

Supporting Information

Insights into the storage mechanism of VS₄ nanowire clusters in aluminum-ion battery

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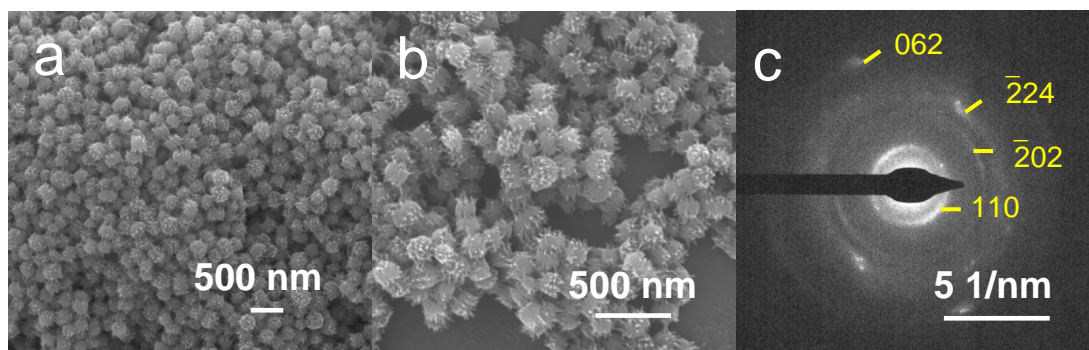


Figure S1. a, b) SEM images, c) SAED pattern of the VS₄ nanowire clusters.

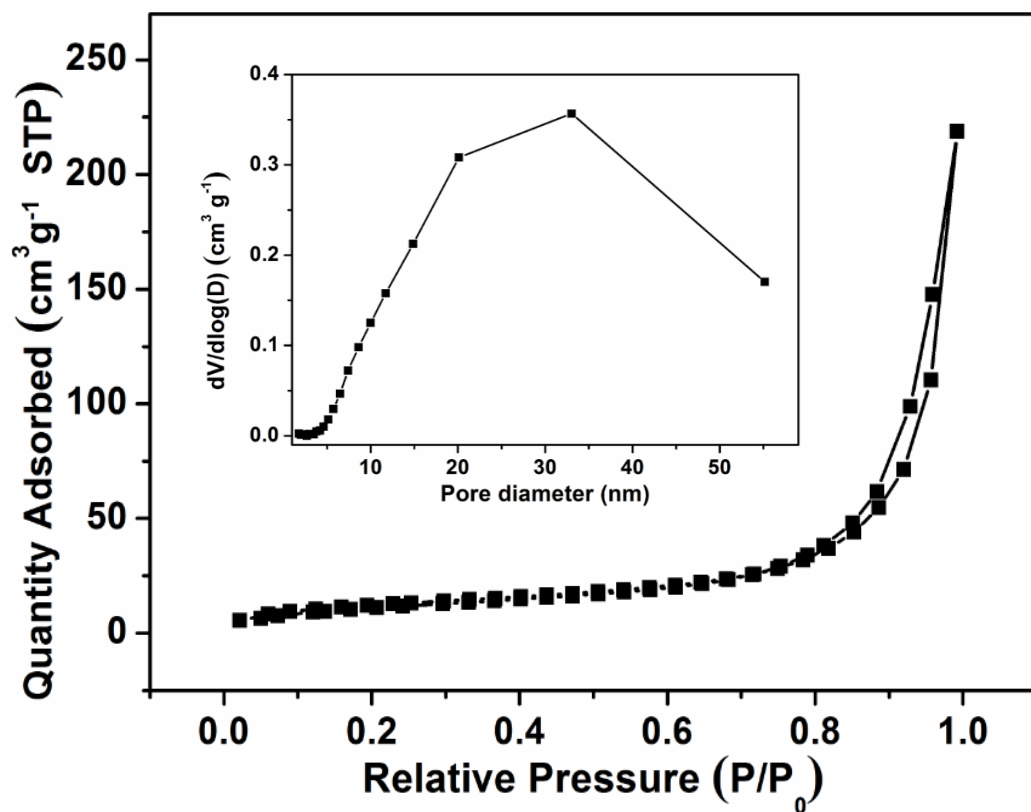


Figure S2. N₂ adsorption-desorption isotherm and pore diameter distribution curve (Inset) of the VS₄ nanowire clusters.

