Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Electronic Supplementary Information

Nitridation-boosted V e_g occupation of VN@CNT flexible electrode for high-rate Zn-ion hybrid supercapacitors

Yuyang Cao[a], Shiqiang Wei [a,*],Yujian Xia[a], Quan Zhou[a], Yixiu Wang[a], Wenjie Xu[a], Changda Wang[a], Shuangming Chen[a,*], Li Song[a]

[a]National Synchrotron Radiation Laboratory, CAS Center for Excellence in Nanoscience, University of Science and Technology of China, Hefei 230029, P. R. China.

Email: sqw@ustc.edu.cn; csmp@ustc.edu.cn

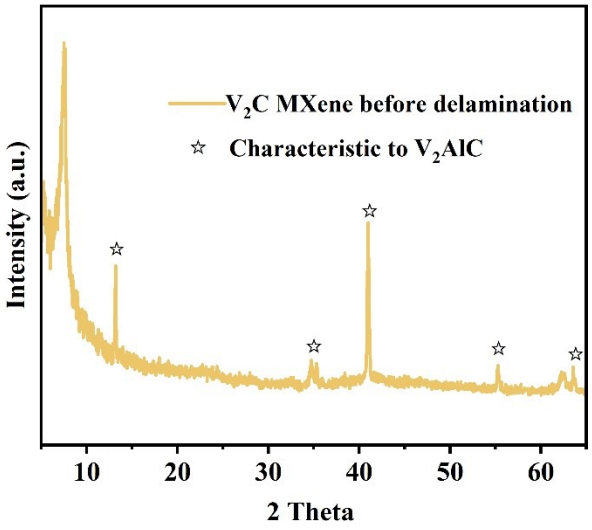

Figure S1. XRD pattern of V_2C MXene before delamination

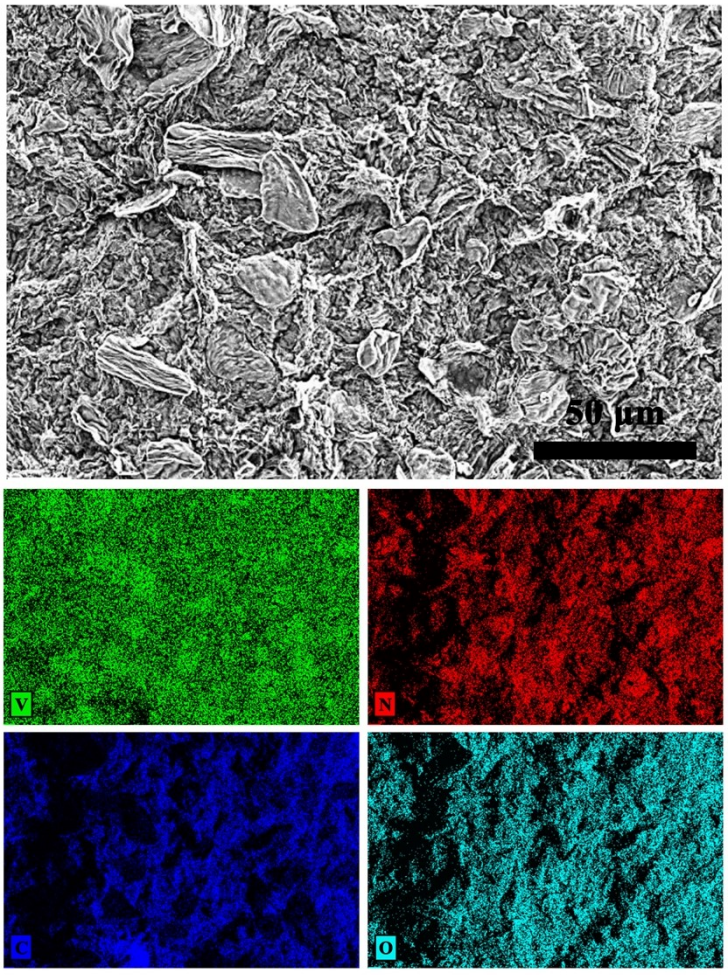

Figure S2. SEM image of VN@CNT membrane and corresponding elemental mapping image of V, N, C, O.

