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

Hollow Nanocages of Vanadium Nitride Based Electrode Material Designed for Superior Charging/Discharging Stability Supercapacitors

Hao Dang, Lu Wang, Yuanyou Peng, Tianqi He, Fen Ran*

State Key Laboratory of Advanced Processing and Recycling of Non-ferrous Metals, School of Materials Science and Engineering, Lanzhou University of Technology, Lanzhou 730050, Gansu, P. R. China

**Corresponding author: ranfen@lut.edu.cn, or ranfen@163.com*

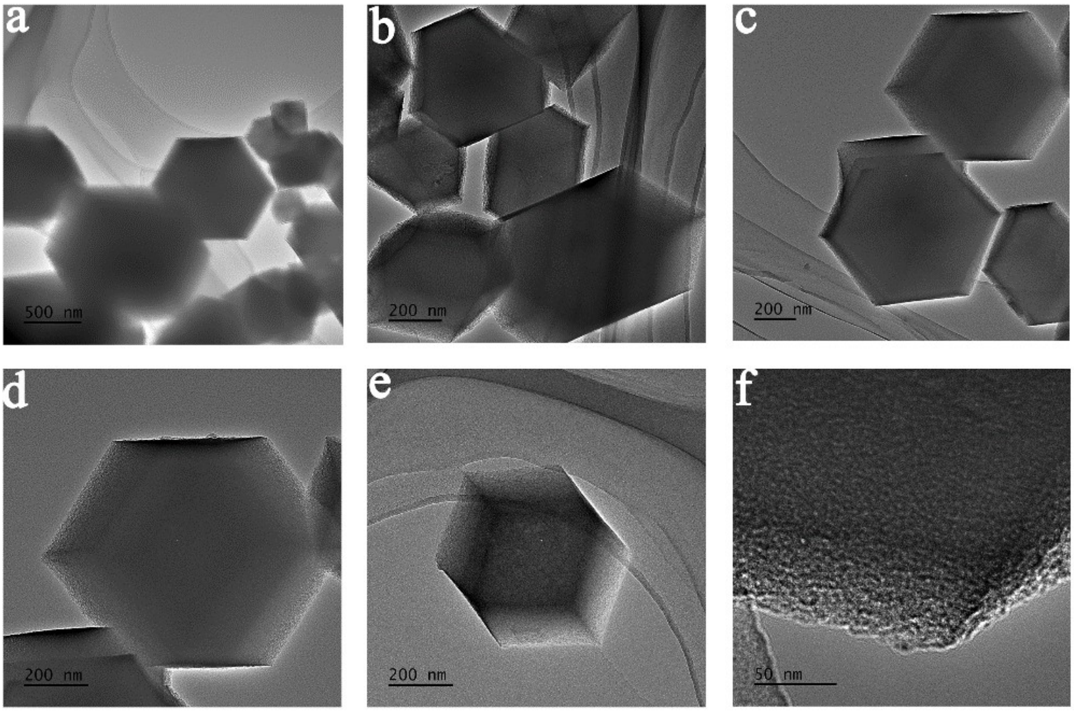


Figure S1. *a-f) TEM images of ZIF-8.*

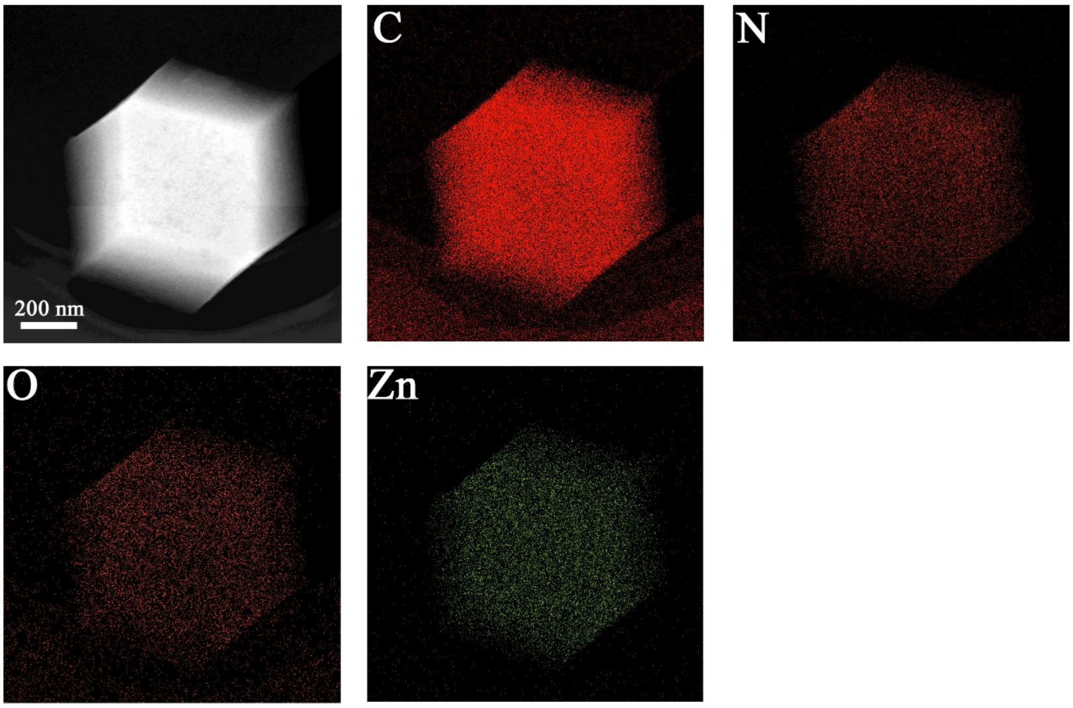
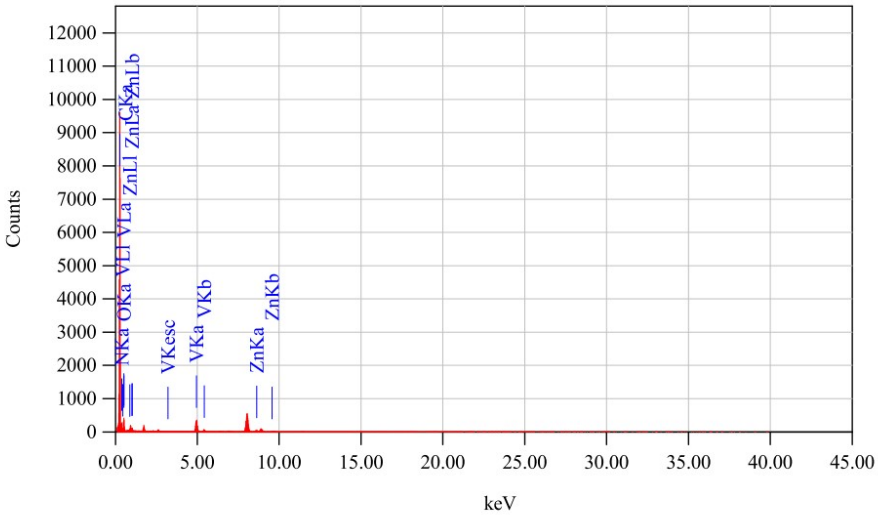


Figure S2. *TEM-EDS mapping analysis of ZIF-8.*



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Thin Film Standardless  Standardless Quantitative Analysis
Fitting Coefficient : 0.2211
Element         (keV)    Mass%     Counts    Sigma    Atom%  Compound    Mass%  Cation          K
