

High-capacity Vanadium Nitride Anode Materials by Melamine-assisted Pyrolysis

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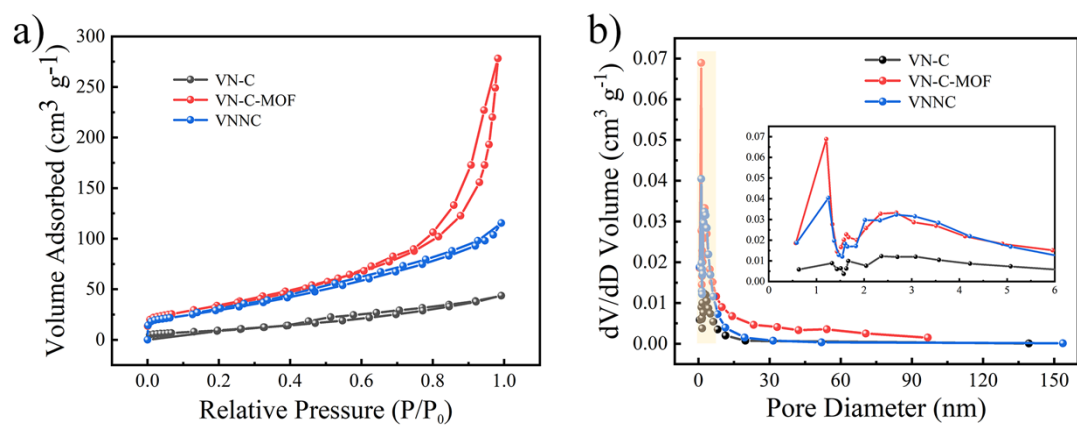


Figure S1. a) Isothermal nitrogen adsorption-desorption curves, b) Pore size distribution curves.

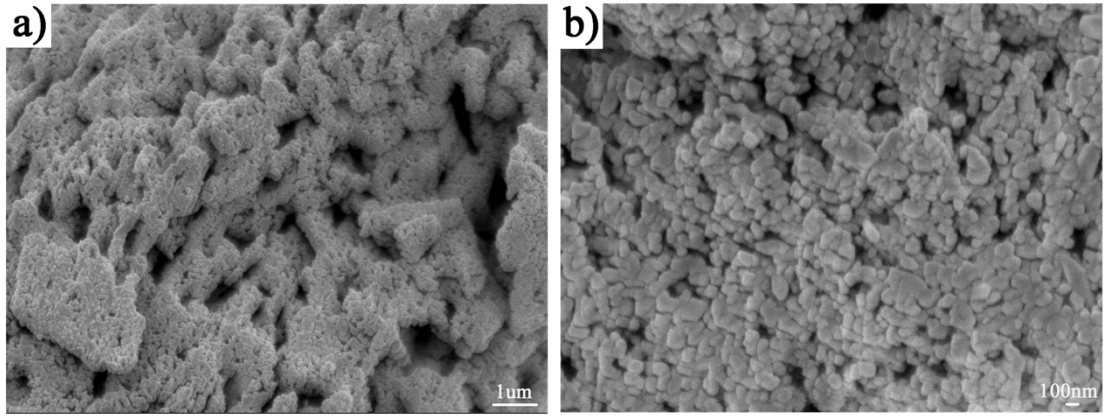


Figure S2. SEM image of VN at different magnifications.