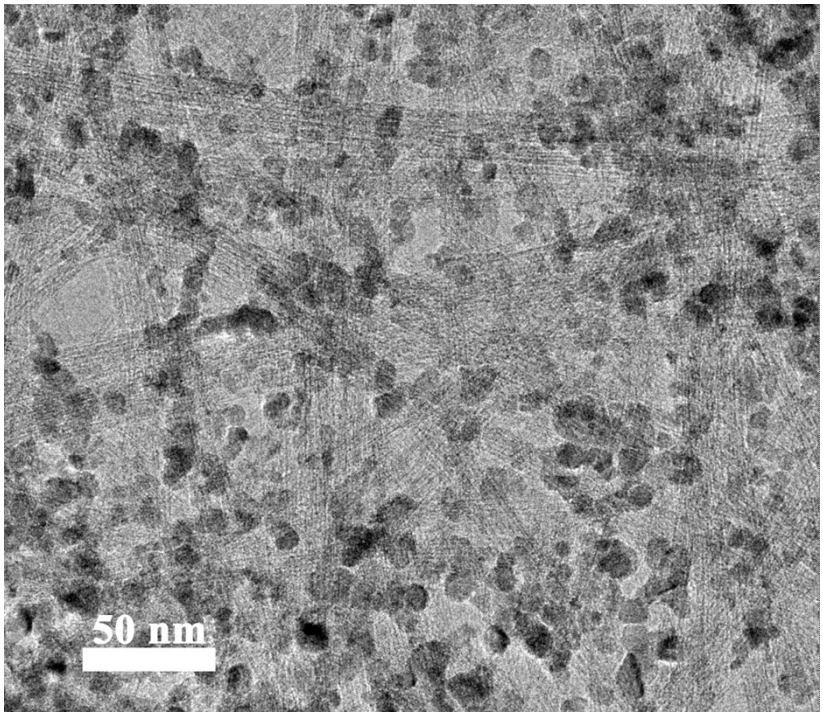

Figure S3. TEM image of VN@CNT.

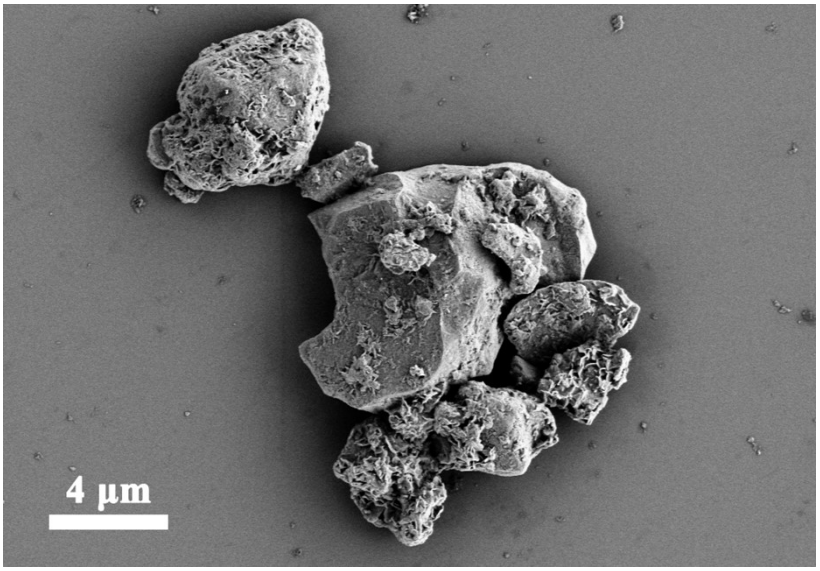

Figure S4. SEM image of C-VN.

The calculation of resistivity is based on the **Perloff** equation:

$\rho = WK_aR_a$

$K_a = \pi/ln2$

R_a is Resistivity, W is thickness.

