Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
This journal is © The Royal Society of Chemistry 2018

Supporting Information for

In situ construction of yolk-shell zinc cobaltite with uniform carbon doping for high performance asymmetric supercapacitor

Xiaoya Chang,[a] Lei Zang,[a] Song Liu,[a] Mengying Wang,[a] Huinan Guo,[a] Caiyun Wang[b] and Yijing Wang*[a]*

[a]Key Laboratory of Advanced Energy Materials Chemistry (Ministry of Education), College of Chemistry, Nankai University, Tianjin 300071, China.

[b]ARC Centre of Excellence for Electromaterials Science, Intelligent Polymer Research Institute | AIIM Facility, University of Wollongong, NSW 2500, Australia.

*Corresponding authors: ***wangyj@nankai.edu.cn***, ***caiyun@uow.edu.au.***

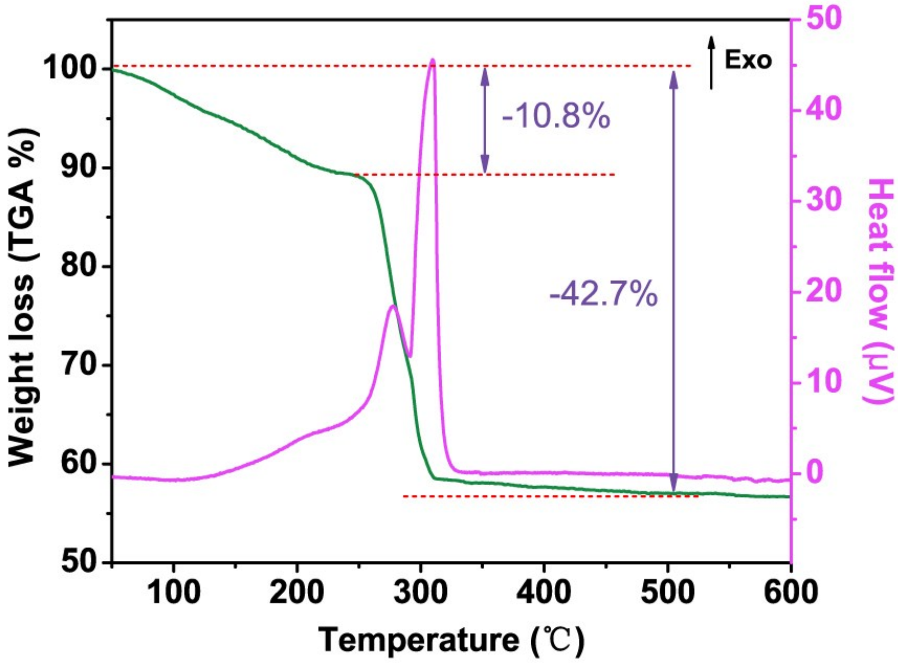

Fig. S1 TG-DCS curve of precursor ZnCo-glycolate under air flow at a heating rate of 10 ^{o}C min^{-1}.

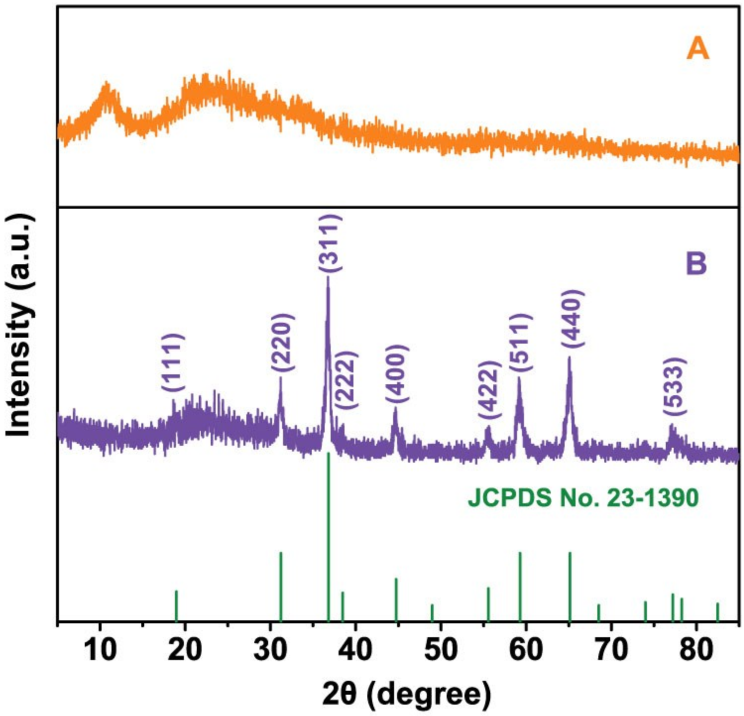

Fig. S2 XRD patterns of precursor ZnCo-glycolate (A) and $ZnCo_2O_4/C$ (B).