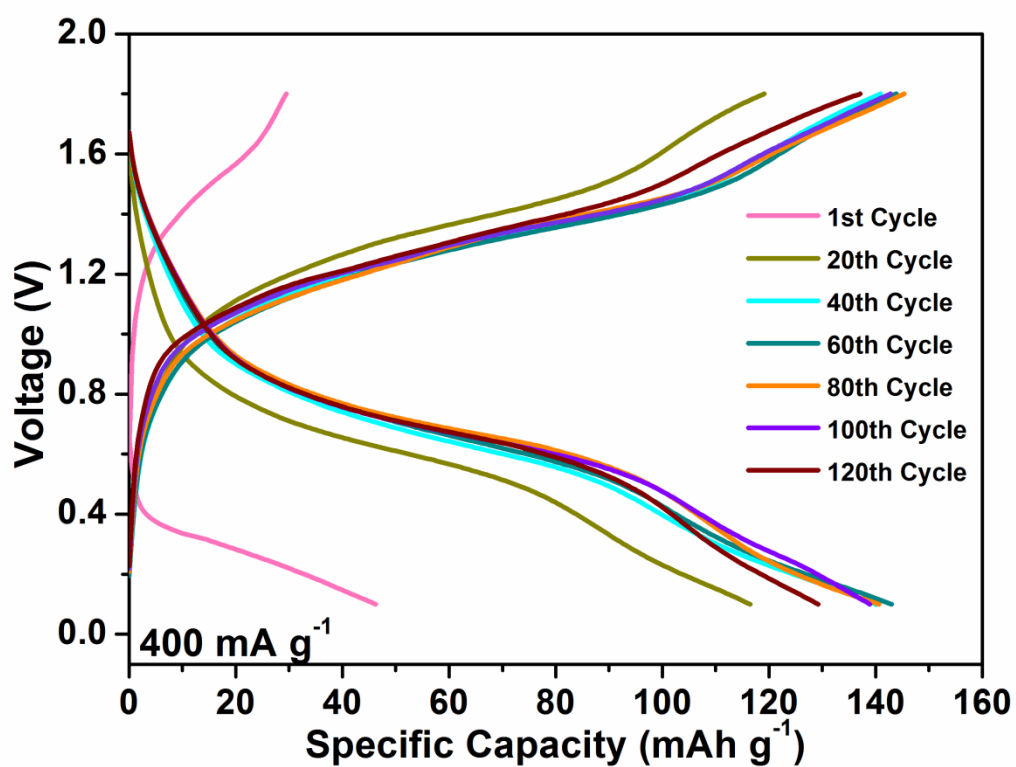


Figure S3. The charge/discharge curves at the 1st, 20th, 40th, 60th, 80th, 100th, 120th cycle with a current density of 400 mA g⁻¹.

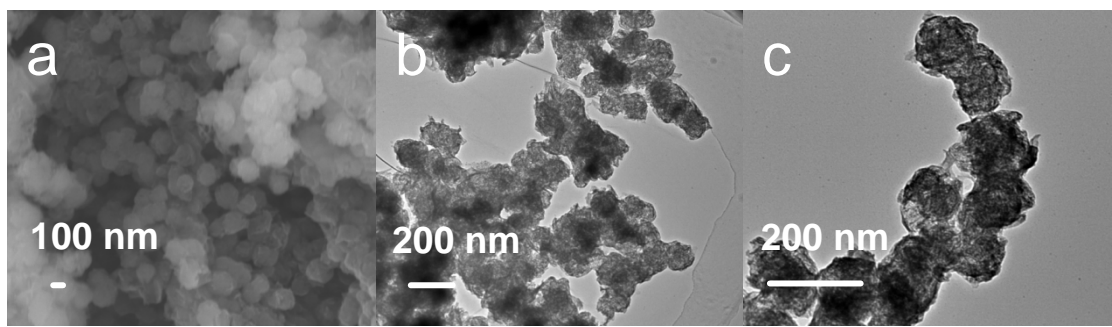


Figure S4. a) SEM image, b, c) TEM images of the VS₄ nanospheres.