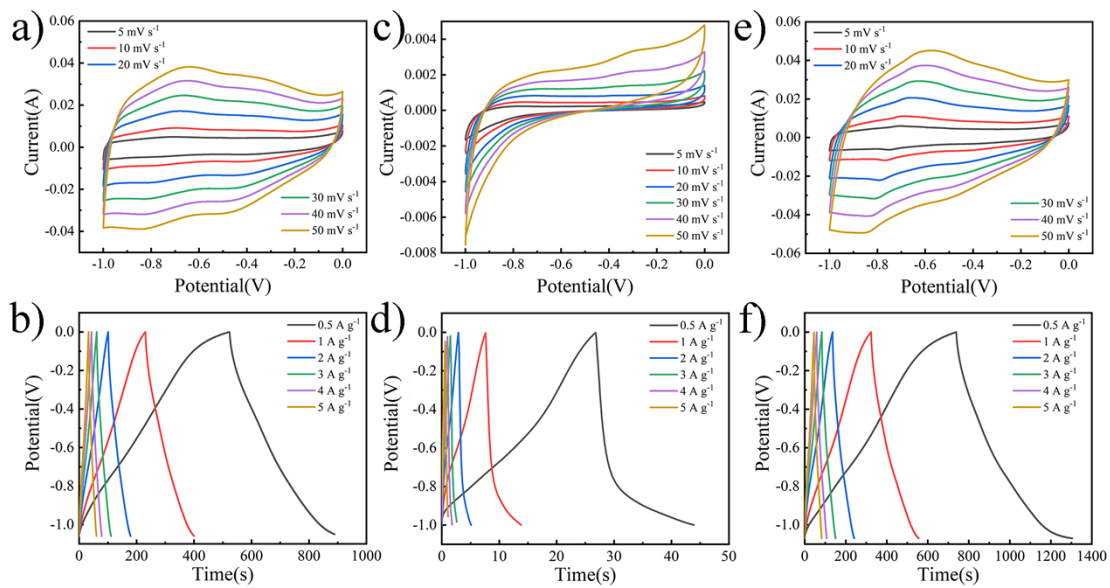


Figure S3. a), c), and e) CV curves of VN-C, VN-C-MOF, and VNNC at different scan rates. b), d), and f) GCD curves of VN-C, VN-C-MOF, and VNNC at different current densities.

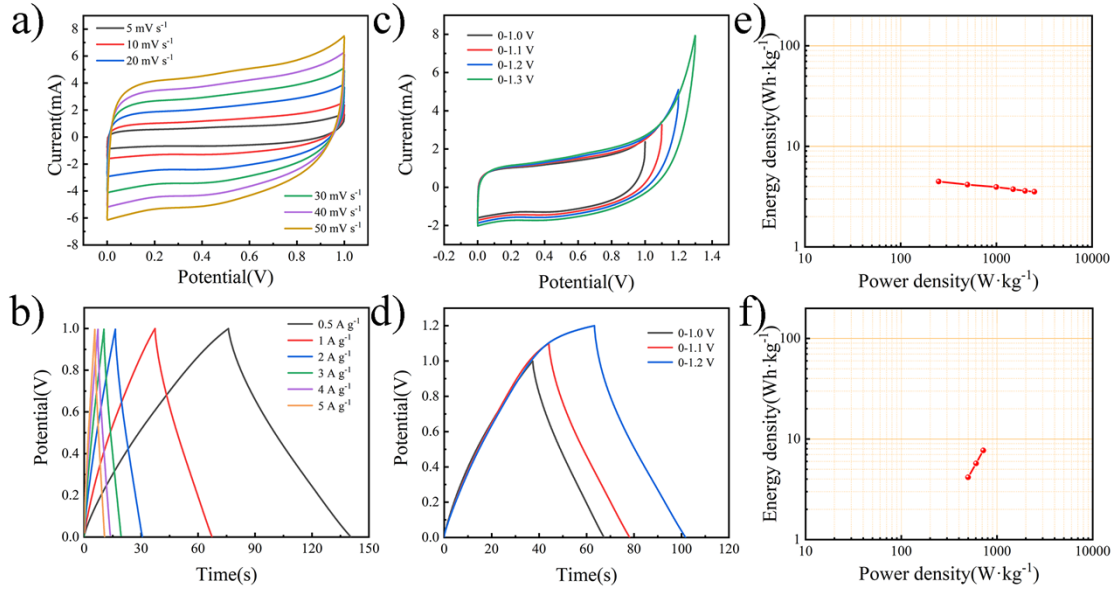


Figure S4. a) CV curves at various scan rates from 5 to 50 mV s^{-1} , b) GCD curves at different current densities ranging from 0.5 to 5 A g^{-1} . c-d) CV and GCD curves after widening the potential window. e), f) Ragone plots of the device.