Membrane	W (μm)	R_a (Ω)	ρ(Ω m)	σ(S/m)
VN@CNT	9.9	0.9	4.04E-05	2.48E+04
V_2C@CNT	8.5	11.81	4.55E-04	2.20E+03

Table S1. The thickness, resistance, resistivity, and conductivity of VN@CNT and V_2C@CNT.

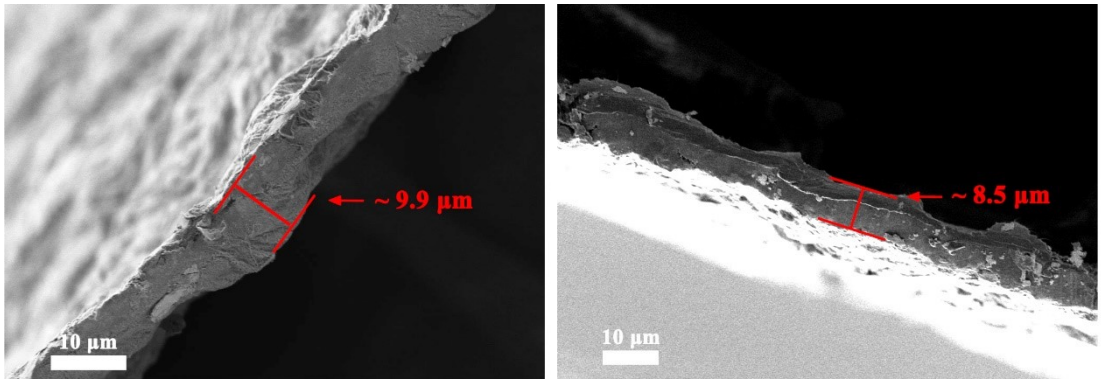

Figure S5. SEM image of cross-section of VN@CNT and V_2C@CNT flexible membrane.

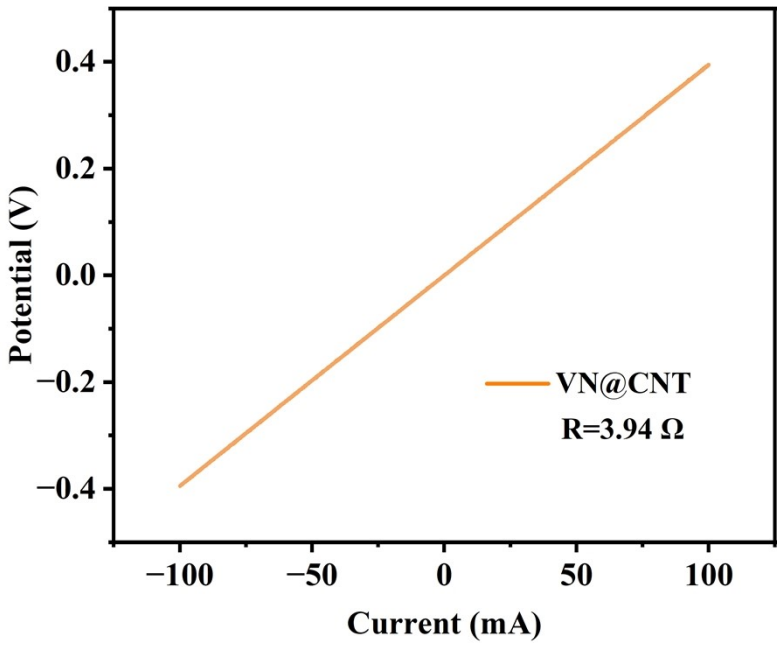

Figure S6. I-V curves of VN@CNT.

The resistivity can also be given from the following equation, and IV test, I-V test is used as a supplementary method to obtain the conductivity of VN@CNT.

$$\sigma = \frac{L}{R\,S}$$

R is Resistivity obtained from I-V test, L is length of VN@CNT membrane, S is the cross-sectional area of VN@CNT membrane.

Membrane	R(Ω)	L(mm)	S(m^2)	σ(S/m)
VN@CNT	3.94	2.00	2.87E-08	1.76E+4

Table S2. Conductivity calculation process parameters.

