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Supporting Information

Activating graphite with defects and oxygenic functional groups to boost sodium-ion storage

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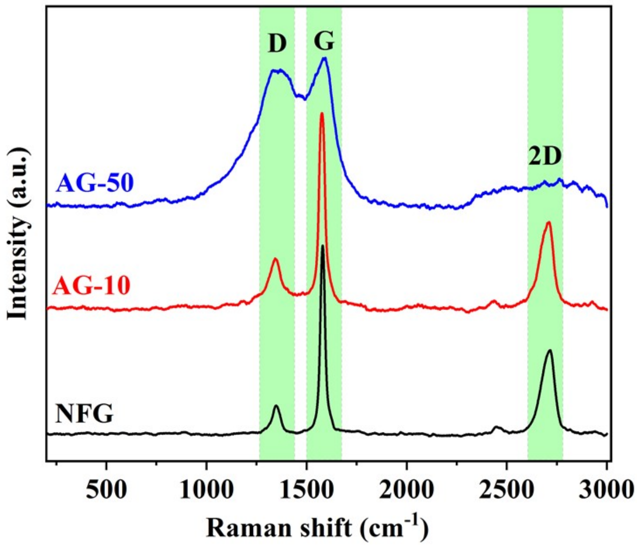

Figure S1. Raman spectra of NFG, AG-10 and AG-50.

Table S1. Deconvoluted band assignments of Raman spectra.

Code	Corresponding structure	Symmetry	Raman Shift (cm^{-1})	Line Shape
D_4	*sp*^{2}-*sp*^{3} hybrid structures or C–C/C=C stretching vibrations	A_{1g}	~1200	Gaussian
D	Disorder in graphite lattice	A_{1g}	~1350	Gaussian
D_3	Amorphous structure	--	~1500	Gaussian
G	Graphite lattice	E_{2g}	~1585	Gaussian
D_2	Few-layer graphene	E_{2g}	~1620	Gaussian

Table S2. Calculated integral areas and relative ratios of fitted subpeaks from Raman spectra for NFG, AG-10 and AG-50.

Substances	D_4 (%)	D (%)	D_3 (%)	G (%)	D_2 (%)	I_D/I_G	I_{D4}/I_G
NFG	--	26.45	--	73.55	--	0.35	--
AG-10	9.74	24.80	12.26	37.01	16.19	0.67	0.26
AG-50	22.40	38.00	14.43	17.74	7.43	2.14	1.26

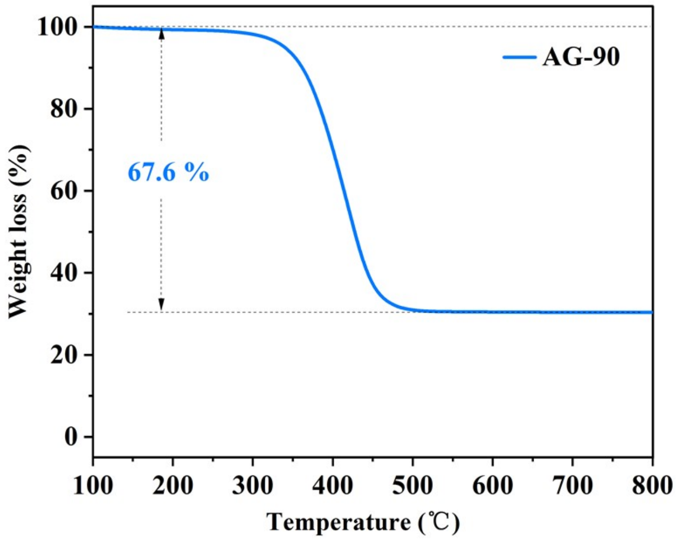

Figure S2. TG curves of sample with ball-milling time of 90 hours (marked as AG-90).

Table S3. Comparisons of electrochemical performance of carbon-based anodes for SIBs.