 C K  (Ref.)    0.277    92.29   50274.25     0.37    95.51                                1.0000
 N K !          0.392     2.58    2077.85     0.08     2.29                                0.6760
 O K !          0.525     1.83    1954.78     0.07     1.42                                0.5110
 V K            4.949     2.73    4387.62     0.09     0.67                                0.3388
Zn K            8.630     0.57     574.46     0.05     0.11                                0.5438
Total                   100.00                       100.00
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Figure S3. *TEM-EDS mapping quantity analysis of ZIF-8@VN-CH_3CH_2OH.*

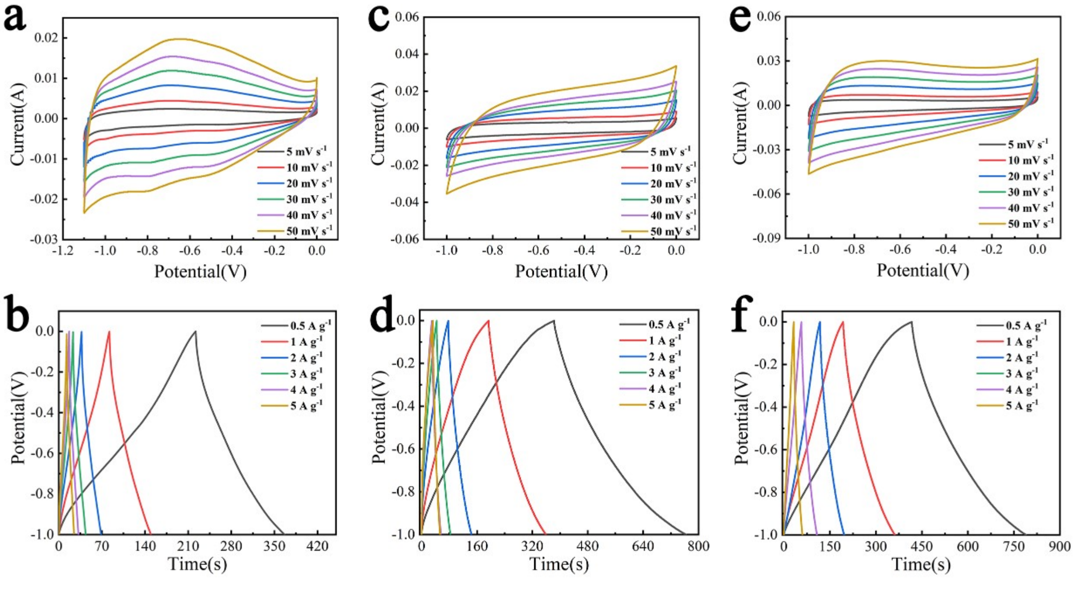

Figure S4. *CV curves at various scan rates from 5-50 mV s^{-1} of a) VN, c) ZIF-8, and e) ZIF-8@VN-H_2O. GCD curves at different current densities from 0.5-5 A g^{-1} of b) VN, d) ZIF-8, and f) ZIF-8@VN-H_2O.*

