Electronic Supplementary Material

Interface-modulated fabrication of hierarchical yolk–shell Co_3O_4/C dodecahedrons as stable anodes for lithium and sodium storage

Yuzhu Wu[1,§], Jiashen Meng[1,§], Qi Li[1] (✉), Chaojiang Niu[1], Xuanpeng Wang[1], Wei Yang[1], Wei Li[1], and Liqiang Mai[1,2] (✉)

[1] State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, Wuhan 430070, China
[2] Department of Chemistry, University of California, Berkeley, California 94720, USA
[§] These authors contributed equally to this work.

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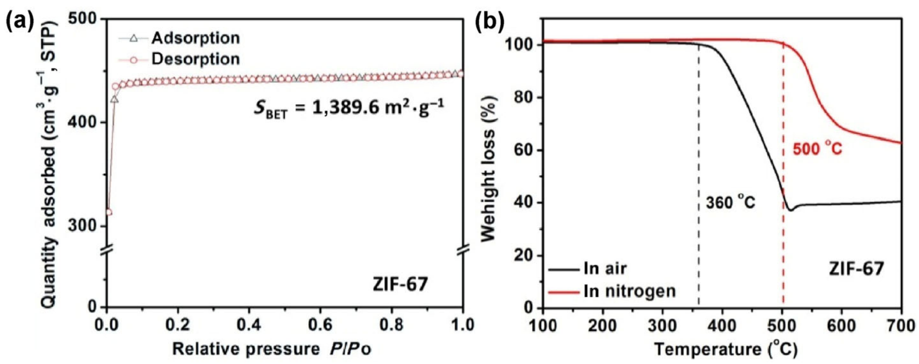

Figure S1 (a) N_2 adsorption/desorption isotherm curve of the as-synthesized rhombic dodecahedral morphology ZIF-67. (b) TG curves of ZIF-67 in air (black) and nitrogen (red) atmosphere.

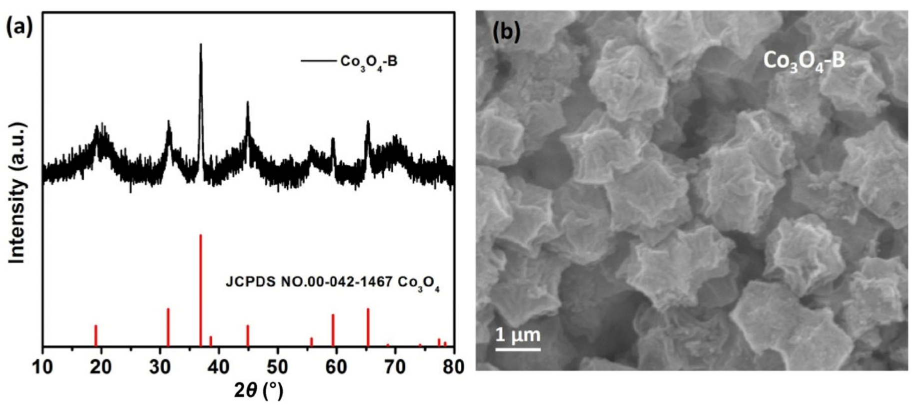

Figure S2 XRD pattern (a) and SEM image of Co_3O_4 bulks (denoted as Co_3O_4-B).

Address correspondence to Liqiang Mai, mlq518@whut.edu.cn; Qi Li, qi.li@whut.edu.cn

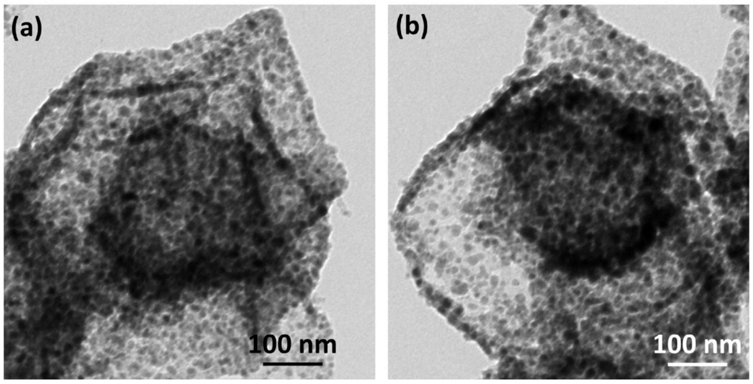

Figure S3 TEM images of the yolk–shell Co_3O_4/C dodecahedrons.