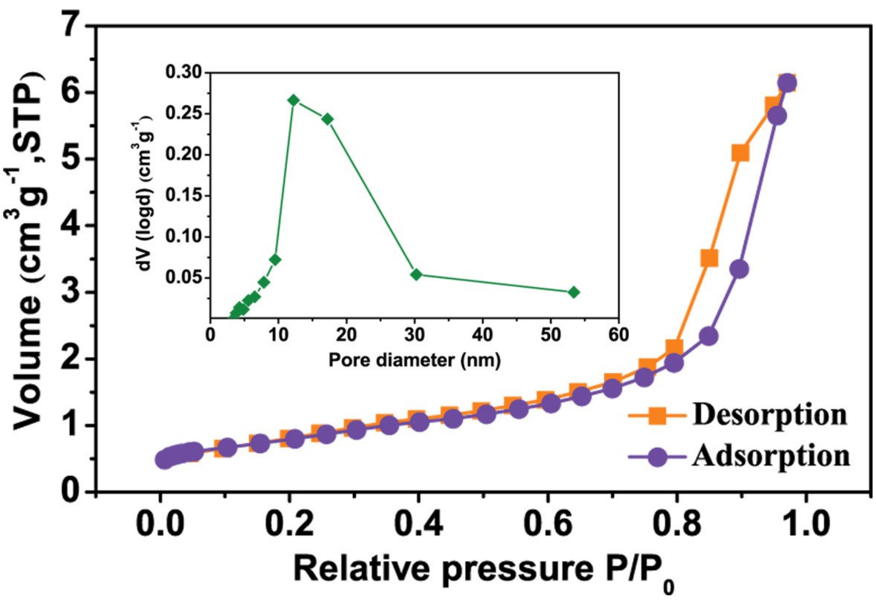

Fig. S3 Nitrogen adsorption-desorption isotherm of $ZnCo_2O_4$/C (Inset, pore size distribution curve).

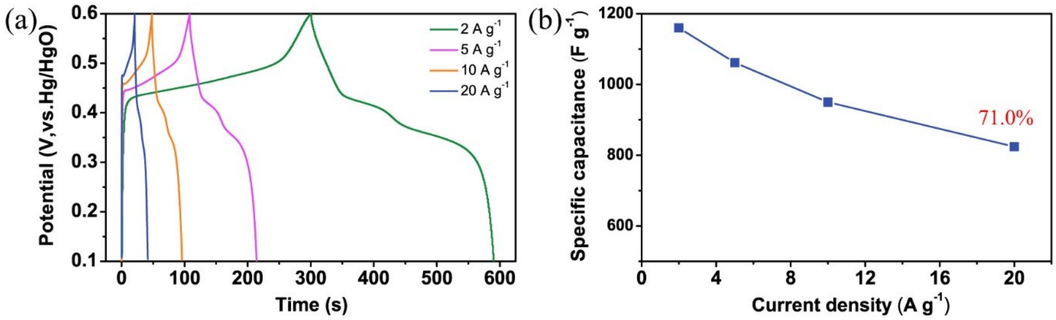

Fig. S4 Galvanostatic charge-discharge curves (a), specific capacitance (b) of pristine $ZnCo_2O_4$ at different current densities.

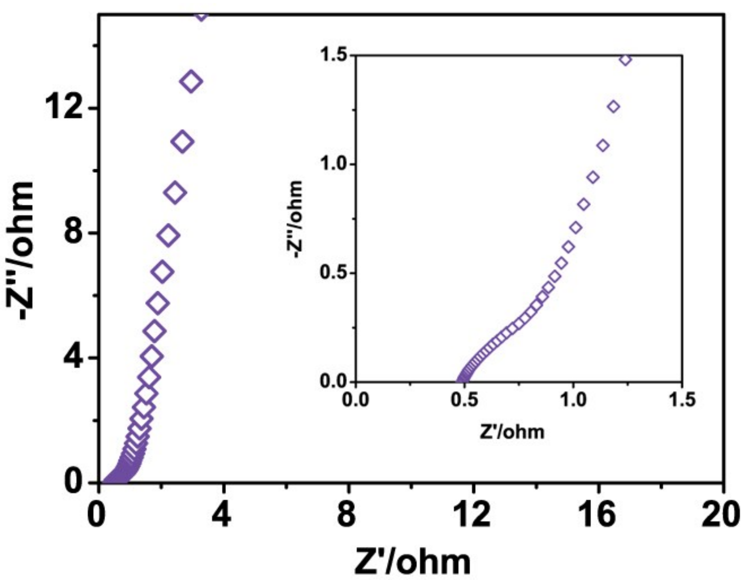

Fig. S5 EIS of pristine $ZnCo_2O_4$.

Table S1 The comparison of the EIS results in this work with the previously reported literatures of similar material for supercapacitors.

