

## Supplementary information

# Microstructure-regulated V<sub>2</sub>O<sub>3</sub> cathodes for high-rate and durable aqueous Zinc-ion batteries

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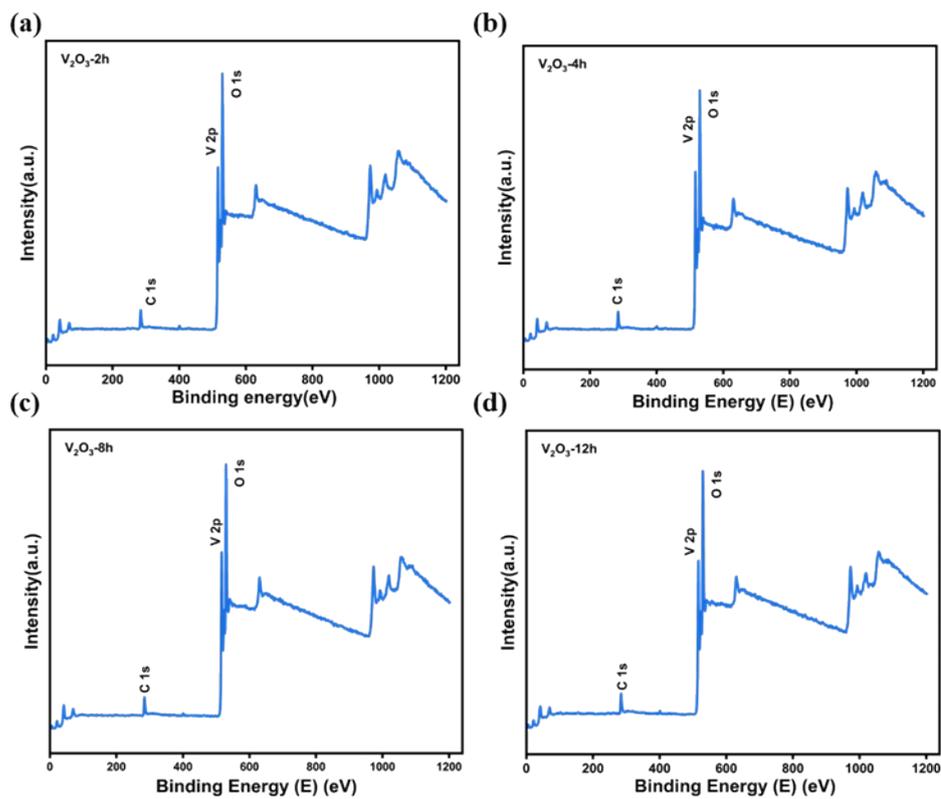
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**Figure S1.** XPS full spectrum of a)  $V_2O_3$ -2h, b)  $V_2O_3$ -4h, c)  $V_2O_3$ -8h and d)  $V_2O_3$ -12h.