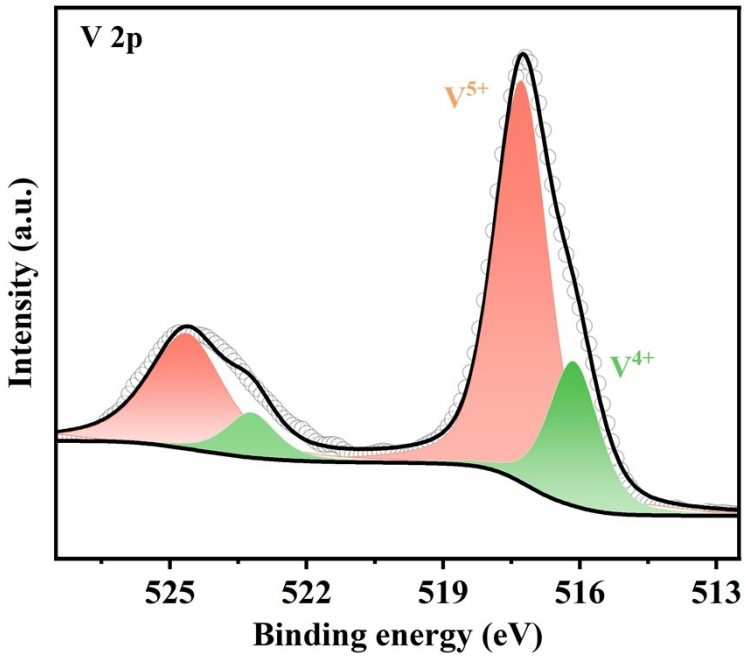

Figure S7. High-resolution V 2p XPS spectra of V_2C@CNT.

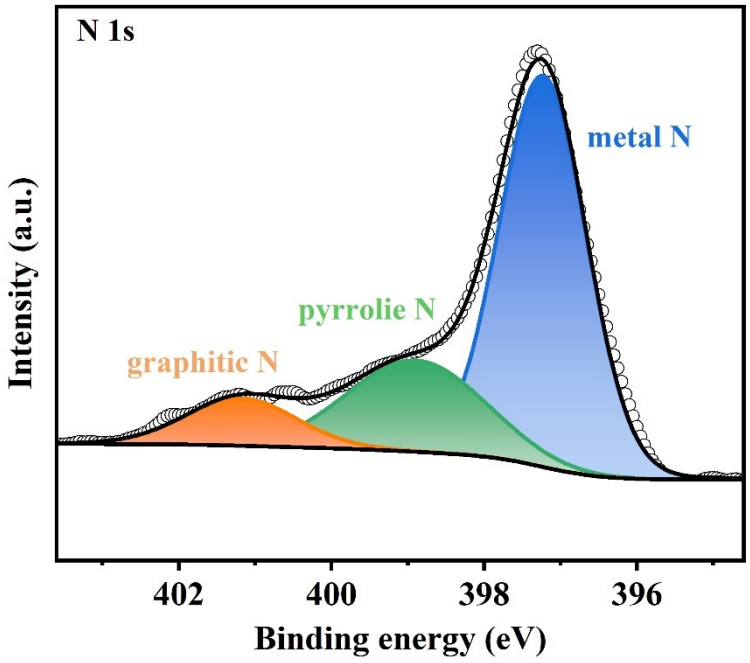

Figure S8. High-resolution N 1s XPS spectra of VN@CNT.