Materials	Voltage range (V)	Current density / ICE / Reversible capacity / Cycle number / Retention rate (A g^{-1} / % / mAh g^{-1} / cycles / %)	Electrolyte system	Ref.
Commercial hard carbon	0-2.0	0.025 / 78 / 220 / 100 / 91.7	1M $NaClO_4$ in 1:1 (v/v) EC: DEC	1
N-doped interconnected carbon nanofibers	0.01-2.0	0.05 / 41.8 / 134.2 / 200 / 88.7	1M $NaPF_6$ in 1:1 (w/w) EC: DEC	2
N-doped carbon nanosheets	0-3.0	0.05 / 34.9 / 155.2 / 260 / 44.4	1M $NaPF_6$ in 1:1 (w/w) EC: DMC	3
nanoporous hard carbon	0.01-2.0	0.02 / 77 / 289 / 100 / 89.2	1M $NaClO_4$ in 1:1 (v/v) EC: DEC	4
3D Amorphous Carbon	0-3.0	0.03 / 75 / 280.1 / - / -/ -	1M $NaPF_6$ in 1:1 (v/v) EC: DMC	5
P-doped carbon nanosheets	0.01-3.0	0.1 / 46.7 / 328 / 100 / 97.7 5 / - / - / 149 / 5000 / -	1M $NaClO_4$ in PC+5% FEC	6
Rape seed shuck derived hard carbon	0.01-3.0	0.1 / 80 / 143 / 200 / 72	1M $NaClO_4$ in 1:1 (v/v) EC: DEC +5% FEC	7
C1600-M	0.02-3.0	0.03 / 47.7 / 368 / - / - 1.5 / - / 141 / 2000 / 80.2	1M $NaClO_4$ in 1:1 (v/v) EC: PC +5% FEC	8
S-doped N-rich carbon nanosheets	0.01-3.0	0.5 / 43.9 / 350 / 200 / 83.5 1 / - / 211 / 1000 / 87.9	1M $NaClO_4$ in 1:1 (v/v) EC: PC	9
S/N-codoped hollow carbon spheres	0.01-3.0	0.1 / 27.8 / 250 / - / - 0.5 / - / 169 / 2000 / 75	1M $NaClO_4$ in 1:1 (v/v) EC: DEC + 2% FEC	10
BPPG-1000-A	0.001-2.8	0.05 / 73 / - / - / - 0.1 / - / 298 / 290 / ~88	1M $NaClO_4$ in 1:1 (v/v) EC: DEC	11
CNPs	0.005-3.0	0.1 / 49 / 278 / 200 / -	1M $NaClO_4$ in 1:1(v/v) EC:PC + 0.3% FEC	12

SHC-1300	0.01-2.5	0.05 / 30.6 / 355.6 / 3 / 87.7 5 / - / 104 / 1000 / ~50	1M $NaClO_4$ in 1:1 (v/v) EC: DMC	13
LS1200	0.01-2.5	0.05 / 50.4 / 295 / 200 / 90	1M $NaClO_4$ in (v/v) PC + 2% FEC	14
C-1300	0.005-2.5	0.05 / 68 / 297 / 100 ~95 2.5 / - / 116 / 500 / ~90	1M $NaClO_4$ in (v/v) EC :PC:DMC(9:9:2)	15
CPP	0.01-3	0.1 / 59.8 / 221.5 / - / - 0.2 / - / 203.3 / 200 / 98	1M $NaClO_4$ in 1:1 (v/v) EC: PC +5% FEC	16
p-HNCs	0.01-3.0	0.1 / 51.6 / 225 / 200 / ~81.8 1.0 / - / 157 / 1000 / ~98	1M $NaClO_4$ in (v/v) EC :PC:DMC(1:1:1)+5%FEC	17
SGHC-1000	0.01-2.5	0.05 / 68.1 / 330.8 / 100 / ~93.2 1 / - / 136.1 / 1000 / 86	1M $NaClO_4$ in 1:1 (v/v) EC: DEC	18
3D-CGCG1	0.01-3.0	0.05 / 37.1 / 415.5 / - / - 2 / - / 101 / 2000 / ~58	1M $NaClO_4$ in 1:1 (v/v) EC: PC +5% FEC	19
CPOP-1400	0.01-3.0	0.03 / 88.6 / 279.3 / 200 / 93.1	1M $NaClO_4$ in 1:1 (v/v) EC: DMC	20
AG-50	0.01-3.0	0.1 / 42.35 / 221.3 / 200 / 96.9 1 / 36.08 / 139.1 / 4500 / 80.7	1M $NaClO_4$ in 1:1 (v/v) EC: DEC + 5% FEC	**This work**

