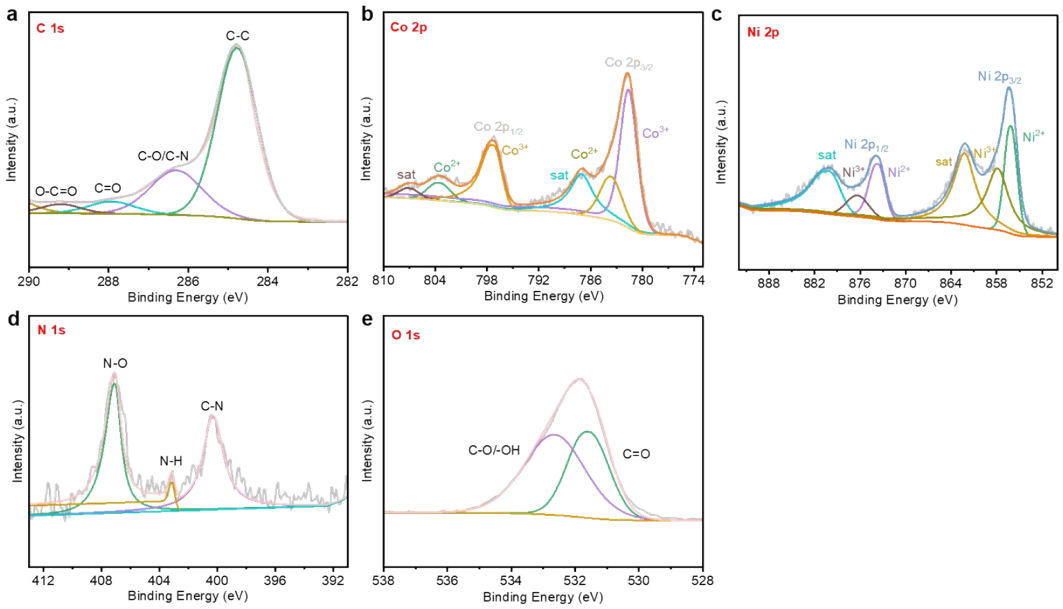

Fig. S7 XPS spectra of SAC/NiCo-LDH. The high resolution XPS spectra of (a) C1s, (b) Co2p, (c) Ni2p, (d) N1s and (e) O1s for the sample SAC/NiCo-LDH.

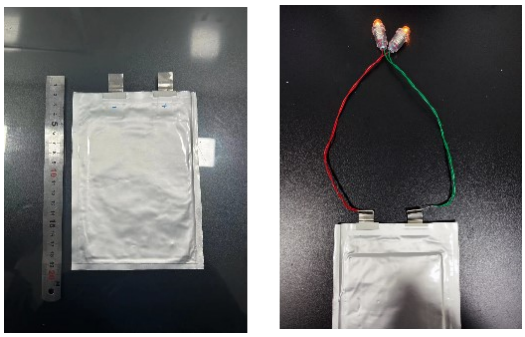

Fig. S8 (a) A flexible supercapacitor pouch cell (approximately 18 cm in height as indicated by the ruler) is assembled by using SAC/NiCo-LDH and SAC as positive and negative, respectively. (b) Supercapacitor pouch cell powering two light bulbs.

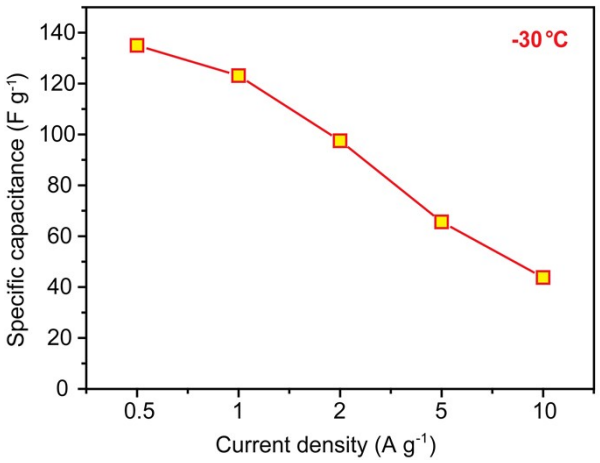

Fig. S9 Specific capacitance of SAC/NiCo-LDH//SAC at -30 °C.

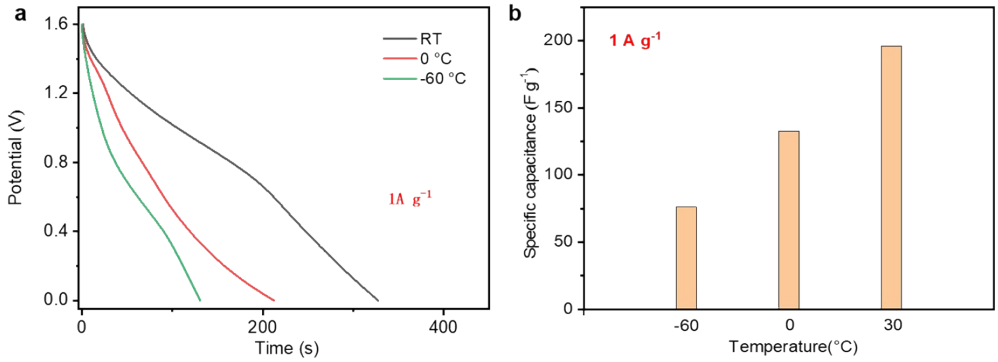

Fig. S10 Electrochemical properties of SAC/NiCo-LDH//SAC at different temperatures. (a) GCD curves of SAC/NiCo-LDH//SAC with 1 A g^{-1}. (b) Specific capacitance of SAC/NiCo-LDH//SAC at different temperatures.

References

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