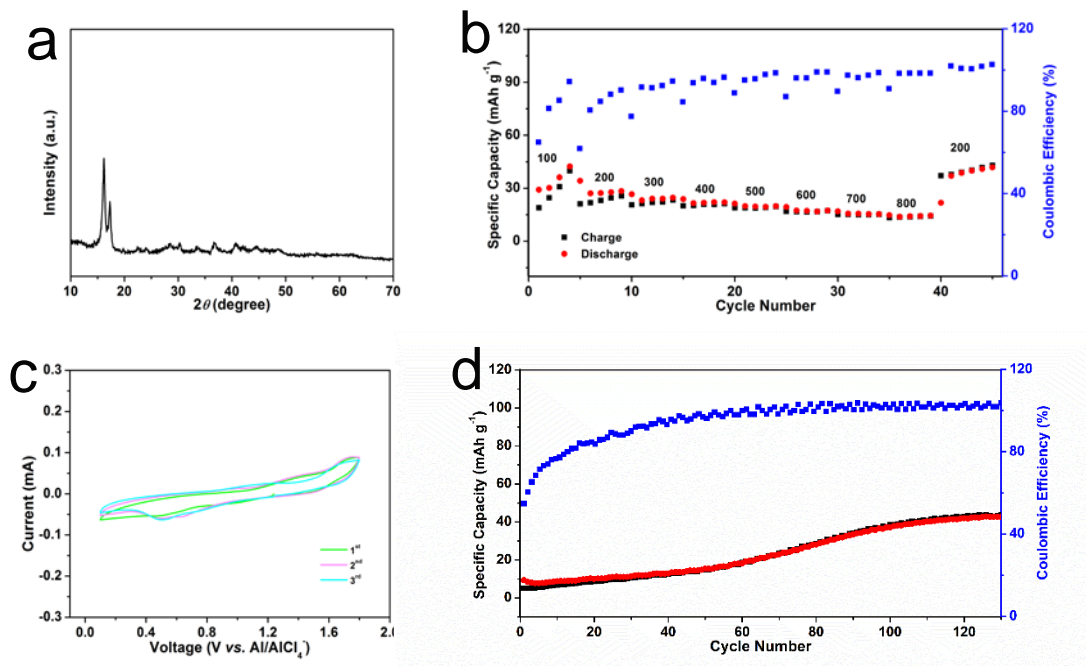


Figure S5. a) XRD pattern. b) Rate performances at various current densities. c) CV curves for the first three cycles at 0.1 mV s⁻¹. d) Cycling performance of VS₄ nanospheres.

Materials	Voltage (V)	Rate capability (mAh g ⁻¹)	Cycling capacity	Ref.
TiO ₂	0.01-1.8	/	20 mA g ⁻¹ 3 cycles < 120 mA h g ⁻¹	[25]
TiS ₂	0.2-1.3	/	5 mA g ⁻¹ 50 cycles < 70 mA h g ⁻¹	[26]
VS ₄ /rGO	0.1-2	80 (100) 70 (200) 60 (300)	100 mA g ⁻¹ 100 cycles > 80 mA h g ⁻¹	[27]
CuO	0.1-2	130 (50) 121 (100) 112 (200)	200 mA g ⁻¹ 100 cycles 130 mA h g ⁻¹	[28]
Co ₃ O ₄	0.3-2.2	330 (100) 195 (200) < 100 (300)	200 mA g ⁻¹ 100 cycles 122.1 mA h g ⁻¹	[29]
Co ₃ S ₄	0.5-1.5	162 (50) 116 (100) 70 (250)	50 mA g ⁻¹ 150 cycles ~90 mA h g ⁻¹	[30]
MoS ₂ /Carbon	0.2-1.8	129 (150) 118 (200) 111 (250)	100 mA g ⁻¹ 200 cycles 130 mA h g ⁻¹	[18]
VS ₄	0.1-1.8	253 (100) 180 (200) 147 (300) 129 (400) 118 (500) 113 (600) 108 (700) 103 (800)	400 mA g ⁻¹ 120 cycles 149 mA h g ⁻¹	This work

Table S1. Summary of electrochemical performance of different host materials for rechargeable aluminum-ion batteries.

