Supplementary Information (SI) for RSC Advances.

Supporting Information

Innovative 2D Dioxonium Vanadium Oxide: Enhancing Stability in Aqueous Zinc-Ion Battery Cathodes

Yannis De Luna,[1] Zakiah Mohamed[2], Abdulilah Dawoud,[3] Nasr Bensalah[3,*]

[1] Materials Science and Technology Graduate Program, Department of Physics and Materials Science, Qatar University, Doha 2713, Qatar
[2] Faculty of Applied Science, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia
[3]Department of Chemistry and Earth Sciences, College of Arts and Science, Qatar University, PO Box 2713, Doha, Qatar
*Corresponding author: nasr.bensalah@qu.edu.qa

Table S1. The estimated crystallite size of each crystal plane detected in XRD for as-prepared $V_3O_8(H_3O)_2$ cathode material.

Crystal plane	2θ (degrees)	D (nm)
(001)	15.97	250.7
(111)	21.51	210.6
(120)	22.38	126.6
(021)	25.55	182.0
(121)	27.57	142.1
(220)	28.24	320.0
(130)	31.82	322.7
(002)	32.17	353.3
(131)	35.76	107.0
(230)	36.71	76.6
(122)	39.53	90.2

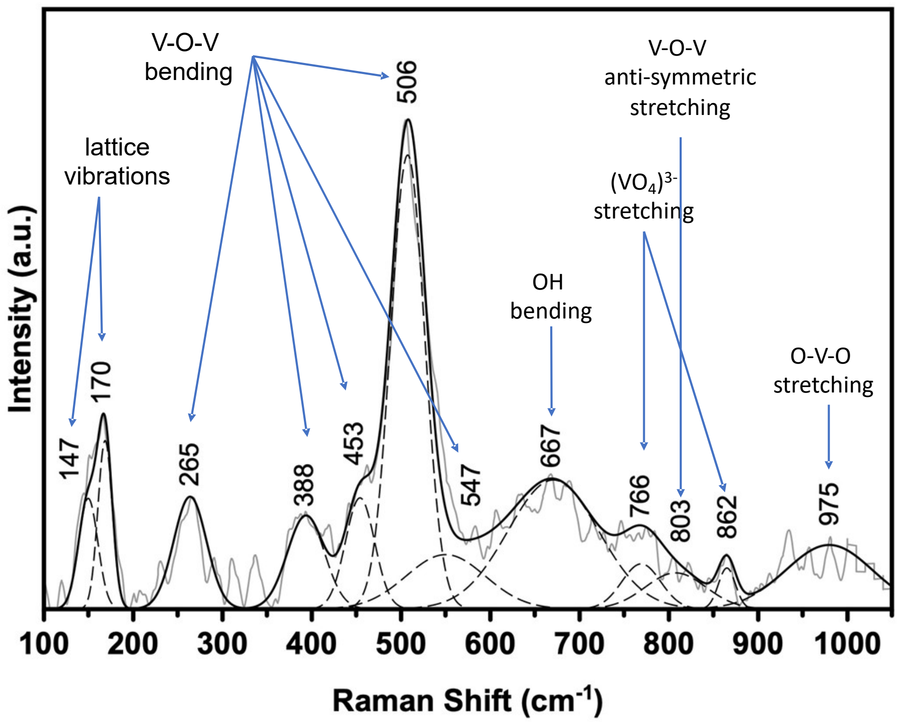

Figure S1. Raman spectrum of as-prepared VO-H_3O cathode material.