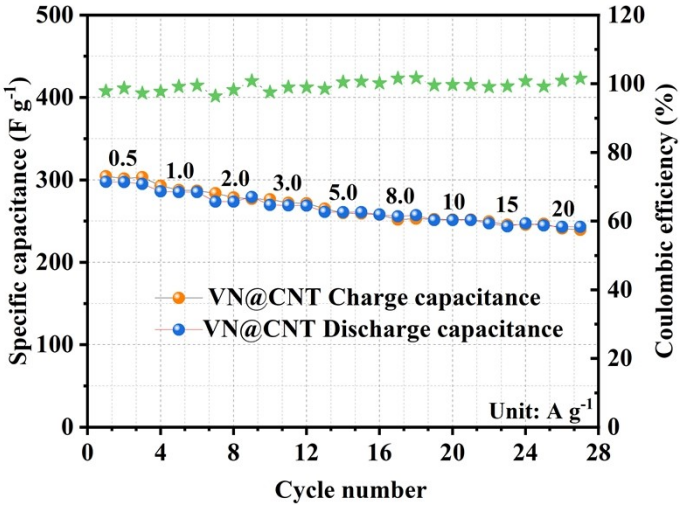

Figure S9. Rate capability at wider range of current densities of VN@CNT.

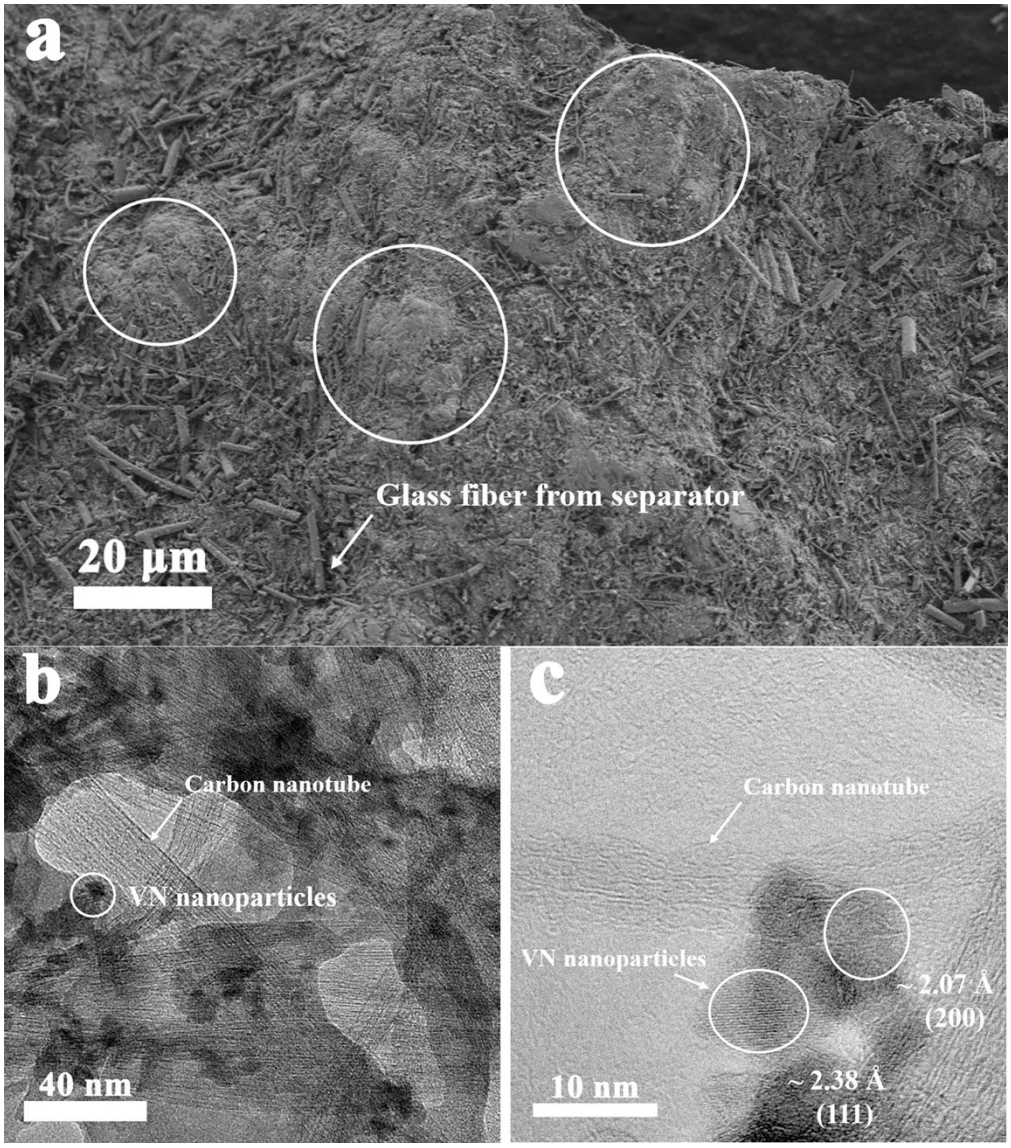

