Porous Mo-C Coverage on ZnO Rods for Enhanced Supercapacitive Performance

Li Sun, Yuanxing Zhang, Haochen Si, Yan Shi, Chao Sun, Yihe Zhang**

Beijing Key Laboratory of Materials Utilization of Nonmetallic Minerals and Solid Wastes, National Laboratory of Mineral Materials, School of Materials Science and Technology, China University of Geosciences, Beijing, 100083, PR China

**E-mail: sunli@cugb.edu.cn, zyh@cugb.edu.cn*

Supplementary Figures

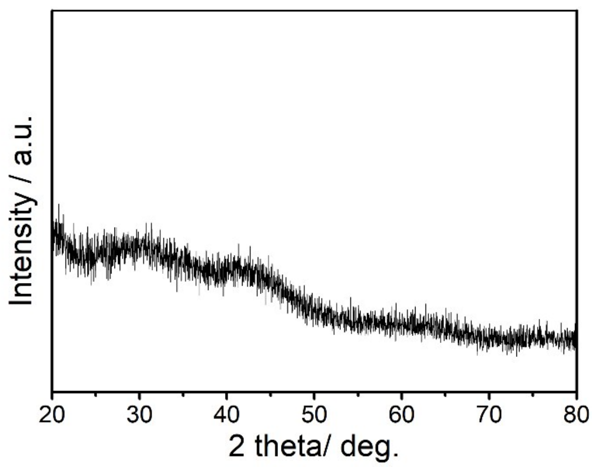


Fig. S1. XRD pattern of Mo-C.

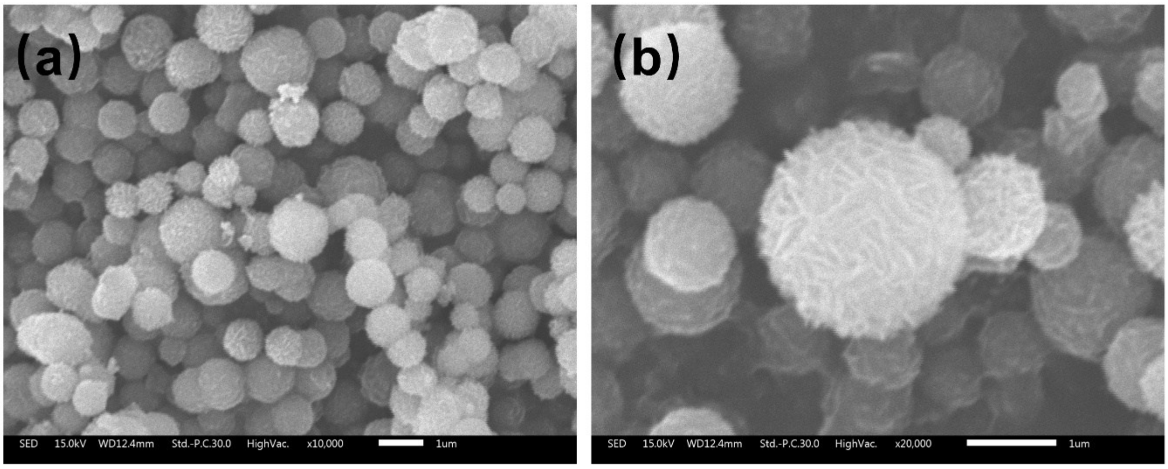
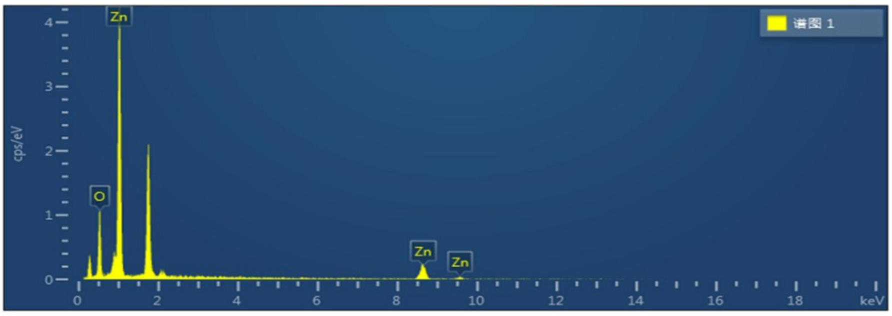
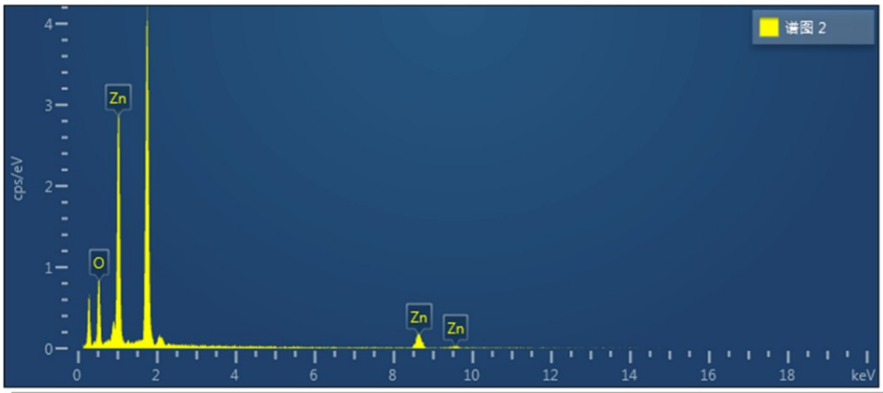