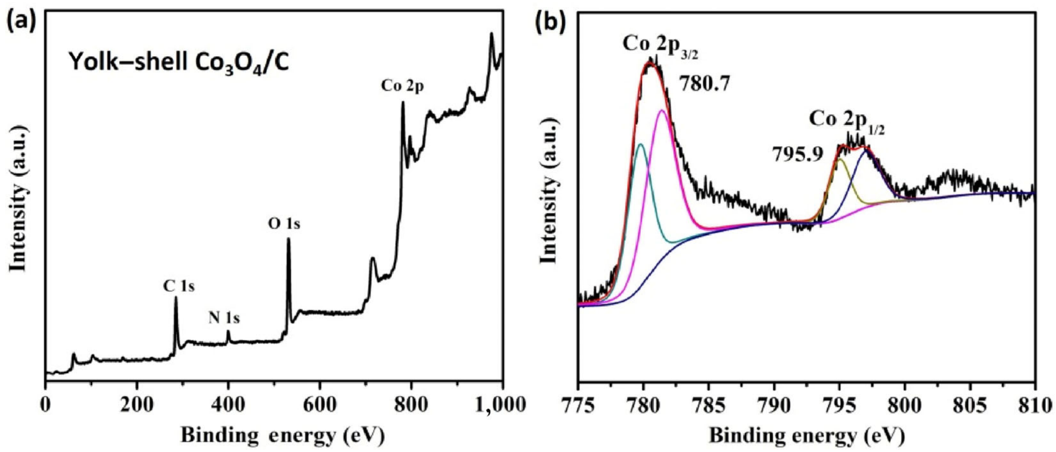

Figure S4 XPS survey spectra of the yolk–shell Co_3O_4/C dodecahedrons: (a) wide scan of Co_3O_4/C, (b) Co 2p.

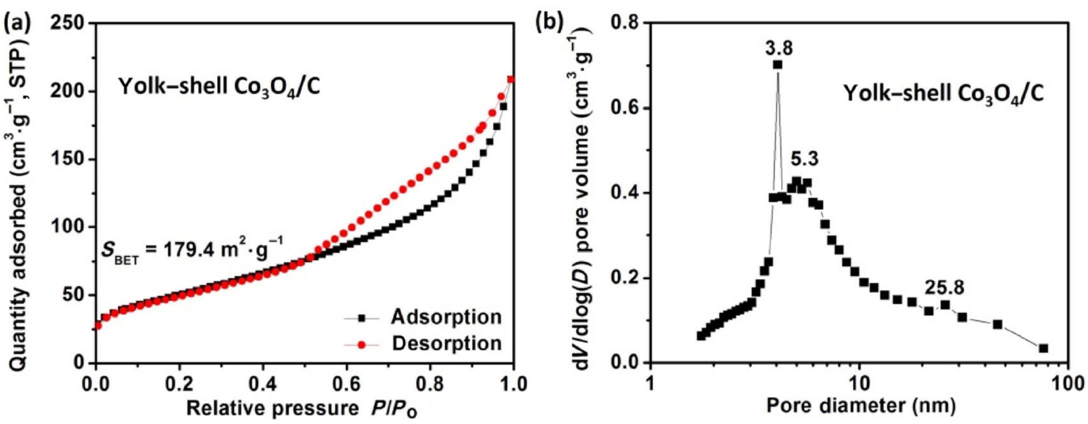

Figure S5 (a) N_2 adsorption/desorption isotherm curve and (b) pore size distribution of the yolk–shell Co_3O_4/C dodecahedrons.