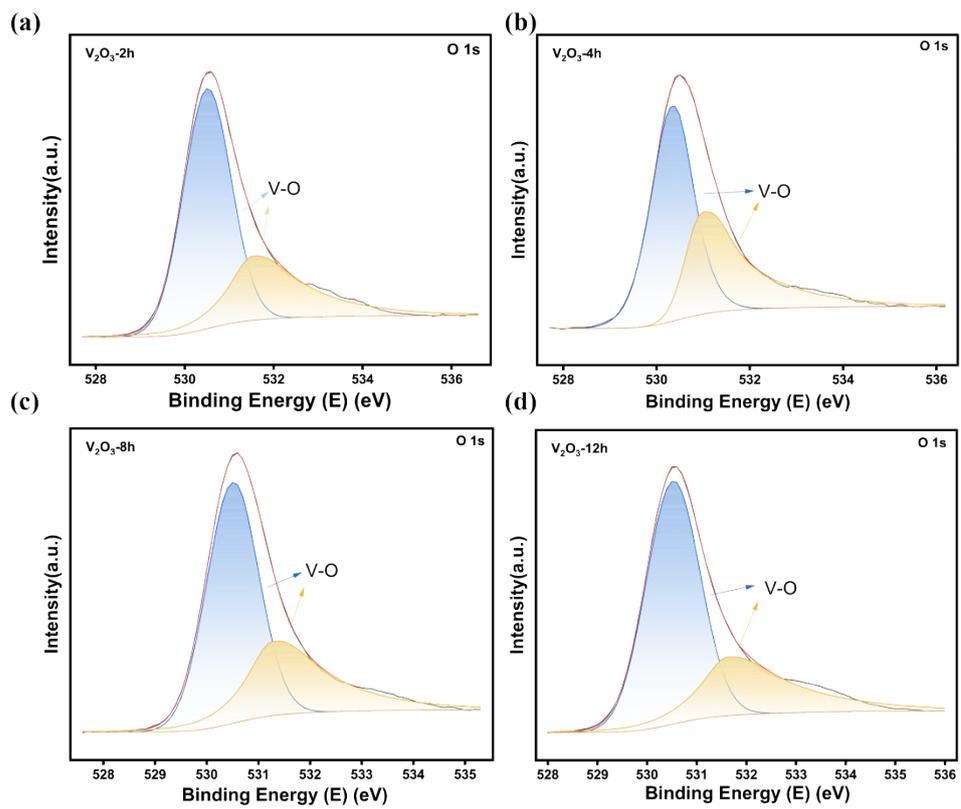
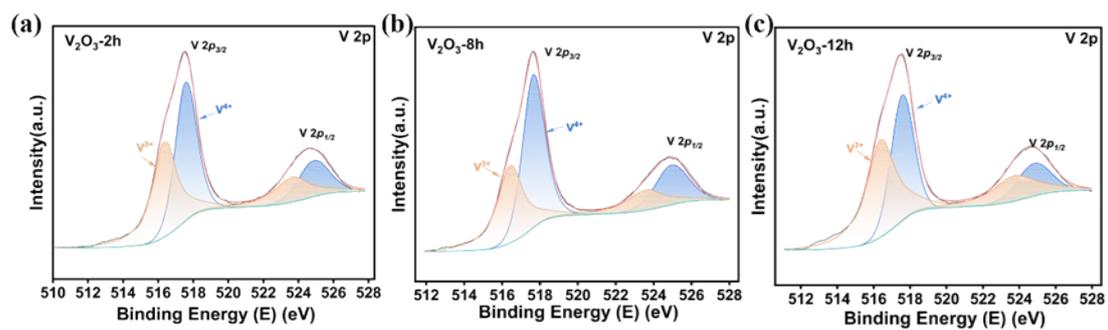
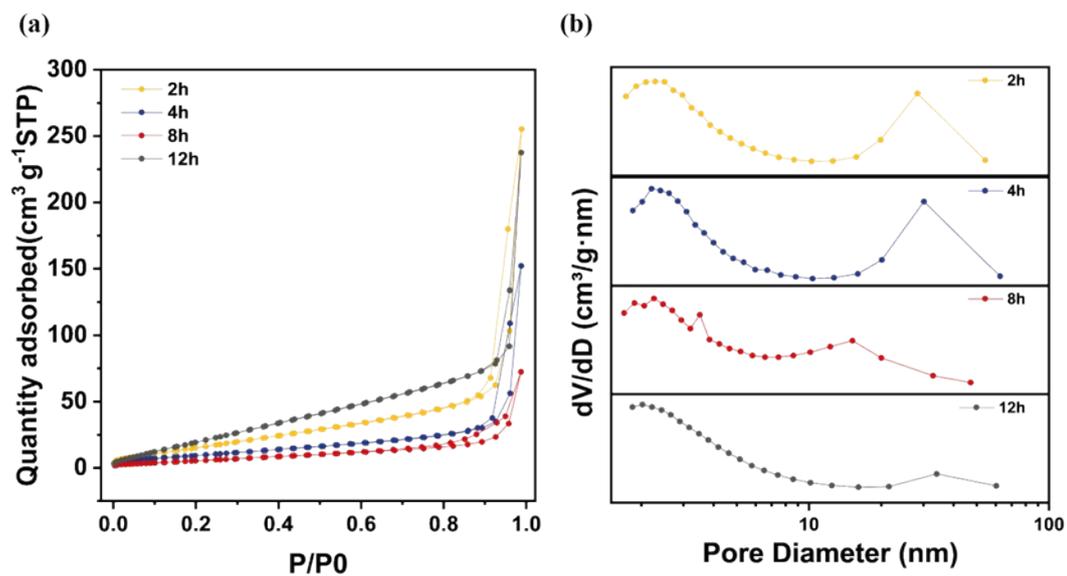