Fig. S2. SEM images of Mo-C at (a) low and (b) high magnification.



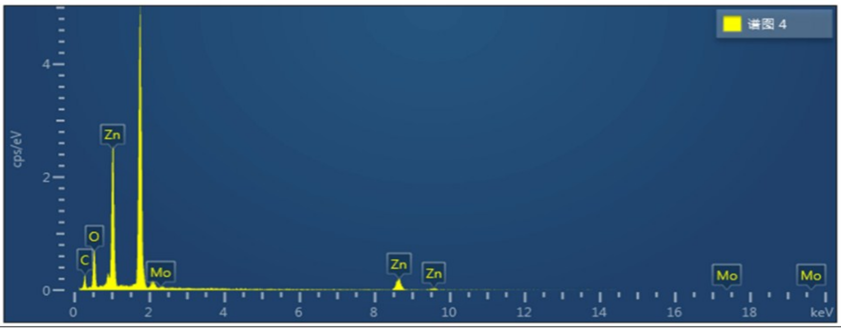
Element	weight %	atom %
O	20.14	50.75
Zn	79.86	49.25

Fig. S3. SEM-EDS spectrum of ZnO.



Element	weight %	atom %
O	22.30	53.97
Zn	77.70	46.03

Fig. S4. SEM-EDS spectrum of ZnO@C.



Element	**weight %**	**atom %**
O	19.40	32.19
Zn	59.57	24.19
C	19.56	43.22
Mo	1.47	0.41

Fig. S5. SEM-EDS spectrum of ZnO@Mo-C.

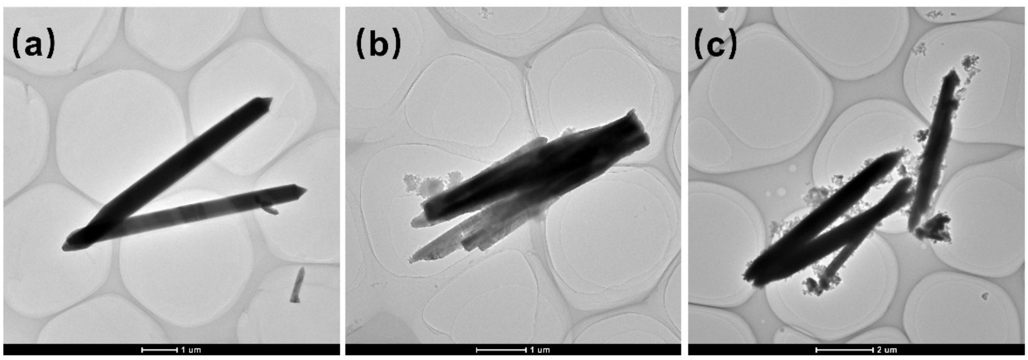


Fig. S6. TEM images of (a) ZnO, (b) ZnO@C and (c) ZnO@Mo-C.