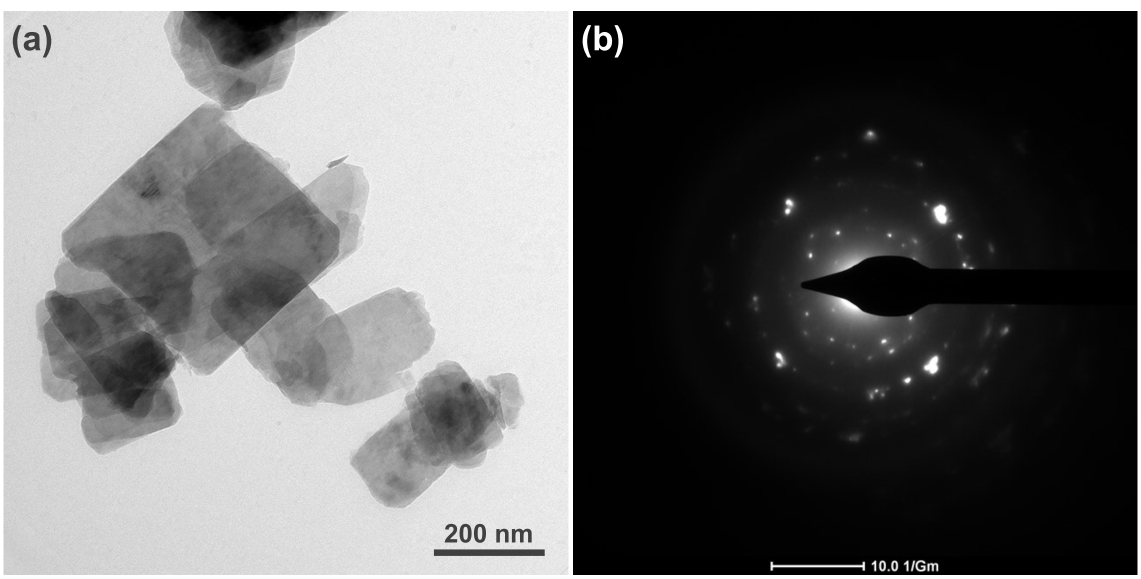

Figure S2. (a) TEM image and (b) SAED pattern of as-prepared layered VO-H_3O cathode material.

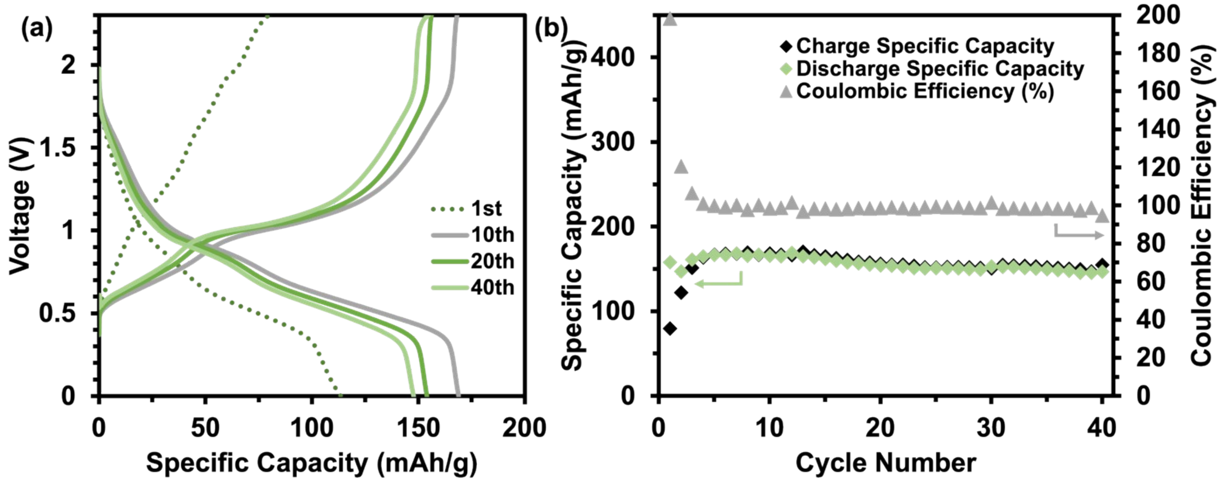

Figure S3. (a) GCD curves and (b) cycling performance of VO-H_3O in half-cells against Zn/Zn^{2+} with 3 M $ZnSO_4.7H_2O$ aqueous electrolytes at 0.1 A g^{-1}.