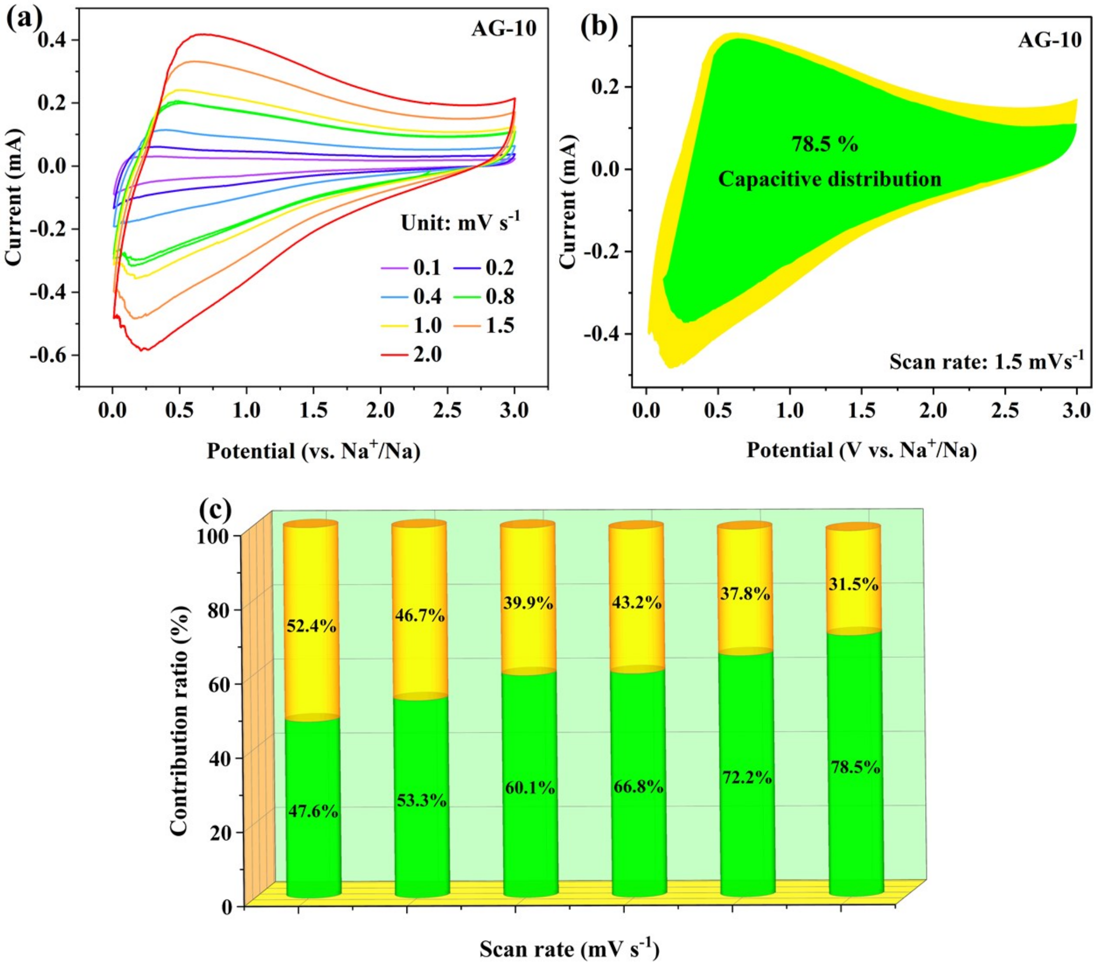

Figure S3. (a) CV curves at various scan rates, (b) CV profile of AG-10 at the scan rate of 1.5 mV s^{-1}. Shaded region shows the calculated capacitive contribution. (c) Contribution percentages of diffusion-controlled and capacitive processes at different scan rates.