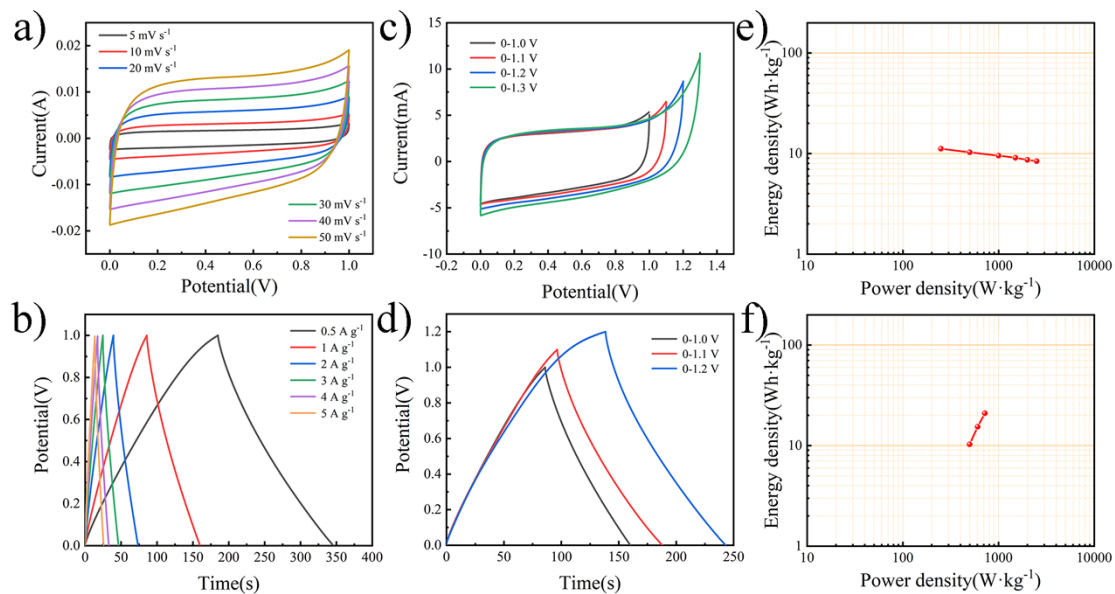


Figure S5. a) CV curves at various scan rates from 5 to 50 mV s^{-1} , b) GCD curves at different current densities ranging from 0.5 to 5 A g^{-1} . c-d) CV and GCD curves after widening the potential window. e), f) Ragone plots of the device.

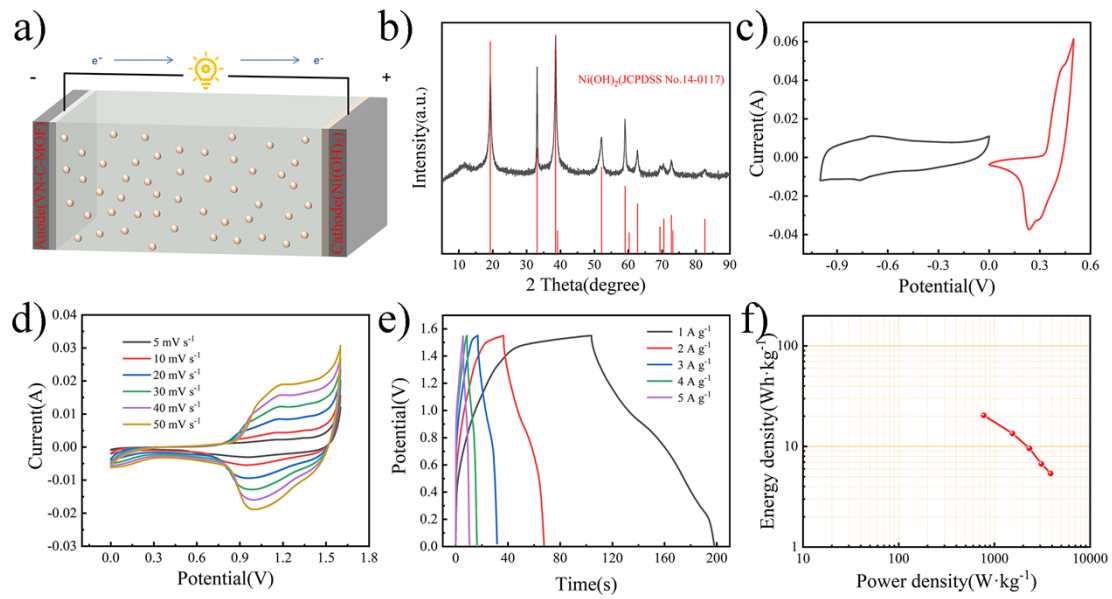


Figure S6. a) Schematic diagram of an asymmetric device. b) XRD patterns of Ni(OH)₂. c) CV curve comparison diagram of VNNC and Ni(OH)₂ at 10 mV s⁻¹. d) CV curves at different scan rates from 5 to 50 mV s⁻¹, e) GCD curves at different current densities ranging from 1 to 5 A g⁻¹, and f) Ragone plots of the device.