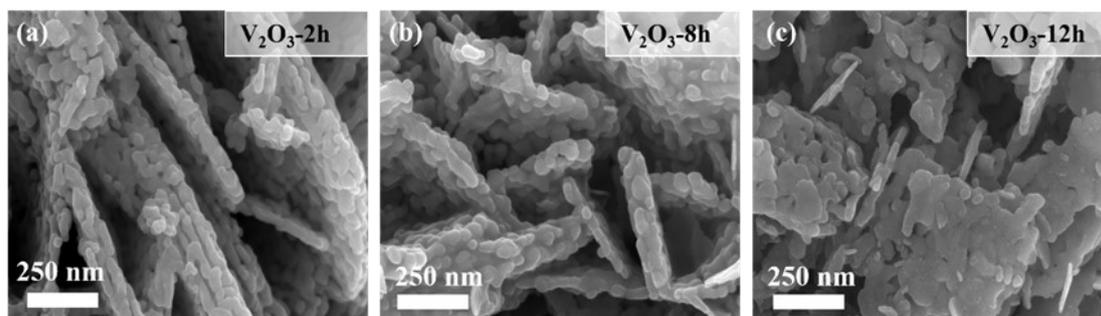
Figure S2. XPS spectra of O 1s.



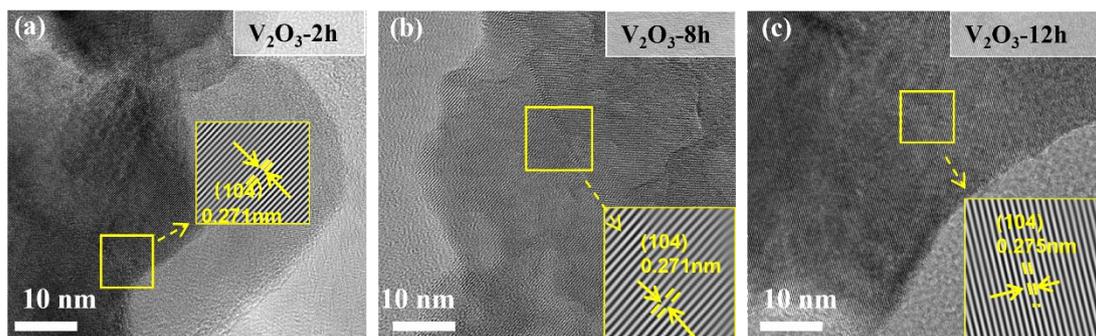
**Figure S3.** XPS spectra of V 2p.



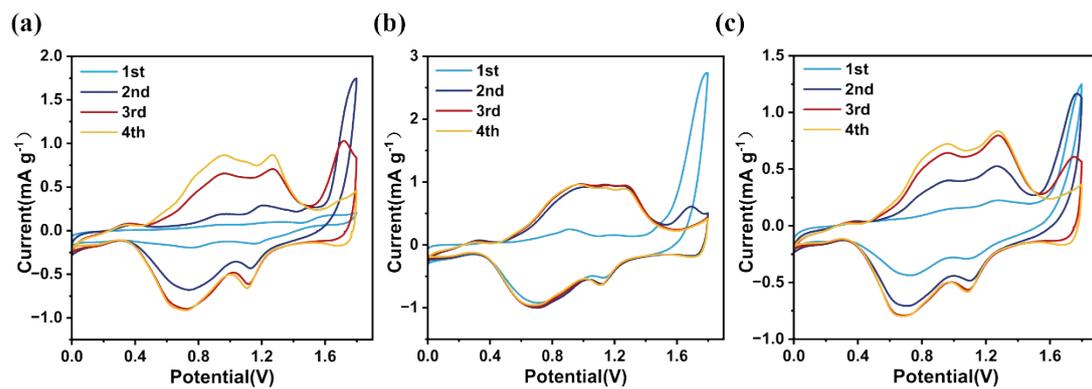
**Figure S4.** a) Nitrogen adsorption-desorption isotherms and b) pore-size distribution plots of  $V_2O_3$ -2h,  $V_2O_3$ -4h,  $V_2O_3$ -8h and  $V_2O_3$ -12h.