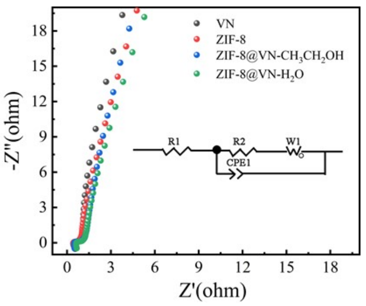

Figure S5. *EIS impedance modelling of different materials.*

Table S1. *Specific capacitance at different sweep speeds.*

Scan Rate Materials	0.005 mV S^{-1}	0.01 mV S^{-1}	0.02 mV S^{-1}	0.03 mV S^{-1}	0.04 mV S^{-1}	0.05 mV S^{-1}
VN	73.8 F g^{-1}	71.0 F g^{-1}	65.9 F g^{-1}	63.8 F g^{-1}	62.2 F g^{-1}	61.1 F g^{-1}
ZIF-8	143.9 F g^{-1}	123.4 F g^{-1}	102.9 F g^{-1}	90.6 F g^{-1}	81.5 F g^{-1}	84.6 F g^{-1}
ZIF-8@VN-CH_3CH_2OH	232.4 F g^{-1}	219.5 F g^{-1}	204.5 F g^{-1}	193.7 F g^{-1}	185.2 F g^{-1}	175.1 F g^{-1}
ZIF-8@VN-H_2O	161.8 F g^{-1}	149.4 F g^{-1}	136.8 F g^{-1}	128.8 F g^{-1}	122.8 F g^{-1}	117.8 F g^{-1}

Table S2 *EIS combined with equivalent circuit fitting results.*

Sample	Rs (Ω)	Rct (Ω)	Zw (Ω)
VN	0.77	1.4×10^{-5}	3.18
ZIF-8	0.48	0.53	0.03
ZIF-8@VN-CH_3CH_2OH	0.45	0.52	0.06
ZIF-8@VN-H_2O	0.63	0.18	0.89

Table S3 *Performance comparison of supercapacitor devices assembled with different* *vanadium nitride electrode materials in the literature.*

Anode materials	ASC device	Vanadium source	Power density and energy density	Reference
ZIF-8@VN-CH_3CH_2OH	ZIF-8@VN-CH_3CH_2OH//$Ni(OH)_2$	VCl_3	3875 W Kg^{-1} and 30.9 Wh Kg^{-1}	This work
VNQDs/PC	VNQDs/PC//$Co(OH)_2$	NH_4VO_3	4231.1 W Kg^{-1} and 29.7 Wh Kg^{-1}	[1]
VN-MWCNT	VN-MWCNT//MnO_2	V_2O_5	316.2 W Kg^{-1} and 13.3 Wh Kg^{-1}	[2]
VN/CNP	VN/CNP//VN/CNP	NH_4VO_3	283.15 W Kg^{-1} and 8 Wh Kg^{-1}	[3]
VN/NC	VN/NCS2//$NiCoS_4$	NH_4VO_3	802 W Kg^{-1} and 21 Wh Kg^{-1}	[4]
Nano-VN/IPC	Nano-VN/IPC// $Ni(OH)_2$	NH_4VO_3	3625 W Kg^{-1} and 20.2 Wh Kg^{-1}	[5]
VN/NCS	VN/NCS//V_2O_3/C	NH_4VO_3	801 W Kg^{-1} and 19.8 Wh Kg^{-1}	[6]

Reference:

[1] Yang Y, Zhao L, Shen K, et al. Ultra-small vanadium nitride quantum dots embedded in porous carbon as high performance electrode materials for capacitive energy storage[J]. Journal of Power Sources, 2016, 333: 61-71.

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[4] Jiang X, Lu W, Li Y, et al. An Eco-Friendly Nitrogen Source for the Preparation of Vanadium Nitride/Nitrogen-Doped Carbon Nanocomposites for Supercapacitors[J]. Chemelectrochem, 2019, 6(13): 3445-3453.

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[6] Jiang X, Lu W, Yu X, et al. Fabrication of a vanadium nitride/N-doped carbon hollow nanosphere composite as an efficient electrode material for asymmetric supercapacitors[J]. Nanoscale Advances, 2020, 2(9): 3865-3871.