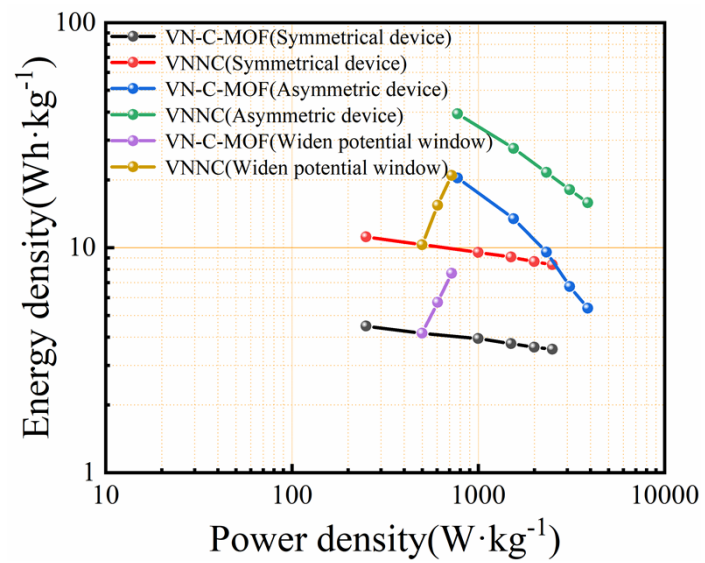


Figure S7. Comparison of energy and power density of VN-C-MOF and VNNC in different devices and current densities.

Table S1. Specific surface area and pore parameters of VN-C, VN-C-MOF, and VNNC.

Samples	S _{BET} (m ² g ⁻¹)	V _p (cm ³ g ⁻¹)	V _{Mic} (cm ³ g ⁻¹)	Micropores (%)	Mesopores and macropores (%)
VN-C	32.934	0.083	0.0104	11.13	88.87
VN-C-MOF	121.674	0.459	0.0456	9.04	90.96
VNNC	106.669	0.198	0.0389	16.40	83.60

Table S2. Specific capacity of VN, VN-C, V-MOF, VN-C-MOF and VNNC at different current densities.

Materials	Current density					
	0.5 A g ⁻¹	1 A g ⁻¹	2 A g ⁻¹	3 A g ⁻¹	4 A g ⁻¹	5 A g ⁻¹
VN	72.1 F g ⁻¹	67.5 F g ⁻¹	63.6 F g ⁻¹	61.5 F g ⁻¹	60.0 F g ⁻¹	58.0 F g ⁻¹
VN-C	174.1 F g ⁻¹	159.7 F g ⁻¹	146.8 F g ⁻¹	139.3 F g ⁻¹	133.6 F g ⁻¹	128.8 F g ⁻¹
V-MOF	8.6 F g ⁻¹	6.2 F g ⁻¹	4.4 F g ⁻¹	3.3 F g ⁻¹	3.2 F g ⁻¹	2.5 F g ⁻¹
VN-C-MOF	263 F g ⁻¹	216.8 F g ⁻¹	196.3 F g ⁻¹	187.7 F g ⁻¹	180.2 F g ⁻¹	175.7 F g ⁻¹
VNNC	407.5 F g ⁻¹	333.0 F g ⁻¹	289.9 F g ⁻¹	272.8 F g ⁻¹	258.7 F g ⁻¹	249.1 F g ⁻¹

Table S3. Energy and power density of VN-C-MOF symmetric devices at different current densities.

Current density	0.5 A g ⁻¹	1 A g ⁻¹	2 A g ⁻¹	3 A g ⁻¹	4 A g ⁻¹	5 A g ⁻¹
C (F g ⁻¹)	32.25 F g ⁻¹	30.0 F g ⁻¹	28.4 F g ⁻¹	27.0 F g ⁻¹	26.0 F g ⁻¹	25.5 F g ⁻¹
E (Wh Kg ⁻¹)	4.48 Wh Kg ⁻¹	4.17 Wh Kg ⁻¹	3.94 Wh Kg ⁻¹	3.75 Wh Kg ⁻¹	3.61 Wh Kg ⁻¹	3.54 Wh Kg ⁻¹
P (W Kg ⁻¹)	250 W Kg ⁻¹	500 W Kg ⁻¹	1000 W Kg ⁻¹	1500 W Kg ⁻¹	2000 W Kg ⁻¹	2500 W Kg ⁻¹

Table S4. Energy and power density of VN-C-MOF symmetric devices in a widened potential window.