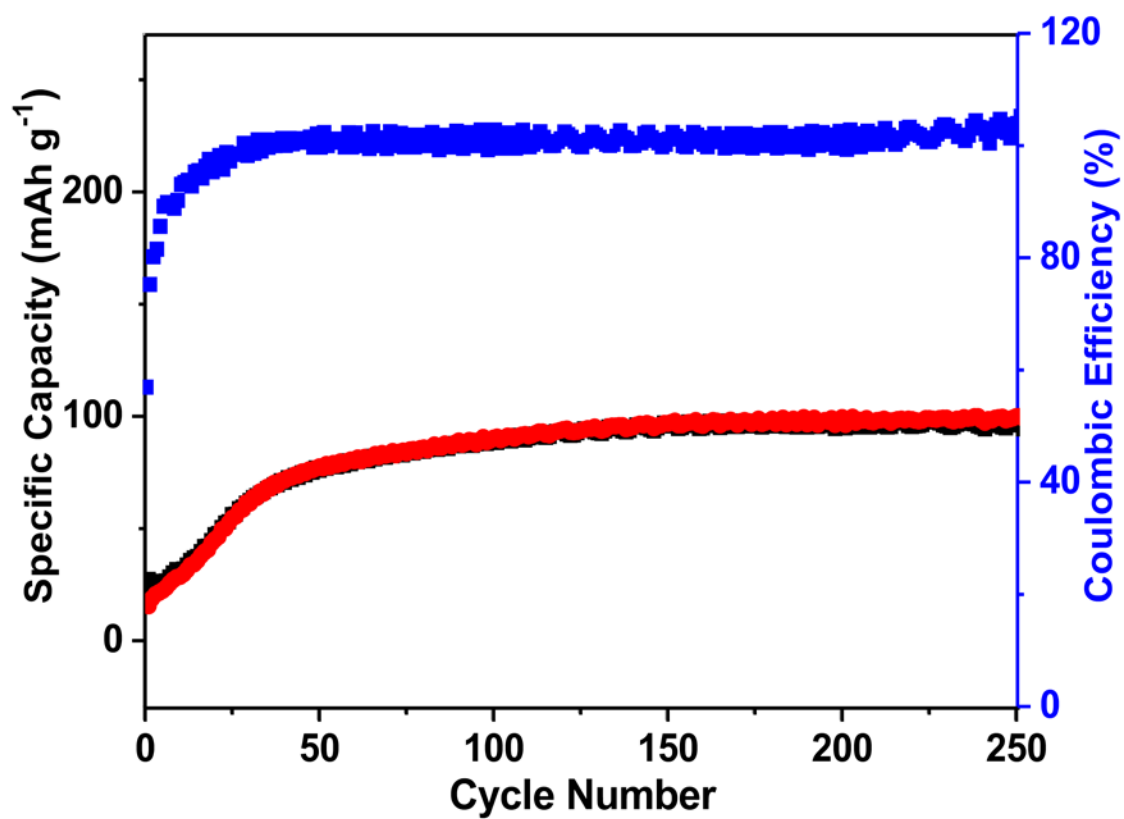


Figure S6. The capacity performance and coulombic efficiency for 250 cycles at a current density of 800 mA g⁻¹.