MOFs are formed by linking organic and inorganic moieties through coordination bonding. ZIFs belong to a subclass of MOFs materials, whose skeleton structures are made of metal ions and imidazoles organic ligands by coordination polymerization. Because of the inherent structure of ZIF-67, it has high specific surface area and high porosity. But after the pyrolysis of ZIF-67, its inherent porous channel structure will collapse, leading to the smaller specific surface area of Co_3O_4/C dodecahedrons than that of ZIF-67.

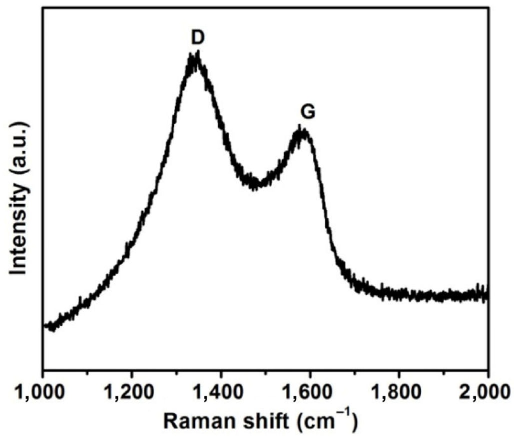

Figure S6 Raman spectrum of the yolk–shell Co_3O_4/C dodecahedrons, showing the amorphous nature of carbon in Co_3O_4/C dodecahedrons.

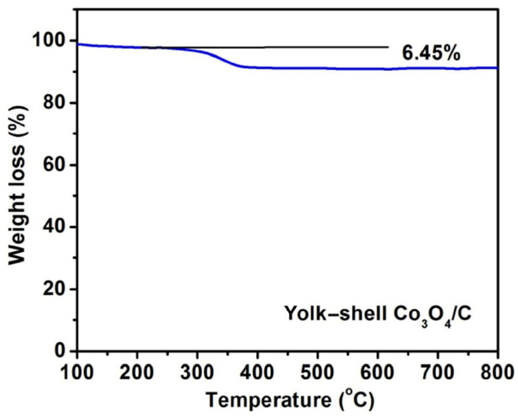

Figure S7 TG curve of the yolk–shell Co_3O_4/C dodecahedrons in air. The mass content of carbon in the yolk–shell Co_3O_4/C is about 6.45 wt.%.

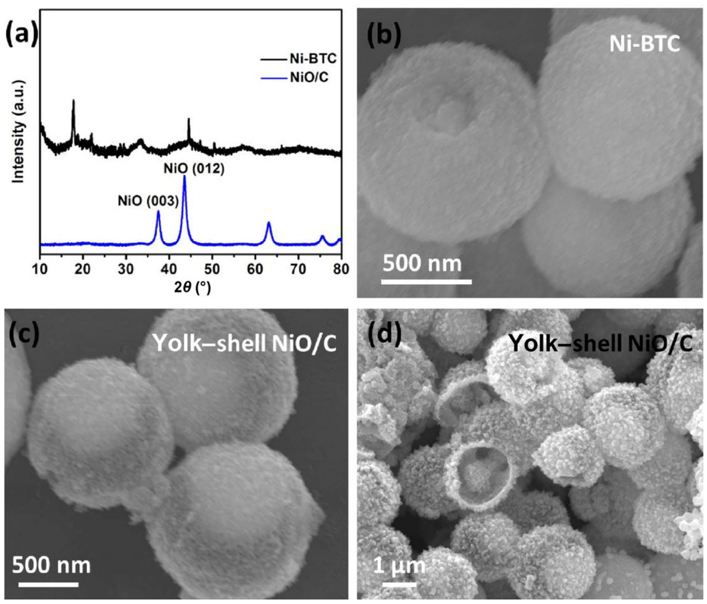

Figure S8 (a) XRD patterns of the as-synthesized Ni-BTC and yolk–shell NiO/C microspheres. (b) SEM image of the as-synthesized Ni-BTC microspheres. ((c) and (d)) SEM images of the yolk–shell NiO/C microspheres.