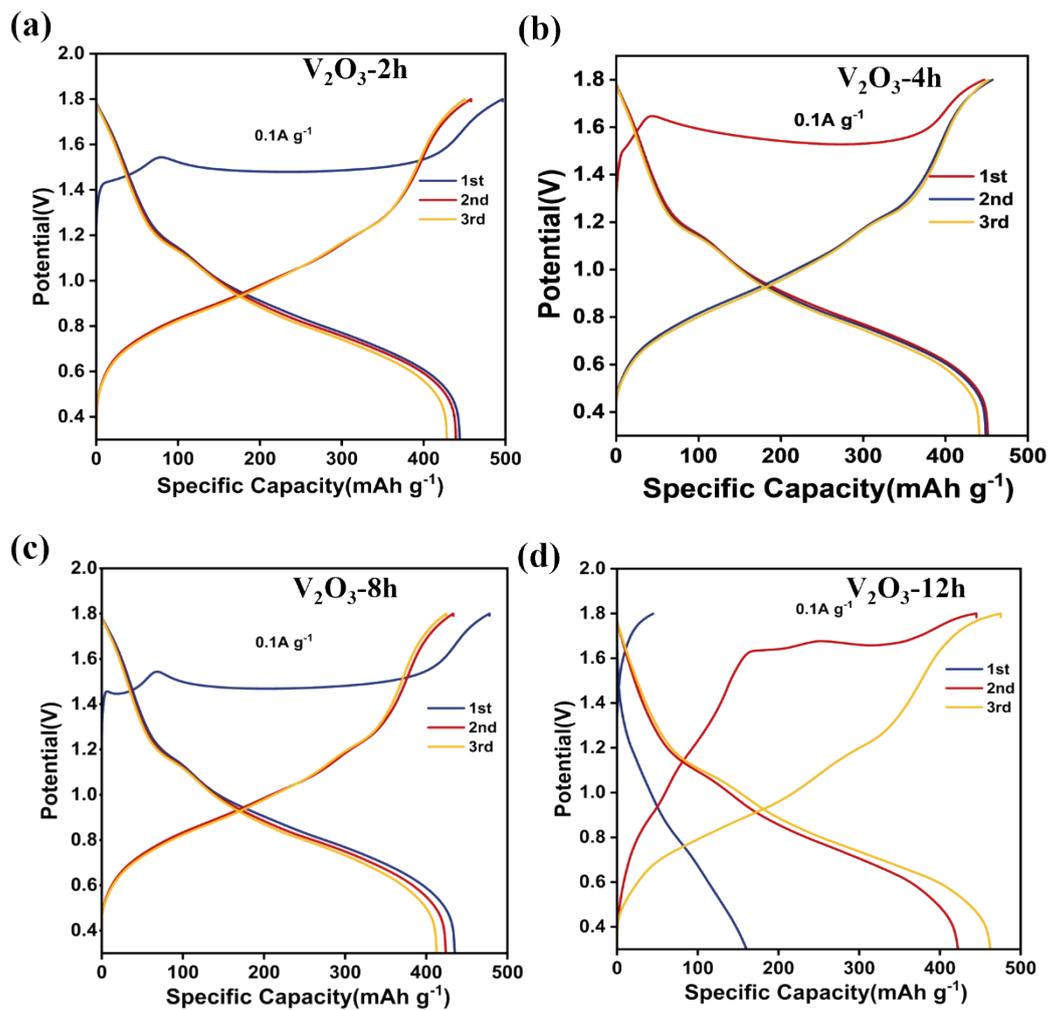
**Figure S5.** The enlarged SEM image of a) V<sub>2</sub>O<sub>3</sub>-2h, b) V<sub>2</sub>O<sub>3</sub>-8h and c) V<sub>2</sub>O<sub>3</sub>-12h.



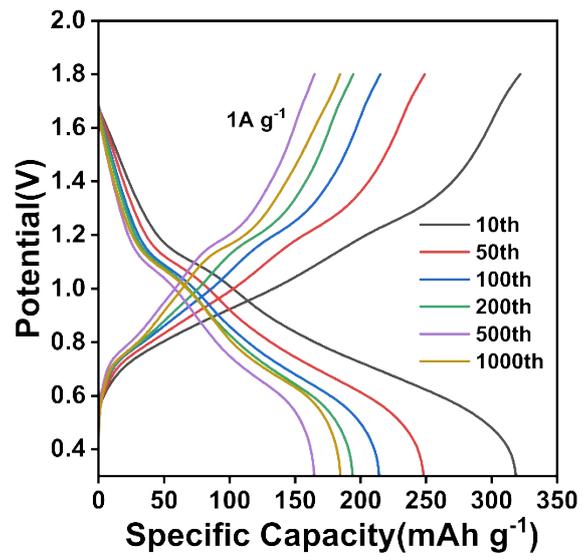
**Figure S6.** The TEM image of a)  $V_2O_3$ -2h, b)  $V_2O_3$ -8h and c)  $V_2O_3$ -12h.