Potential window	C (F g ⁻¹)	E (Wh Kg ⁻¹)	P (W Kg ⁻¹)
1.0 V	30.0 F g ⁻¹	4.17 Wh Kg ⁻¹	500.00 W Kg ⁻¹
1.1 V	34.0 F g ⁻¹	5.71 Wh Kg ⁻¹	605.00 W Kg ⁻¹
1.2 V	38.5 F g ⁻¹	7.7 Wh Kg ⁻¹	720.00 W Kg ⁻¹

Table S5. Energy and power density of VNNC symmetric devices at different current densities.

Current density	0.5 A g ⁻¹	1 A g ⁻¹	2 A g ⁻¹	3 A g ⁻¹	4 A g ⁻¹	5 A g ⁻¹
C (F g ⁻¹)	80.4 F g ⁻¹	72.2 F g ⁻¹	68.6 F g ⁻¹	65.4 F g ⁻¹	62.4 F g ⁻¹	60.5 F g ⁻¹
E (Wh Kg ⁻¹)	11.2 Wh Kg ⁻¹	10.3 Wh Kg ⁻¹	9.5 Wh Kg ⁻¹	9.1 Wh Kg ⁻¹	8.7 Wh Kg ⁻¹	8.4 Wh Kg ⁻¹
P (W Kg ⁻¹)	250 W Kg ⁻¹	500 W Kg ⁻¹	1000 W Kg ⁻¹	1500 W Kg ⁻¹	2000 W Kg ⁻¹	2500 W Kg ⁻¹

Table S6. Energy and power density of VNNC symmetric devices in a widened potential window.

Potential window	C (F g ⁻¹)	E (Wh Kg ⁻¹)	P (W Kg ⁻¹)
1.0 V	72.2 F g ⁻¹	10.31 Wh Kg ⁻¹	500.00 W Kg ⁻¹
1.1 V	91.7 F g ⁻¹	15.41 Wh Kg ⁻¹	605.00 W Kg ⁻¹
1.2 V	104.7 F g ⁻¹	20.94 Wh Kg ⁻¹	720.00 W Kg ⁻¹

Table S7. Energy and power density of VN-C-MOF asymmetric devices at different current densities.

Current density	1 A g ⁻¹	2 A g ⁻¹	3 A g ⁻¹	4 A g ⁻¹	5 A g ⁻¹
C (F g ⁻¹)	61.10 F g ⁻¹	40.26 F g ⁻¹	28.65 F g ⁻¹	20.13 F g ⁻¹	16.13 F g ⁻¹
E (Wh Kg ⁻¹)	20.39 Wh Kg ⁻¹	13.43 Wh Kg ⁻¹	9.56 Wh Kg ⁻¹	6.72 Wh Kg ⁻¹	5.38 Wh Kg ⁻¹
P (W Kg ⁻¹)	775 W Kg ⁻¹	1550 W Kg ⁻¹	2325 W Kg ⁻¹	3100 W Kg ⁻¹	3875 W Kg ⁻¹

Table S8. Energy and power density of VNNC asymmetric devices at different current densities.

Current density	1 A g ⁻¹	2 A g ⁻¹	3 A g ⁻¹	4 A g ⁻¹	5 A g ⁻¹
C (F g ⁻¹)	117.74 F g ⁻¹	82.71 F g ⁻¹	64.65 F g ⁻¹	54.19 F g ⁻¹	47.42 F g ⁻¹
E (Wh Kg ⁻¹)	39.29 Wh Kg ⁻¹	27.6 Wh Kg ⁻¹	21.57 Wh Kg ⁻¹	18.08 Wh Kg ⁻¹	15.82 Wh Kg ⁻¹
P (W Kg ⁻¹)	775 W Kg ⁻¹	1550 W Kg ⁻¹	2325 W Kg ⁻¹	3100 W Kg ⁻¹	3875 W Kg ⁻¹