Figure S10. (a) SEM, (b) TEM, and (c) HRTEM images of VN@CNT after 500 charge-discharge cycles.

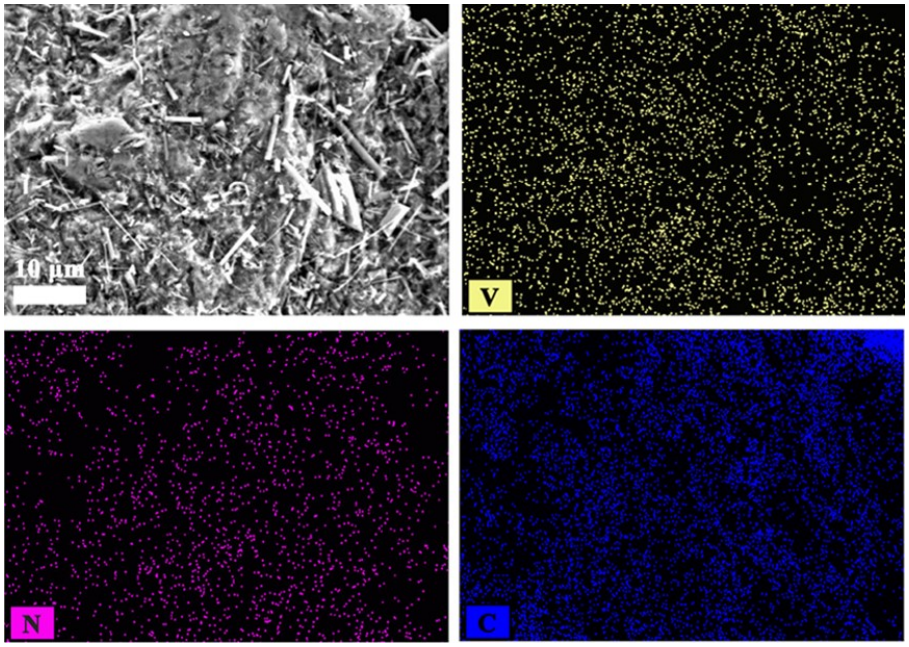

Figure S11. EDS mapping images of post-cycling VN@CNT of V, N, C.