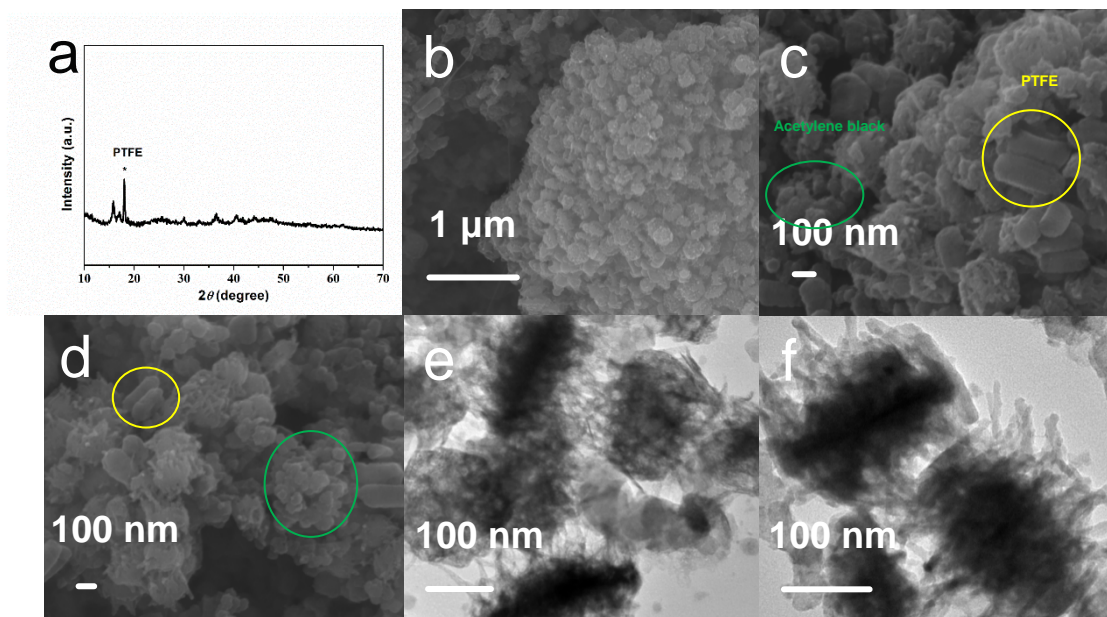


Figure S7. a) XRD pattern. b-d) SEM images. e, f) TEM images of the VS₄ nanowire clusters electrode after undergoing long cycling.