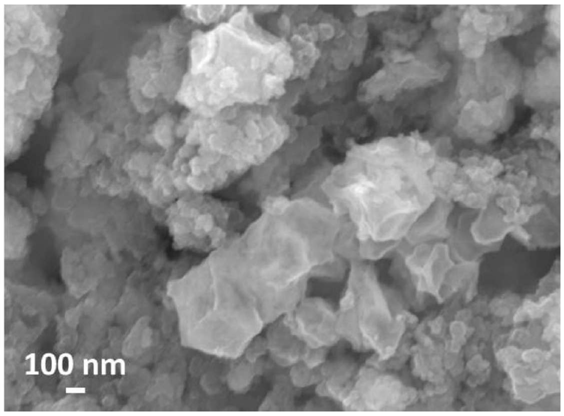

Figure S9 SEM image of the Co_3O_4/C dodecahedrons after cycling at 200 mA·g^{-1} for 50 cycles, showing no notable variation in morphology. It should be noted that the small nanoparticles observed in the image are carbon black.

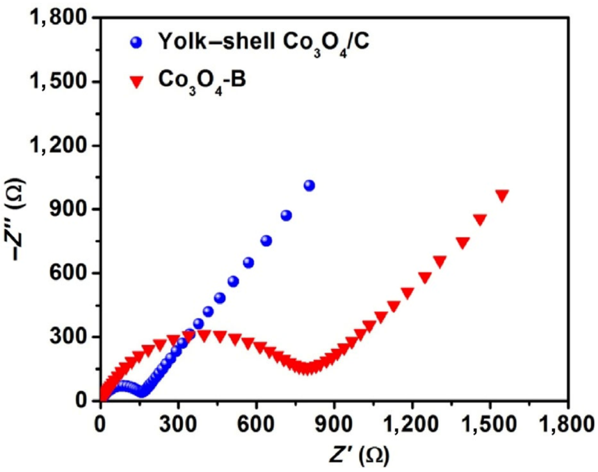

Figure S10 Electrochemical impedance spectra (Nyquist plots) of the yolk–shell Co_3O_4/C dodecahedrons and Co_3O_4-B.

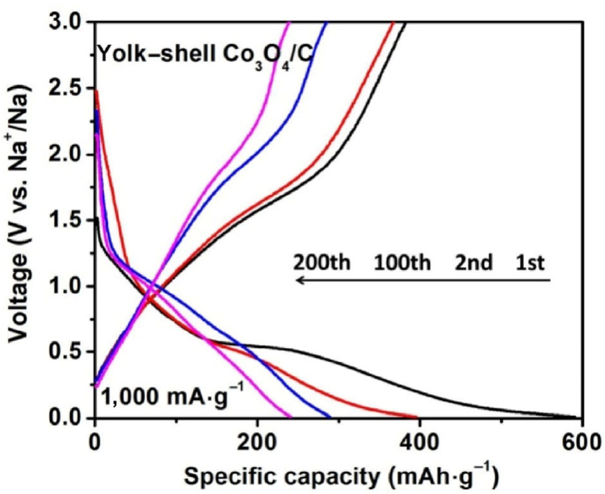

Figure S11 Electrochemical performance of yolk–shell Co_3O_4/C dodecahedrons in SIBs: galvanostatic charge/discharge profiles at a current density of 1,000 mA·g^{-1}.