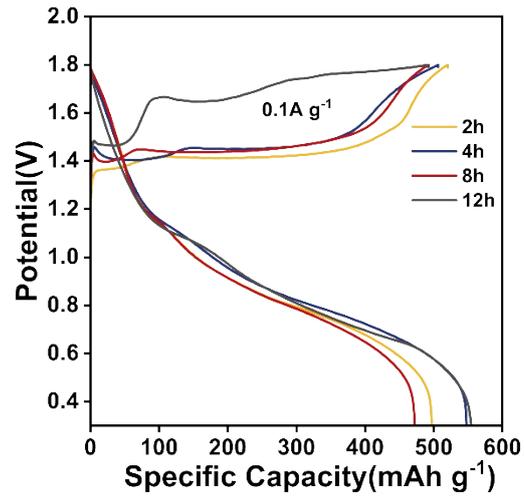
**Figure S7. a-c)** The CV curves of  $V_2O_3$ -2h,  $V_2O_3$ -8h and  $V_2O_3$ -12h electrode at a scan rate of  $0.5 \text{ mV s}^{-1}$ .



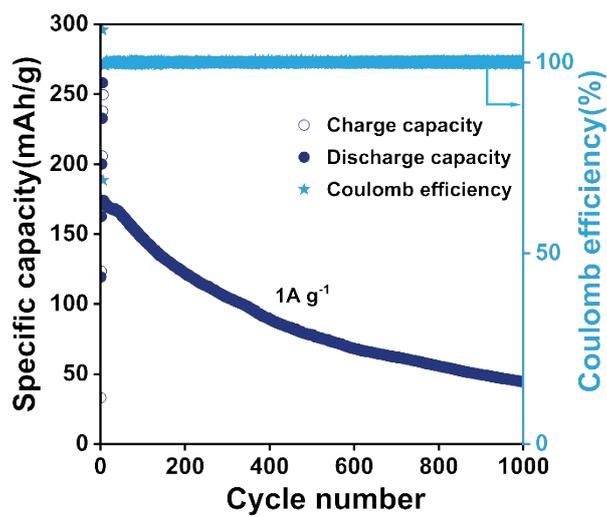
**Figure S8.** a-d) The first three galvanostatic charge and discharge curves of  $V_2O_3$ -2h,4h ,8h and 12h at  $0.1 A g^{-1}$ .



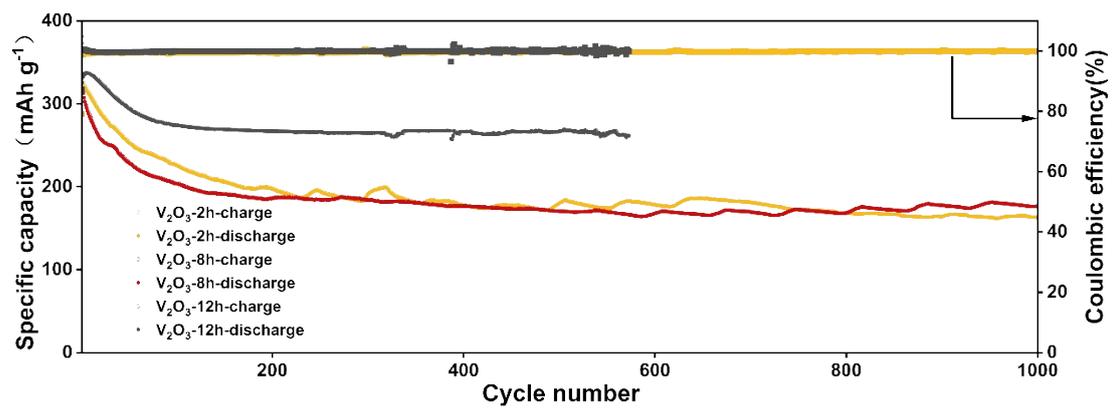
**Figure S9.** The GCD curves of the 4h sample after different cycles.