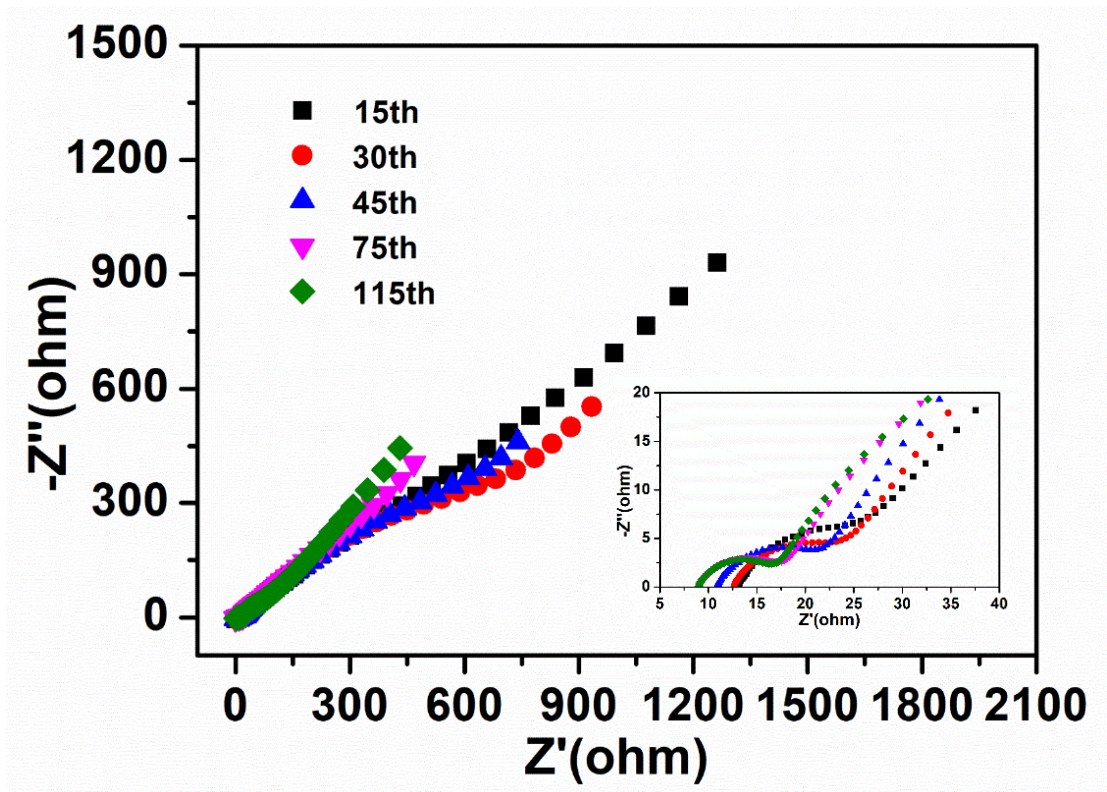


Figure S8. The *ex-situ* EIS at different cycles.

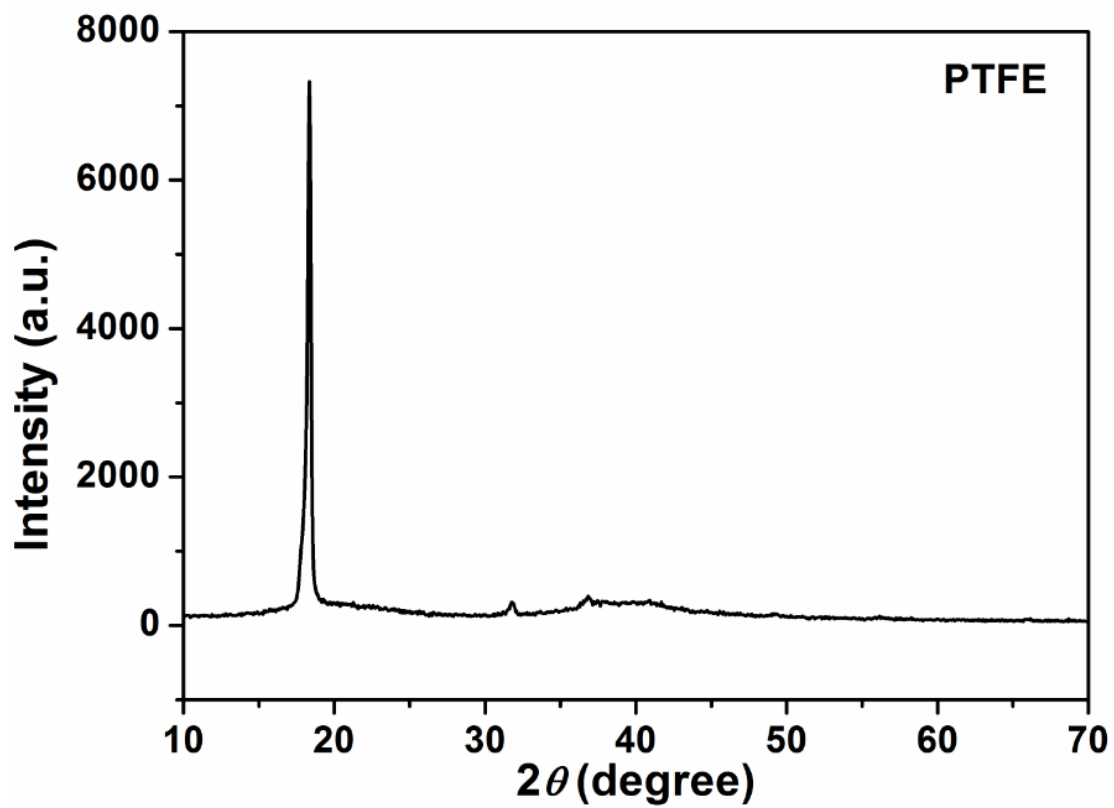


Figure S9. XRD pattern of the PTFE.