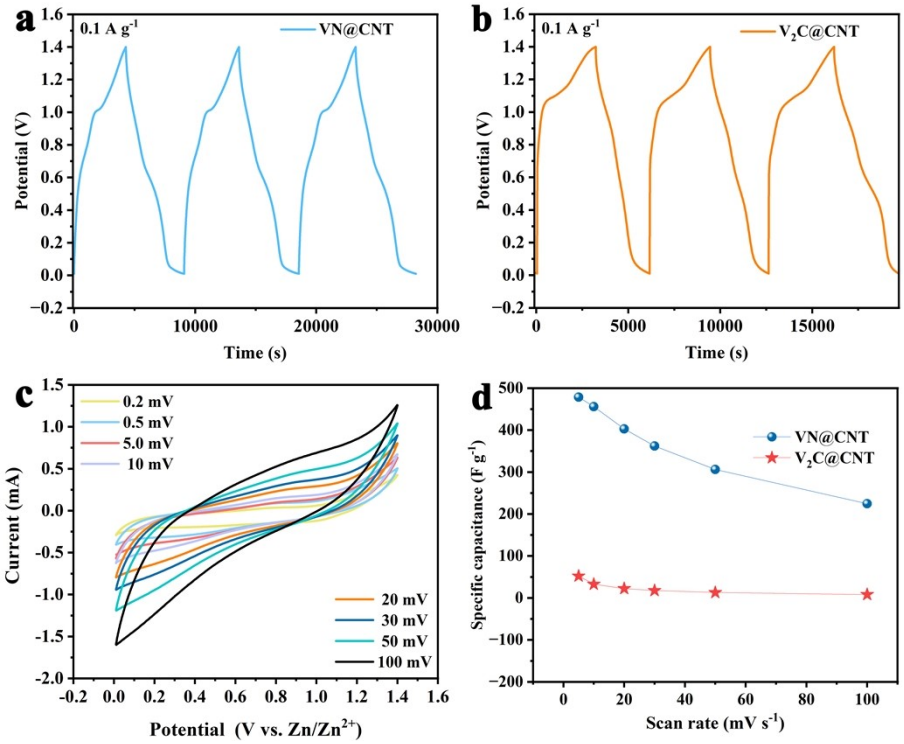

Figure S12. Electrochemical performance of the VN@CNT and V_2C@CNT cathode for ZHSCs. GCD curves of (a) VN@CNT, and (b) V_2C@CNT at the density of 0.1 A g^{-1}. (c) CV curves V_2C@CNT of at the scan rate of 0.2 to 100 mV s^{-1} of V_2C@CNT. (d) Specific capacitance calculated from CV curves of VN@CNT and V_2C@CNT.

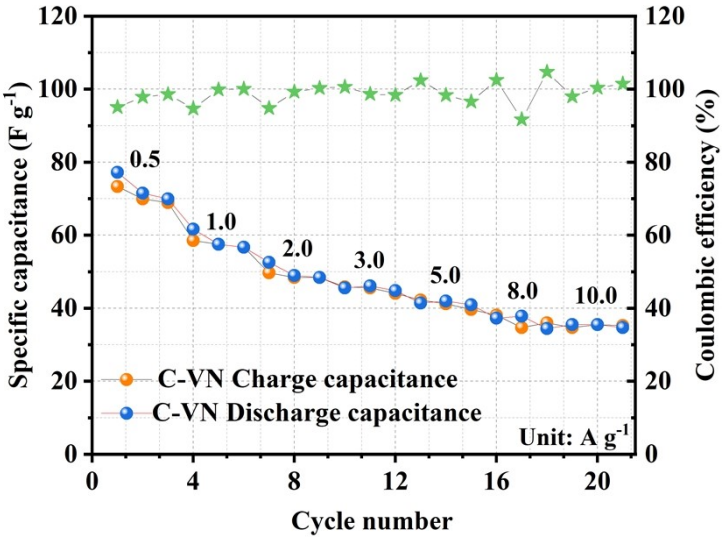

Figure S13. Rate capability at different current densities of C-VN.

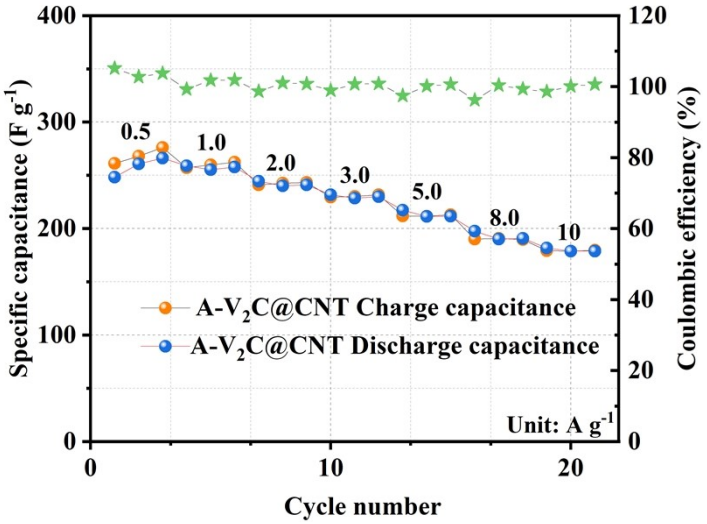

Figure S14. Rate capability at different current densities of A-V_2C@CNT.