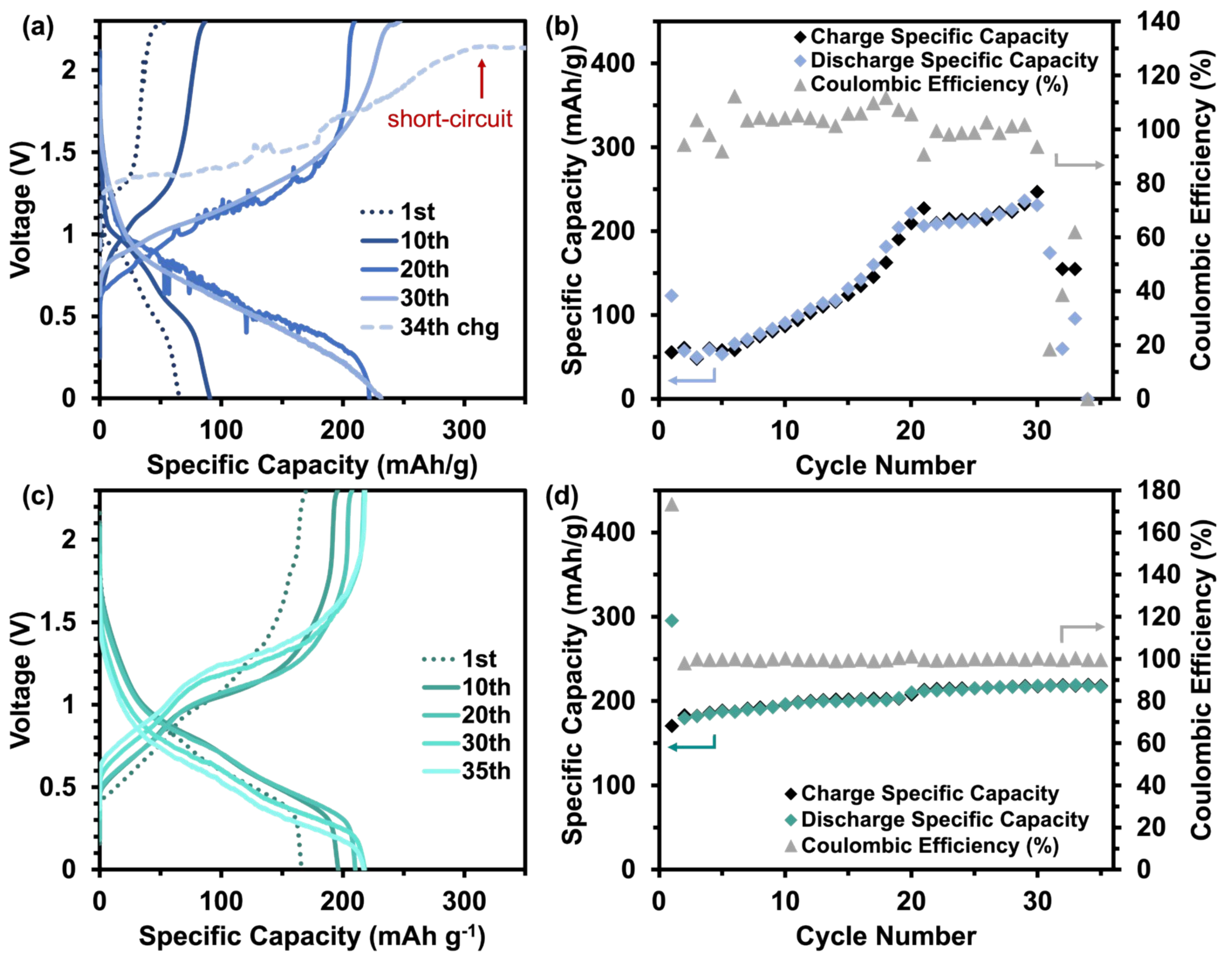

Figure S4. GCD curves and cycling performance of (a,b) V_2O_5 and (c,d) VO-H_3O in half-cells against Zn/Zn^{2+} with 3 M $Zn(CF_3SO_3)_2$ aqueous electrolyte at 0.05 A g^{-1}.

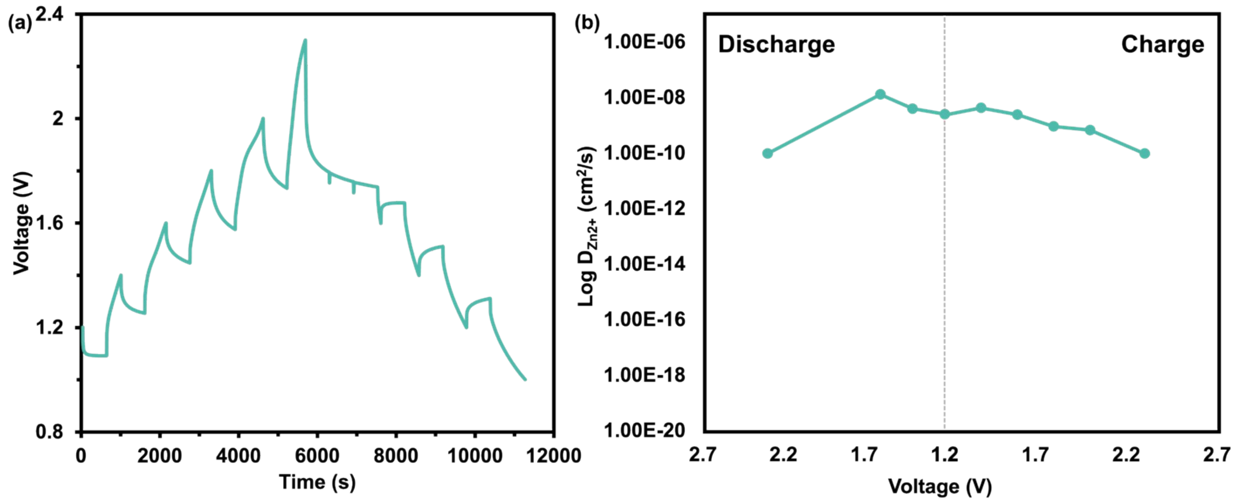

Figure S5. (a) GITT profile of VO-H_3O in half-cells against Zn/Zn^{2+} with 3 M $Zn(CF_3SO_3)_2$ aqueous electrolyte at 0.05 A g^{-1} and (b) plot of diffusion coefficient of Zn^{2+} ions against voltage during discharge and charge.