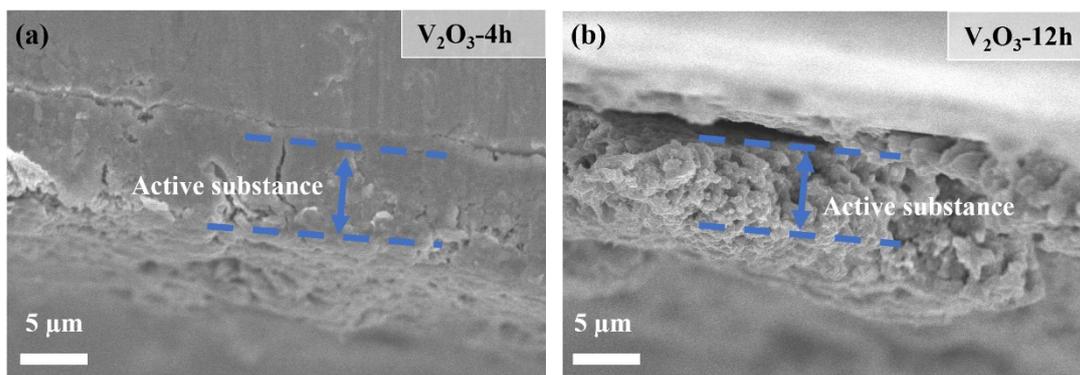
**Figure S10.** The plateau curves of  $V_2O_3$ -2h, 4h, 8h and 12h.



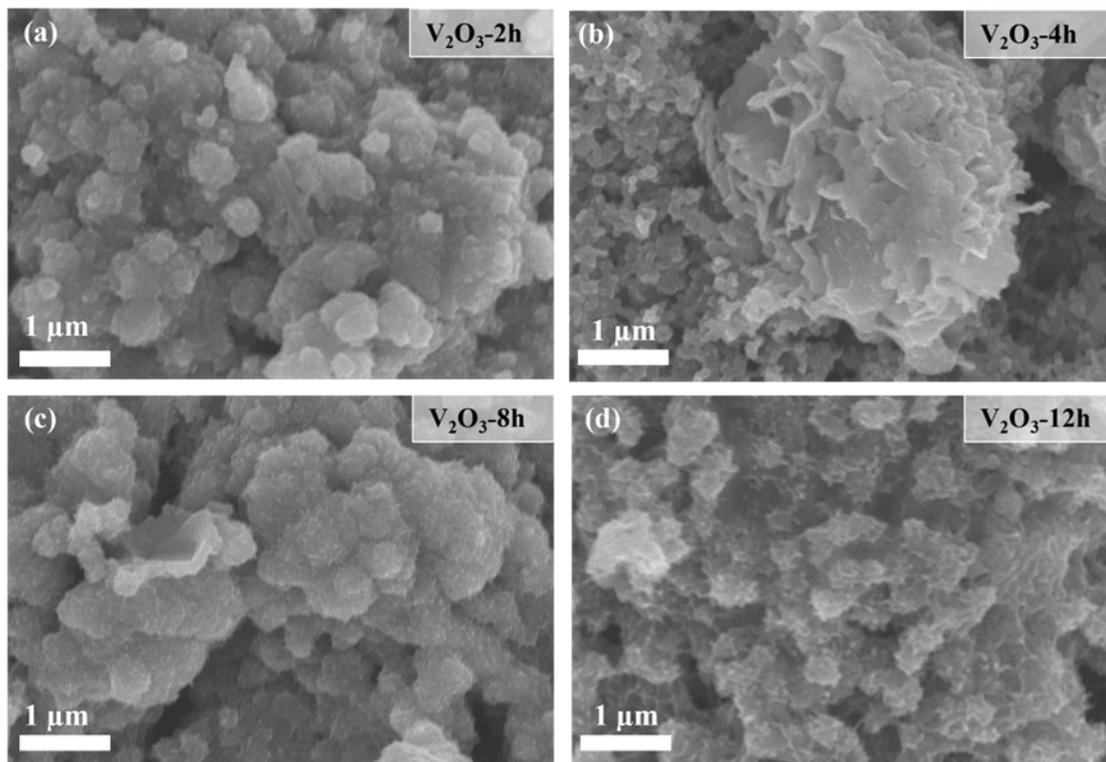
**Figure S11.** Long-term cycling of the 4h sample in 2M ZnSO<sub>4</sub> electrolyte.