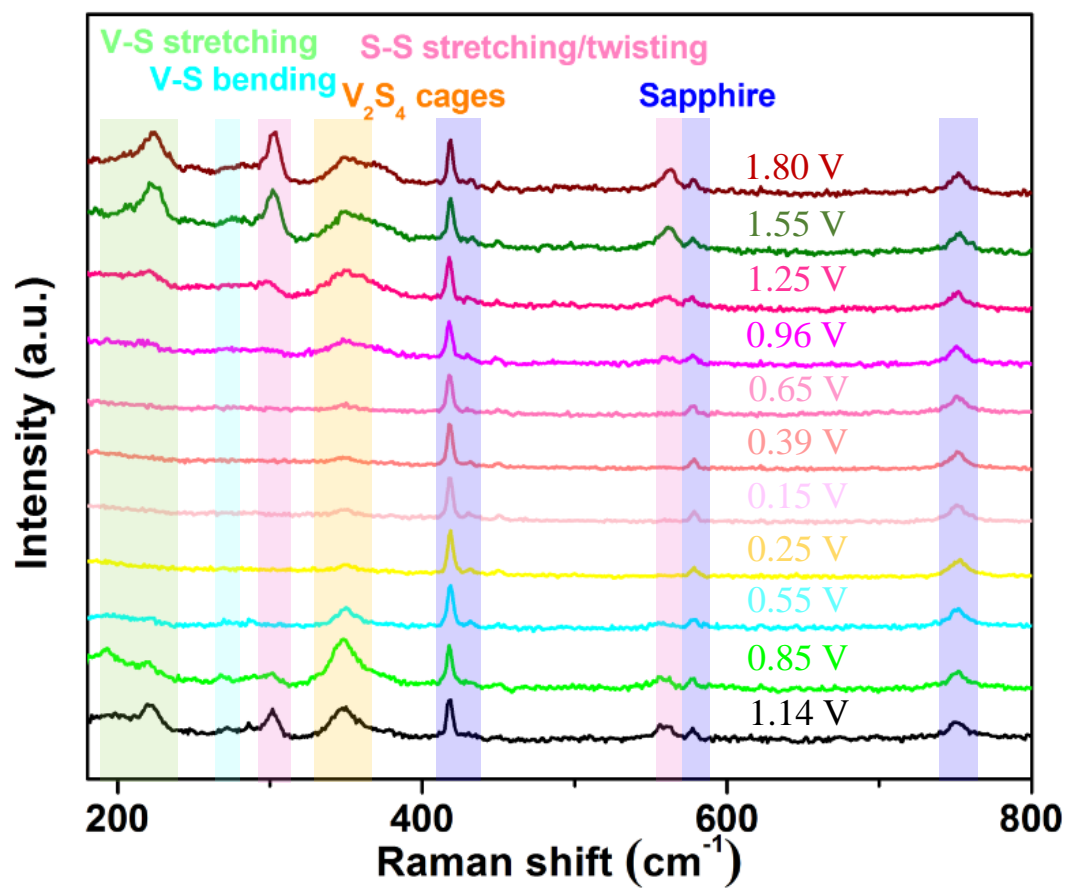


Figure S10. *In-situ* Raman spectra of VS_4 cathode at 100 mA g^{-1} for the first cycles.