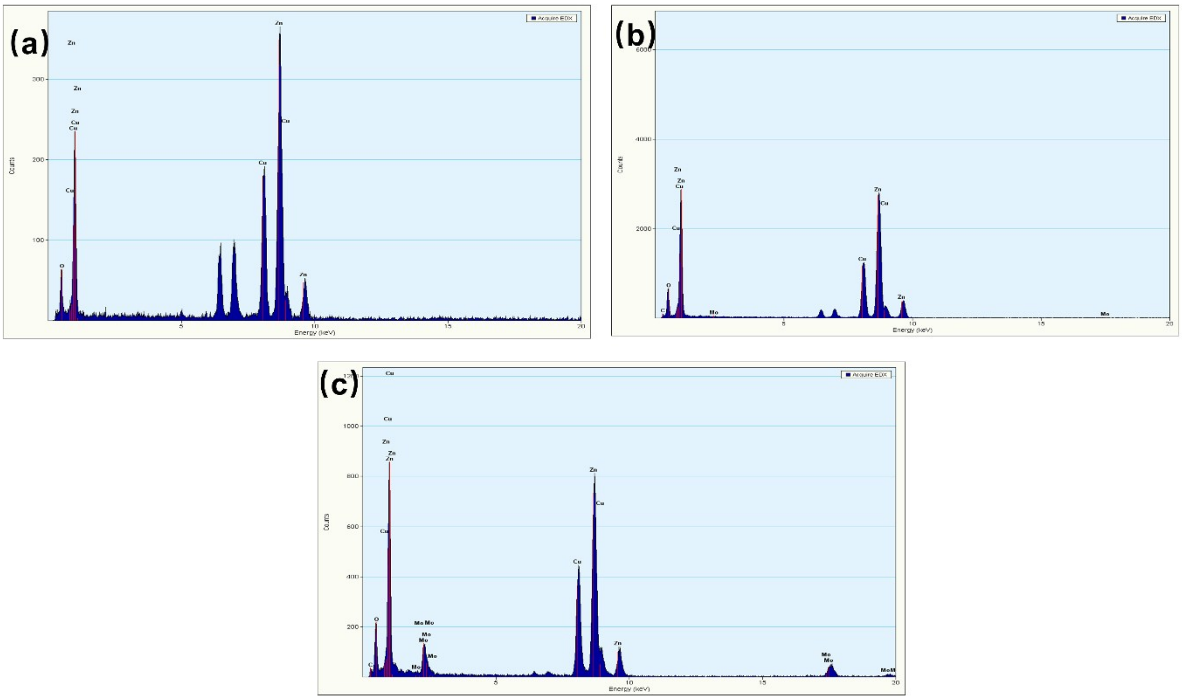


Fig. S7. STEM-EDS spectra of (a) ZnO, (b) ZnO@C and (c) ZnO@Mo-C.

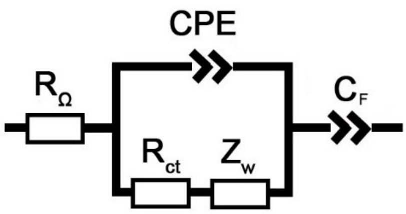


Fig. S8. Equivalent circuit model of the EIS spectra. CPE and C_F were the double layer capacitance and Faraday capacitance.

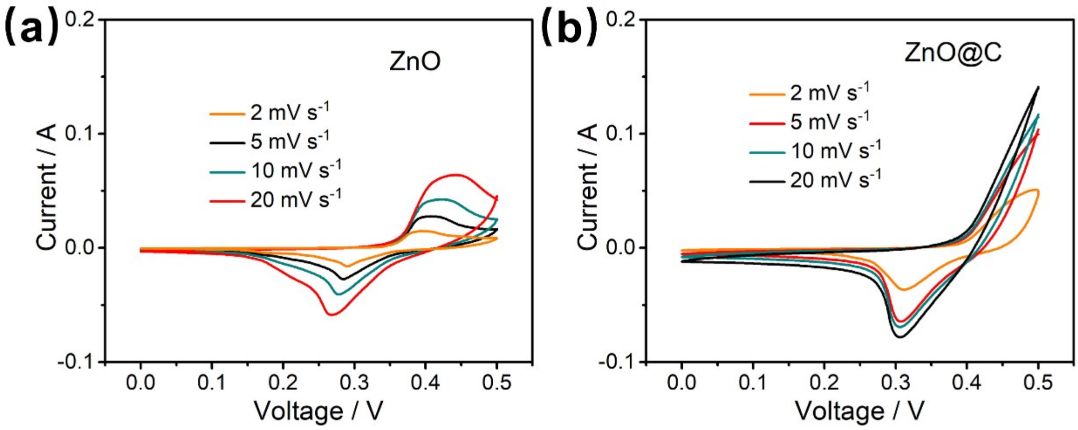


Fig. S9. CV curves of (a) ZnO and (b) ZnO@C.