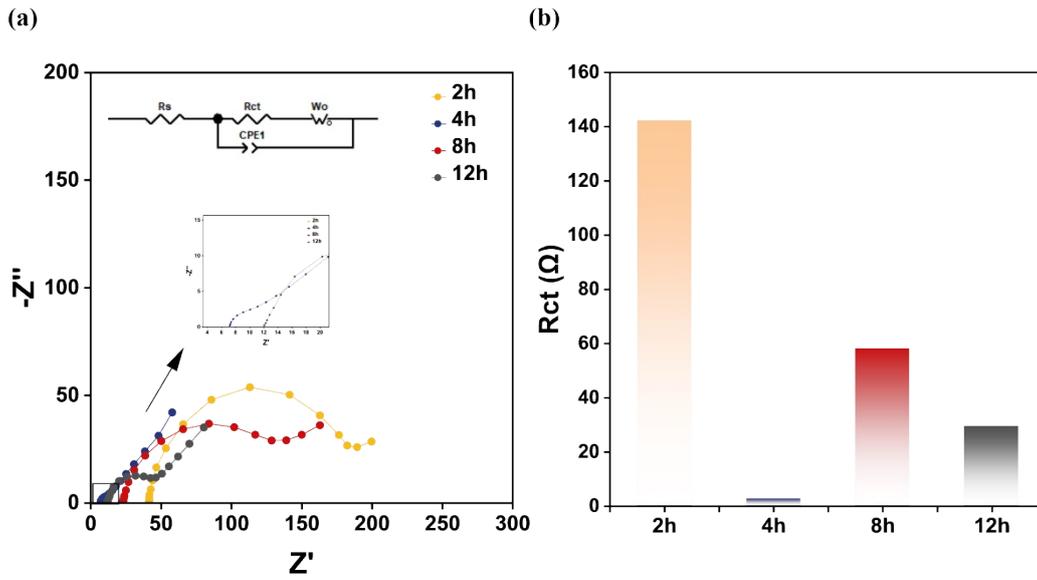
**Figure S12.** Long-term cycling of the 2h, 8h and 12h sample in 25M Zn(Cl)<sub>2</sub>electrolyte.



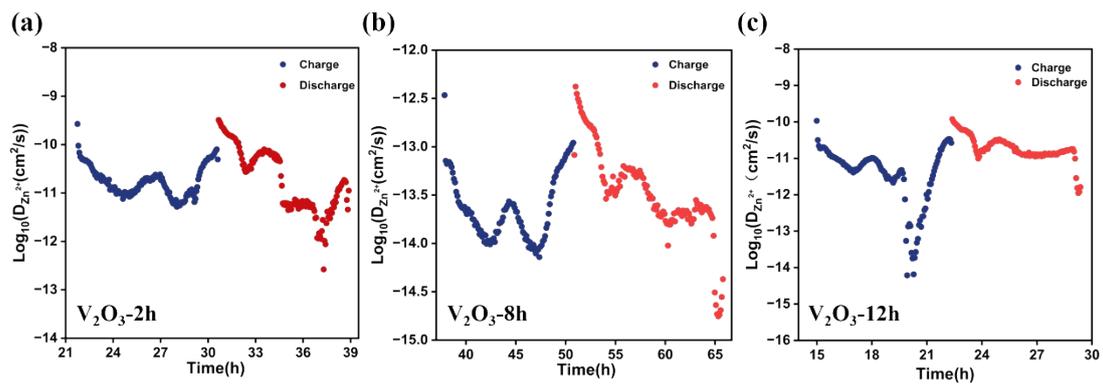
**Figure S13.** a-b) SEM image of the cross-section of the electrode after cycling.



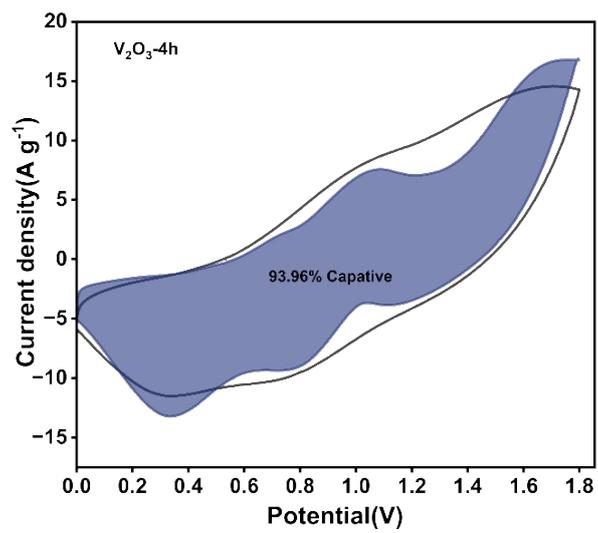
**Figure S14.** The SEM image of  $V_2O_3$ -2h,  $V_2O_3$ -4h,  $V_2O_3$ -8h and  $V_2O_3$ -12h after two cycles.



