Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Electrospun carbon nanofibers embedded with MOF-derived N-doped porous carbon and ZnO quantum dots for asymmetric flexible supercapacitors

*Zhen Li [a, *], Jingting Bu [a], Chenying Zhang [a], Lingli Cheng [a, *], Dengyu Pan [b], Zhiwen Chen [a] and Minghong Wu [b, *]*

[a] *Shanghai Applied Radiation Institute, Shanghai University, Shanghai, 200444, PR China*

[b] *School of Environmental and Chemical Engineering, Shanghai University, Shanghai, 201800, PR China*

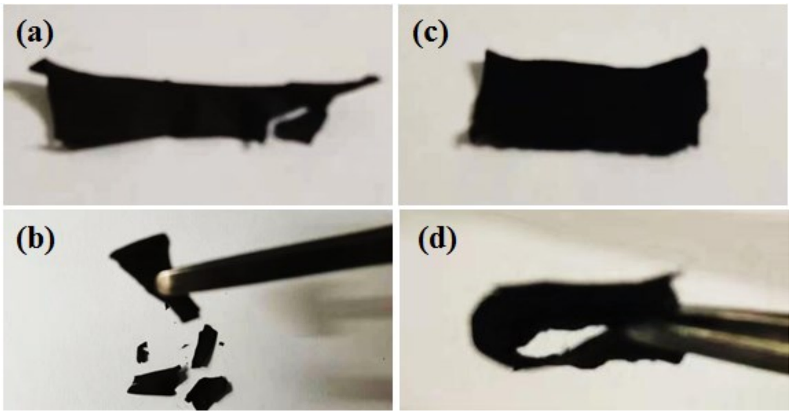

Fig. S1. (a, b) Photographs of CNF membrane before and after bending. (c, d) Photographs of ZnO QD/NPC/CNF membrane before and after bending.

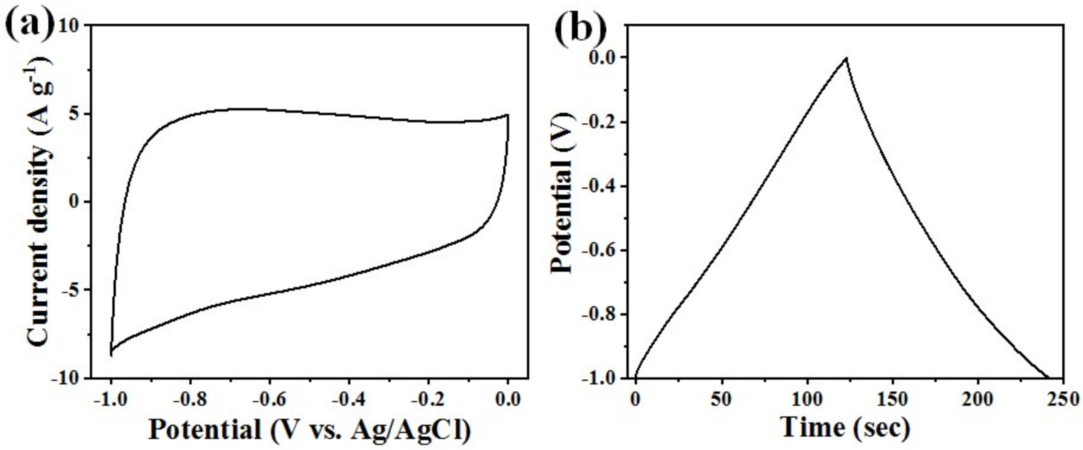

Fig. S2. Electrochemical performance of CNFs (a) CV curve at 20 mV s^{-1}. (b) GCD curve at 1 A g^{-1}.