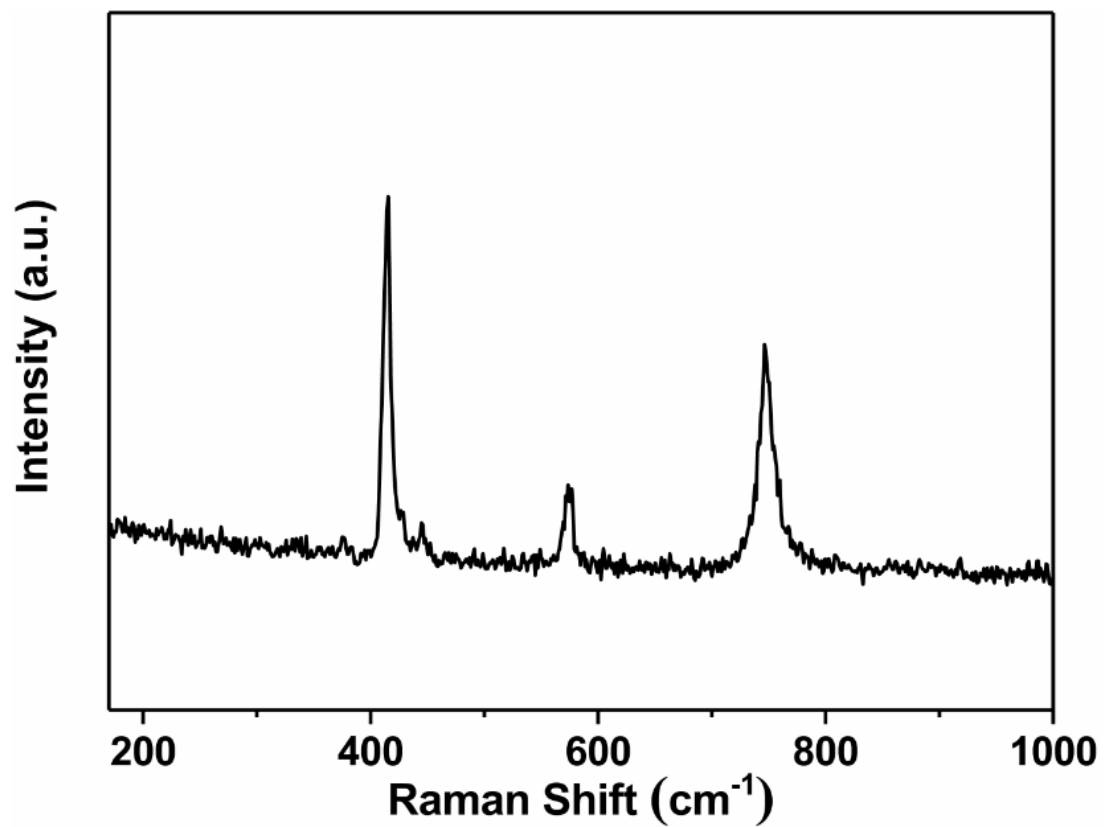


Figure S11. Raman spectra of the sapphire.

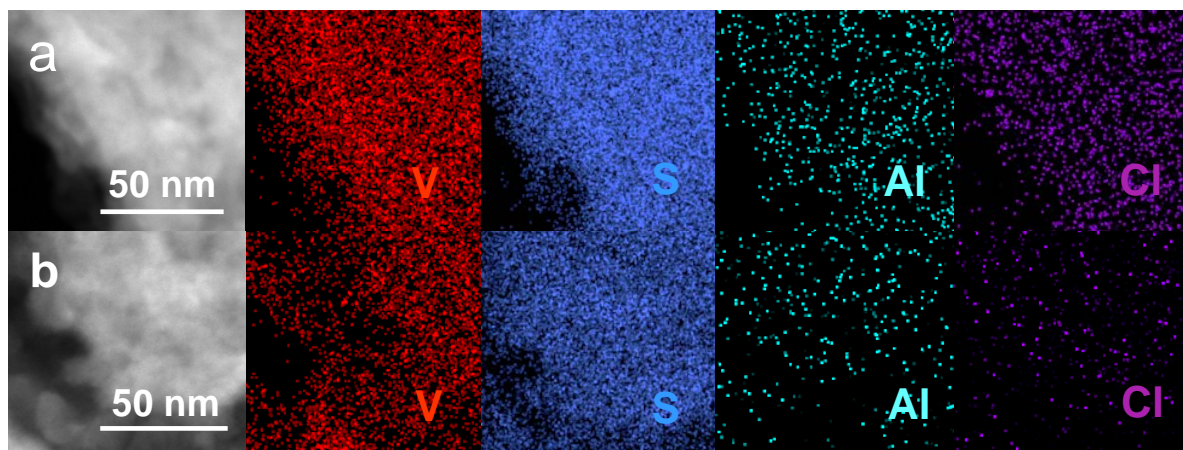


Figure S12. HAADF-STEM images of the discharged a) and charged b) VS_4 cathode and corresponding energy-dispersive X-ray spectroscopy (EDS) spectra of V, S, Al and Cl elements.