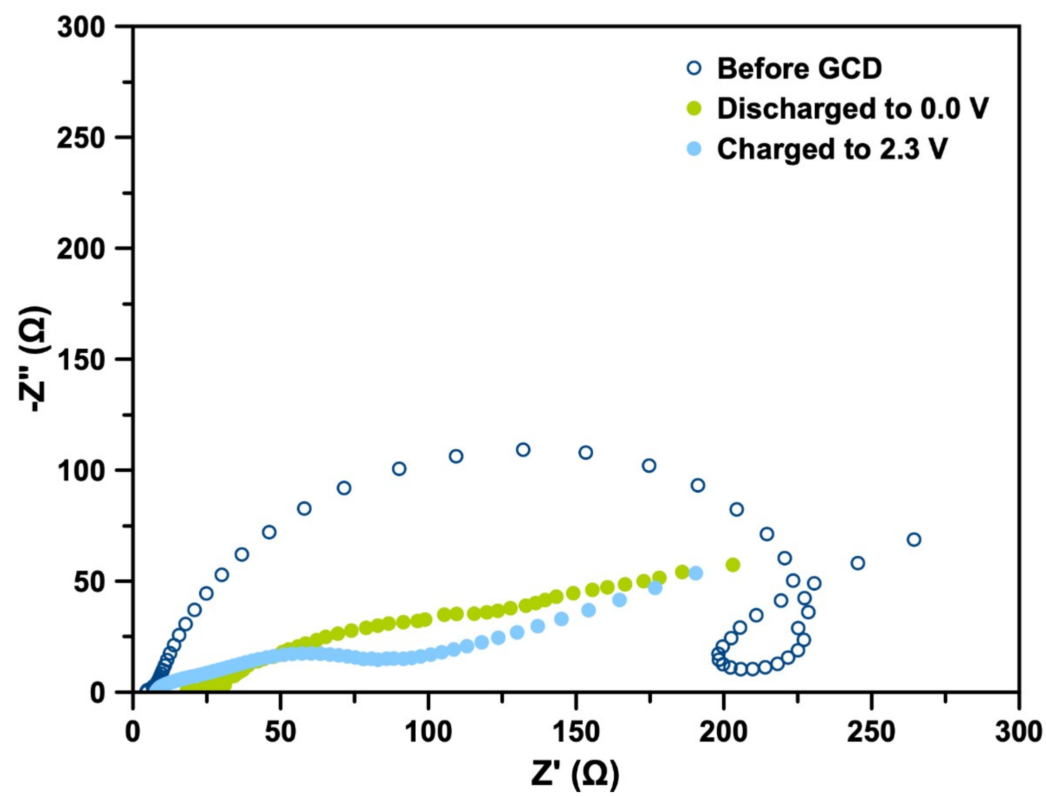

Figure S6. EIS analysis of VO-H_3O half-cell against Zn/Zn^{2+} in 3 M $Zn(CF_3SO_3)_2$ electrolyte before and after being discharged/charged.

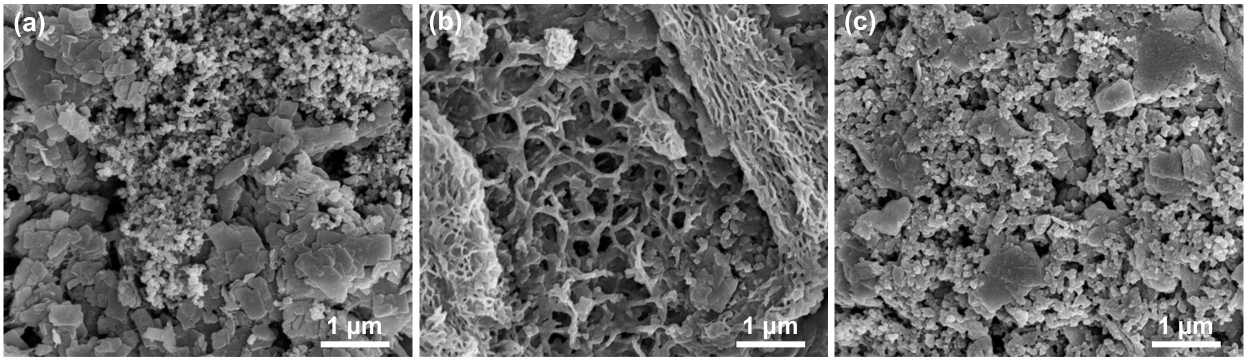

Figure S7. SEM images of VO-H_3O half-cell with 3 м $ZnSO_4.7H_2O$ electrolyte in the (a) pristine condition, (b) discharged (0.0 V), and (c) charged (2.3 V) states.