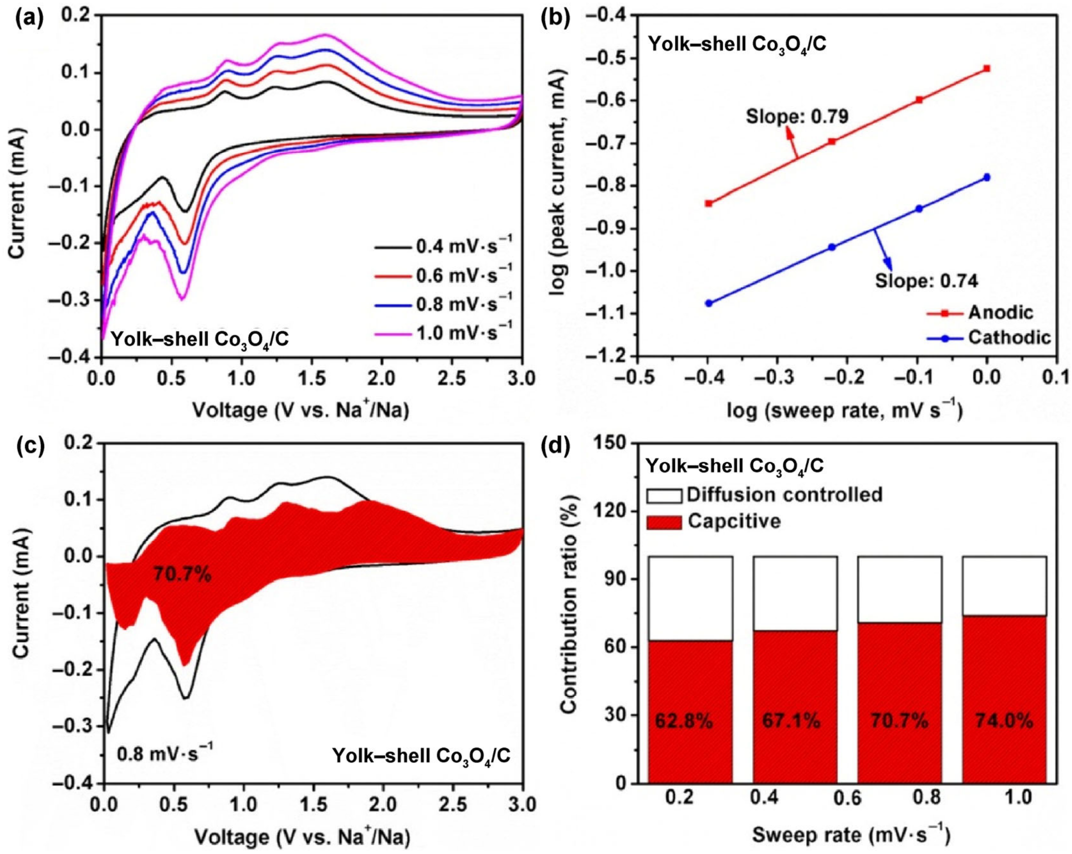

Figure S12 Kinetic analysis of the electrochemical behavior vs. Na^+/Na for the yolk–shell Co_3O_4/C dodecahedrons. (a) CV curves at various scan rates from 0.2 to 1.0 $mV\cdot s^{-1}$. (b) Determination of the *b*-value using the relationship between peak current and scan rate. (c) Separation of the capacitive and diffusion currents at a scan rate of 0.8 $mV\cdot s^{-1}$. (d) Contribution ratio of the capacitive and diffusion-controlled charge at various scan rates.

Table S1 Comparison of the cycling performance for LIBs with previous reports

	Current density ($mA\cdot g^{-1}$)	Specific capacity ($mA\cdot g^{-1}$)	Cycle number	Reference
Yolk–shell Co_3O_4/C dodecahedrons	200	1,100	120	This work
Co_3O_4 nanocages	50	970	30	[S1]
Co_3O_4 polyhedra/MWCNTs	100	889	100	[S2]
Co_3O_4 embedded N-porous carbon dodecahedrons	100	1,350	100	[S3]
Ultrafine Co_3O_4 nanocrystallites in grapheme oxide	200	908	100	[S4]

Table S2 Comparison of the cycling performance for SIBs with previous reports

	Current density ($mA\cdot g^{-1}$)	Specific capacity ($mA\cdot g^{-1}$)	Cycle number	Reference
Yolk–shell Co_3O_4/C dodecahedrons	1,000	240	200	This work
Co_3O_4@CNTs	160	440	30	[S5]
Nanostructured Co_3O_4	25	447	50	[S6]
Co_3O_4 MNSs @ 3DGNs	25	523	50	[S7]
m-Co_3O_4	90	416	100	[S8]

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