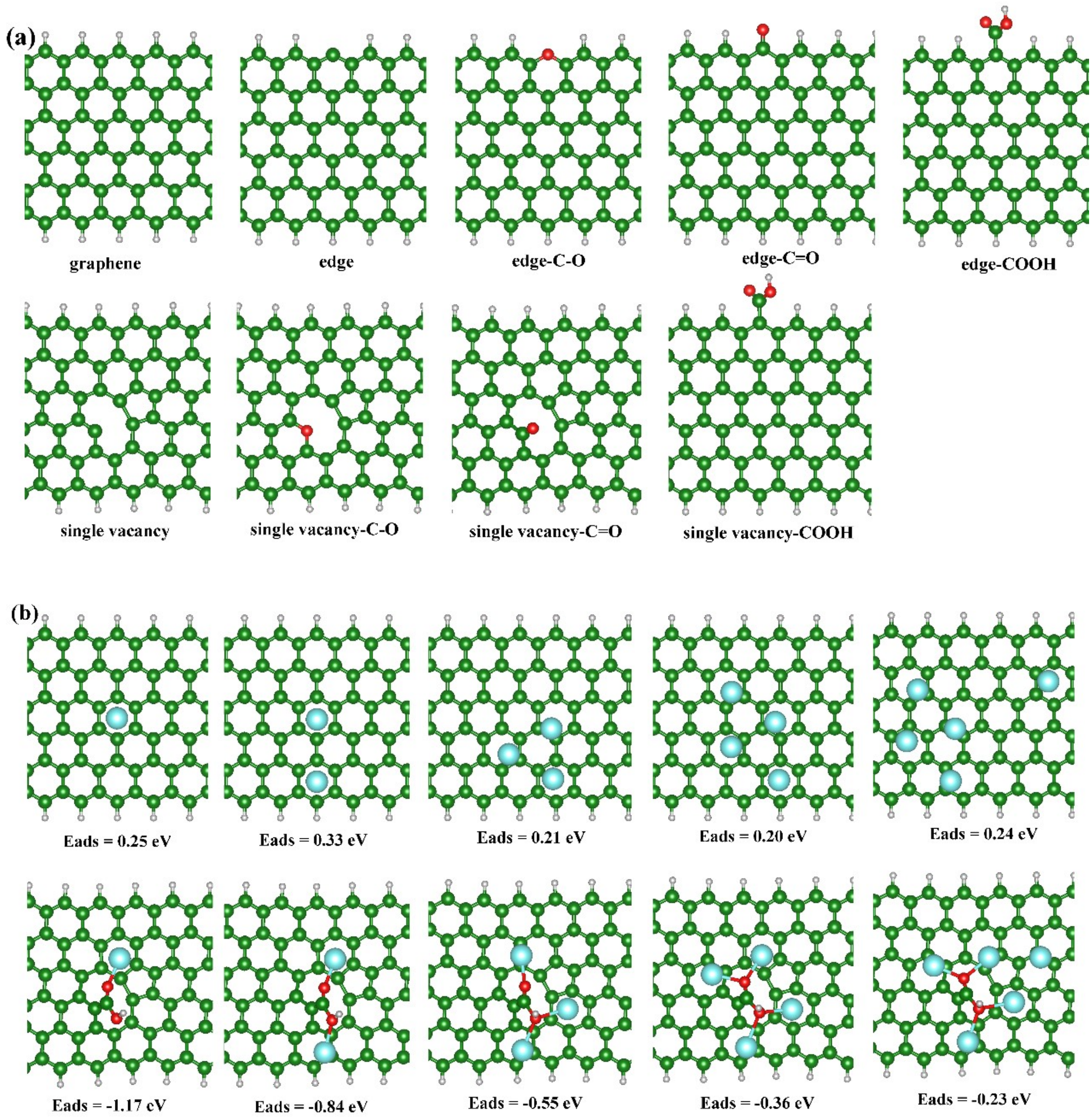

Figure S4. (a) various models. (b) 1-5 Na atom adsorption energies over adsorption energies of one Na atom over the pristine graphene and the vacancy with COOH, respectively.

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