Sample	R_s (Ω)	R_{ct} (Ω)	Reference
$ZnCo_2O_4$	1.05	0.62	1
$ZnCo_2O_4$@$Ni_xCo_{2x}(OH)_{6x}$	0.75	1.12	2
$ZnCo_2O_4/MnO_2$	0.72	2.5	3
$ZnCo_2O_4$	1.12	2.55	4
$ZnCo_2O_4$/C	**0.4**	**0.1**	**this work**

Table S2 The specific capacitance of the $ZnCo_2O_4$/C at different current densities.

Current density ($A g^{-1}$)	2	5	10	20
Specific capacitance ($F g^{-1}$)	2064	1821	1680	1600

Table S3 The comparison of the results in this work with the previously reported performance of similar material for supercapacitors.

Sample	Microstructure	Specific capacitance	Cycle stability	Reference
$ZnCo_2O_4$	Hexagonal	846 F g^{-1} at 1 A g^{-1}	464 F g^{-1} at 5 A g^{-1} (95.3%, 5000 cycles)	5
$ZnCo_2O_4$	ring-like	1152 F g^{-1} at 5 A g^{-1}	278 F g^{-1} at 50 mV s^{-1} (83.7%, 3000 cycles)	6
$ZnCo_2O_4$/rGO/NiO	nanowire arrays	1256 F g^{-1} at 3 A g^{-1}	533 F g^{-1} at 25 A g^{-1} (80%, 3000 cycles)	7
$ZnCo_2O_4$	urchin-like microspheres	1842 F g^{-1} at 1 A g^{-1}	1390 F g^{-1} at 10 A g^{-1} (95.8%, 3000 cycles)	8
$ZnCo_2O_4$	porous microspheres	647 F g^{-1} at 1 A g^{-1}	590 F g^{-1} at 1 A g^{-1} (91.5%, 2000 cycles)	9
$ZnCo_2O_4$/$NiCo_2O_4$	core-sheath nanowires	1476 F g^{-1} at 1 A g^{-1}	1040 F g^{-1} at 10 A g^{-1} (98.9%, 2000 cycles)	10
$ZnCo_2O_4$	mesoporous nanoflakes	1220 F g^{-1} at 2 A g^{-1}	1149 F g^{-1} at 2 A g^{-1} (94.2%, 5000 cycles)	4
$ZnCo_2O_4$	nanorods	1400 F g^{-1} at 1 A g^{-1}	1078 F g^{-1} at 6 A g^{-1} (97%, 1000 cycles)	11
$ZnCo_2O_4$/C	**yolk-shell microspheres**	**2064 F g^{-1} at 2 A g^{-1} 1821 F g^{-1} at 5 A g^{-1} 1680 F g^{-1} at 10 A g^{-1} 1600 F g^{-1} at 20 A g^{-1}**	**without any decay, 9000 cycles**	**this work**

Reference

[1] S. Vijayakumar, S. Nagamuthu, S.-H. Lee and K.-S. Ryu, *Int. J. Hydrogen Energy*, 2017, **42**, 3122-3129.

[2] W. Fu, Y. Wang, W. Han, Z. Zhang, H. Zha and E. Xie, *J. Mater. Chem. A*, 2016, **4**, 173-182.

[3] K. Qiu, Y. Lu, D. Zhang, J. Cheng, H. Yan, J. Xu, X. Liu, J.-K. Kim and Y. Luo, *Nano Energy*, 2015, **11**, 687-696.

[4] J. Cheng, Y. Lu, K. Qiu, H. Yan, X. Hou, J. Xu, L. Han, X. Liu, J.-K. Kim and Y. Luo, *Phys. Chem. Chem. Phys.*, 2015, **17**, 17016-17022.

[5] V. Venkatachalam, A. Alsalme, A. Alswieleh and R. Jayavel, *Chem. Eng. J.*, 2017, **321**, 474-483.

[6] G.M. Tomboc, H.S. Jadhav and H. Kim, *Chem. Eng. J.*, 2017, **308**, 202-213.

[7] S. Sahoo and J.-J. Shim, *ACS Sustainable Chem. Eng.*, 2017, **5**, 241-251.

[8] C. Wu, J. Cai, Q. Zhang, X. Zhou, Y. Zhu, L. Li, P. Shen and K. Zhang, *Electrochimica Acta*, 2015, **169**, 202-209.

[9] Q. Wang, L. Zhu, L. Sun, Y. Liu and L. Jiao, *J. Mater. Chem. A*, 2015, **3**, 982-985.

[10] Y. Huang, Y.-E. Miao, H. Lu and T. Liu, *Chem. Eur. J.*, 2015, **21**, 10100-10108.

[11] B. Liu, B. Liu, Q. Wang, X. Wang, Q. Xiang, D. Chen and G. Shen, *ACS Appl. Mater. Interfaces*, 2013, **5**, 10011-10017.