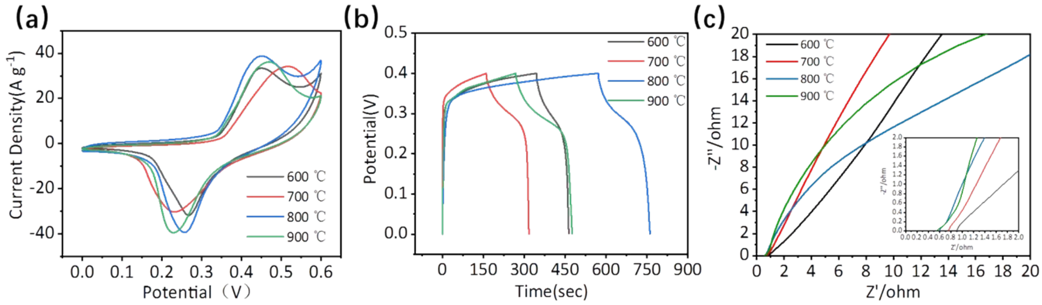

Fig. S3. The evaluated optimum temperature condition of ZnO QD/NPC/CNF.

Table. S1. Pore characteristics of the CNFs, ZnO QD/NPC/CNF and NPC/CNF.

Sample	S_{BET} (m^2 g^{-1})	V_{Total} (cm^3 g^{-1})	V_{Micro} (cm^3 g^{-1})	Pore size(nm)
CNFs	32.1	0.17	0.007	5.2
ZnO QD/NPC/CNF	111.3	0.48	0.02	4.7
NPC/CNF	586.5	0.64	0.17	4.4

Table. S2. The maximum energy density and power density of previously reported asymmetric supercapacitors.

Supercapacitors	Energy density ($W\ h\ kg^{-1}$)	Power density ($kW\ kg^{-1}$)
This work	33.8	16
ZnO QD/carbon/CNTs//porous N-doped carbon/CNTs [1]	23.6	16.9
CNO-ZnO//ZnO [2]	10	8.1
ZnO NC//AC [3]	25.2	2
rGO/Co_3O_4/ZnO//rGO [4]	12.4	8.5
CC/ZnO@C@NiO CSNAs//commercial grapheme [5]	35.7	2.7
Mo:ZnO@NF//AC@NF [6]	39	7.4
ZnO/α-Fe_2O_3//ZnO/C [7]	41.2	7

[1] Y. Zhang, B. Lin, J. Wang, J. Tian, Y. Sun, X. Zhang, H. Yang, All-solid-state asymmetric supercapacitors based on ZnO quantum dots/carbon/CNT and porous N-doped carbon/CNT electrodes derived from a single ZIF-8/CNT template, Journal of Materials Chemistry A 4 (2016) 10282-10293.

[2] D. Mohapatra, S. Parida, S. Badrayyana, B.K. Singh, High performance flexible asymmetric CNO-ZnO//ZnO supercapacitor with an operating voltage of 1.8 V in aqueous medium, Applied Materials Today 7 (2017) 212-221.

[3] X. He, J.E. Yoo, M.H. Lee, J. Bae, Morphology engineering of ZnO nanostructures for high performance supercapacitors: enhanced electrochemistry of ZnO nanocones compared to ZnO nanowires, Nanotechnology 28 (2017) 245402.

[4] S. Borhani, M. Moradi, M.A. Kiani, S. Hajati, J. Toth, Co_xZn_{1-x} ZIF-derived binary Co_3O_4/ZnO wrapped by 3D reduced graphene oxide for asymmetric supercapacitor: Comparison of pure and heat-treated bimetallic MOF, Ceramics International 43 (2017) 14413-14425.

[5] Y. Ouyang, X. Xia, H. Ye, L. Wang, X. Jiao, W. Lei, Q. Hao, Three-Dimensional Hierarchical Structure ZnO@C@NiO on Carbon Cloth for Asymmetric Supercapacitor with Enhanced Cycle Stability, ACS Applied Materials & Interfaces 10 (2018) 3549-3561.

[6] A. Ali, M. Ammar, M. Ali, Z. Yahya, M.Y. Javaid, S.u. Hassan, T. Ahmed, Mo-doped ZnO nanoflakes on Ni-foam for asymmetric supercapacitor applications, RSC Advances 9 (2019) 27432-27438.

[7] D. Sarkar, S. Das, S. G, B. Pal, H. Rensmo, A. Shukla, D.D. Sarma, A Cost-Effective and High-Performance Core-Shell-Nanorod-Based ZnO/α-Fe_2O_3//ZnO/C Asymmetric Supercapacitor, Journal of The Electrochemical Society 164 (2017) A987-A994.