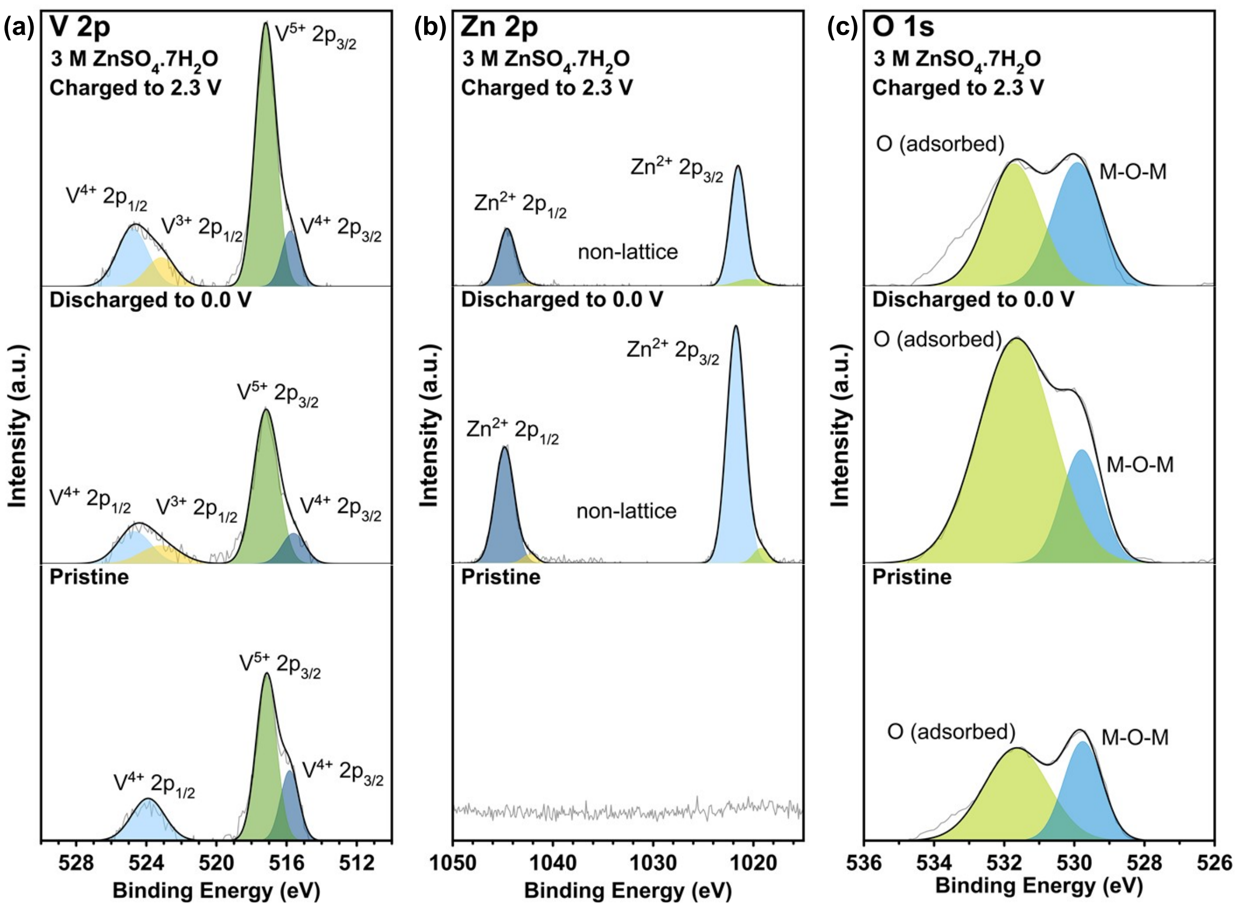

Figure S8. XPS analysis of (a) V 2p, (b) Zn 2p, (c) O 1s orbitals for VO-H_3O half-cell with 3 м $ZnSO_4.7H_2O$ electrolyte at pristine, discharged, and charged states.