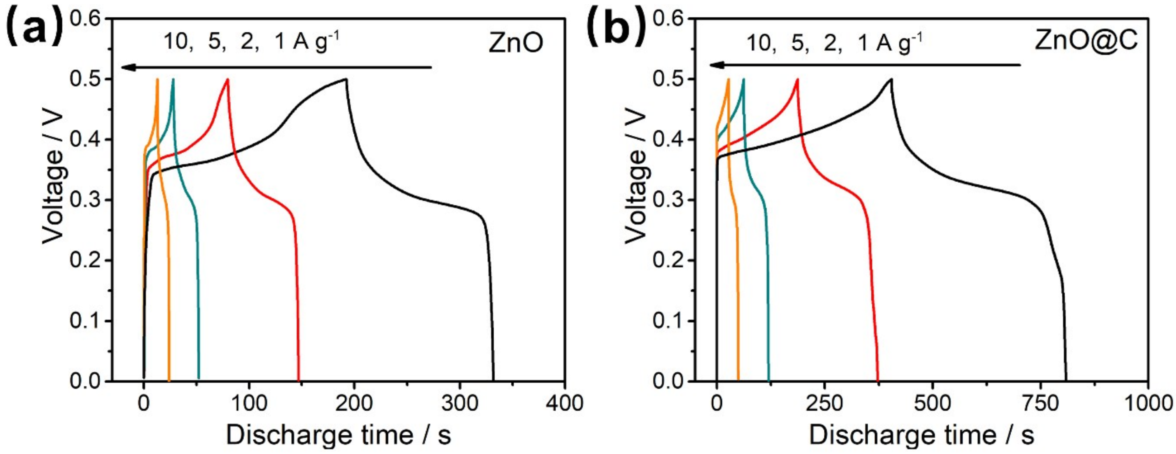


Fig. S10. CV curves of (a) ZnO and (b) ZnO@C.

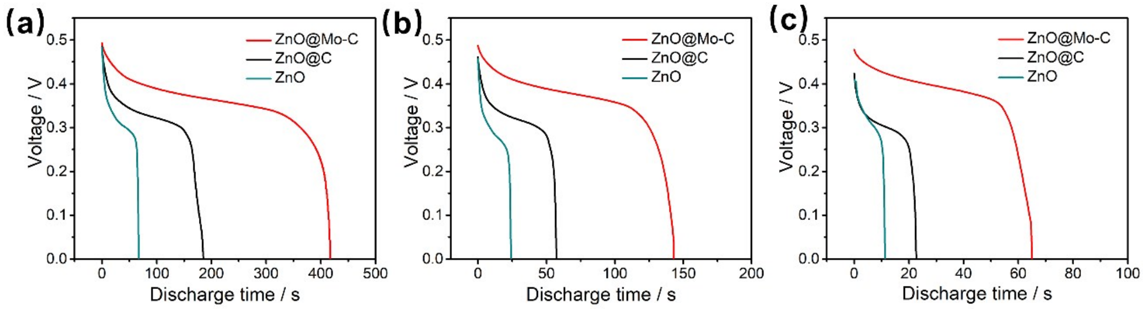


Fig. S11. IR drops at (a) 2 A g^{-1}, (b) 5 A g^{-1} and (c) 10 A g^{-1}.

Table S1. Electric circuit fitting model of the EIS spectra.

Samples	Resistance (Ω)	
	R_{ct}	Z_w
ZnO	1.5	98
ZnO@C	2.21	51
ZnO@Mo-C	2.4	5.92

Table S2 Comparison of this work with previously-reported ZnO based supercapacitor devices.

Electrode material	Energy density ($Wh\ kg^{-1}$)	Power density ($W\ kg^{-1}$)	Ref.
ZnO@Mo-C//AC	30	991.73	This work
ZnO NC//AC	25.2	896.44	1
NZO-12h //AC	27.1	321.42	2
Zn(20)-ACNF	22.7	400	3
$ZnO@MnO_2$//AC	17	393	4
rGO/HTZIF3//rGO	12.4	840	5
PPy/GO/ZnO	10.6	258.2	6
ZnO/carbon nanotube	13.1	792	7
ZnO QDs/C /CNTs// P-N/CNTs	23.6	847	8

References:

1. X. He, J. E. Yoo, M. H. Lee and J. Bae, Nanotechnology, 2017, 28.
2. J. H. Zheng, R. M. Zhang, K. K. Cheng, Z. Q. Xu, P. F. Yu, X. G. Wang and S. F. Niu, Crystals, 2019, 9.
3. C. H. Kim and B. H. Kim, J Power Sources, 2015, 274, 512-520.
4. A. V. Radhamani, K. M. Shareef and M. S. R. Rao, Acs Appl Mater Inter, 2016, 8, 30531-30542.
5. S. Borhani, M. Moradi, M. A. Kiani, S. Hajati and J. Toth, Ceram Int, 2017, 43, 14413-14425.
6. W. K. Chee, H. N. Lim, I. Harrison, K. F. Chong, Z. Zainal, C. H. Ng and N. M. Huang, Electrochim Acta, 2015, 157, 88-94.

7. L. S. Aravinda, K. K. Nagaraja, H. S. Nagaraja, K. U. Bhat and B. R. Bhat, Electrochim Acta, 2013, 95, 119-124.
8. Y. D. Zhang, B. P. Lin, J. C. Wang, J. H. Tian, Y. Sun, X. Q. Zhang and H. Yang, J Mater Chem A, 2016, 4, 10282-10293.