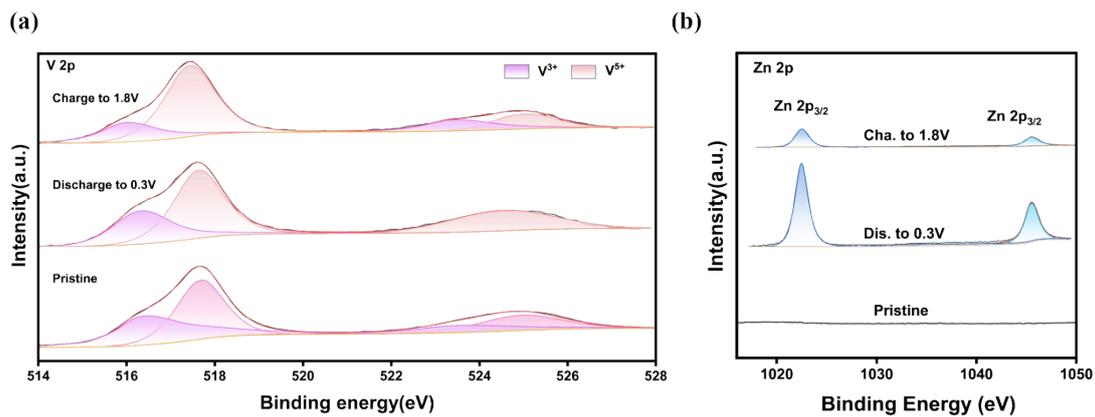
**Figure S15.** a) Nyquist plots and b) The Rct column chart of the  $V_2O_3$  electrode.



**Figure S16.** a-c) GITT curves of  $V_2O_3$ -2h, 8h and 12h.



**Figure S17.** The capacitive contribution (shaded area) at  $10\ mV\ s^{-1}$  of  $V_2O_3-4h$ .



**Figure S18.** XPS spectra of a) V 2p and b) Zn 2p at pristine, fully discharged and charged states of V<sub>2</sub>O<sub>3</sub>-4h electrode.

**Table S1:** BET data of V<sub>2</sub>O<sub>3</sub>-4h

<b>Samples</b>	<b>S<sub>BET</sub> (m<sup>2</sup>/g)</b>	<b>Pore Volume (cm<sup>3</sup>/g)</b>	<b>Average pore diameter (nm)</b>
V <sub>2</sub> O <sub>3</sub> -2h	65.4204	0.395562	18.9741
V <sub>2</sub> O <sub>3</sub> -4h	36.2197	0.235509	21.6801
V <sub>2</sub> O <sub>3</sub> -8h	22.3561	0.111634	15.2014
V <sub>2</sub> O <sub>3</sub> -12h	100.5103	0.367974	13.7339

**Table S2.** Comparison of the recently reported vanadium-based materials

<b>Materials</b>	<b>Cycle performance</b>	<b>Reference</b>
$V_2O_3/VO_2@NC@GO$	92.4 % after 1000 cycles at 5 A g <sup>-1</sup>	1
$V_2O_{3-x}@rGO$	75% (38.6 mAh g <sup>-1</sup> ) after 250 cycles at 100 mA g <sup>-1</sup>	2
$N/C@V_2O_3$	285 mAh g <sup>-1</sup> after 500 cycles at 1 A g <sup>-1</sup>	3
$VOOH/VS_x$	94.6% after 180 cycles at 1A g <sup>-1</sup>	4
$VO_2@Co-N-C$	376.7 mAh g <sup>-1</sup> after 200 cycles at 1A g <sup>-1</sup>	5
$V_2O_3/VN@C$	278 mAh g <sup>-1</sup> after 400 cycles at 200 mA g <sup>-1</sup>	6
$V_2O_3-4h$	200 mAh g <sup>-1</sup> after 1000 cycles at 1 A g <sup>-1</sup>	This work

## Reference

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