

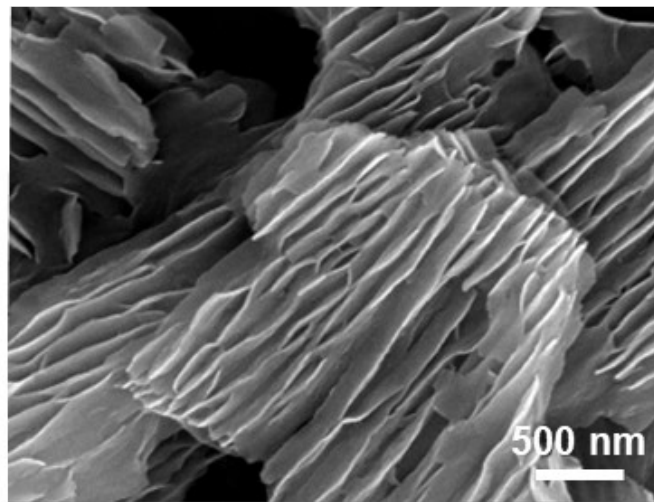
## Supporting Information

### **Multiscale Modulation of Vanadium Oxides via One-Step Facile Reduction to Synergistically Boost Zinc-Ion Batteries Performance**

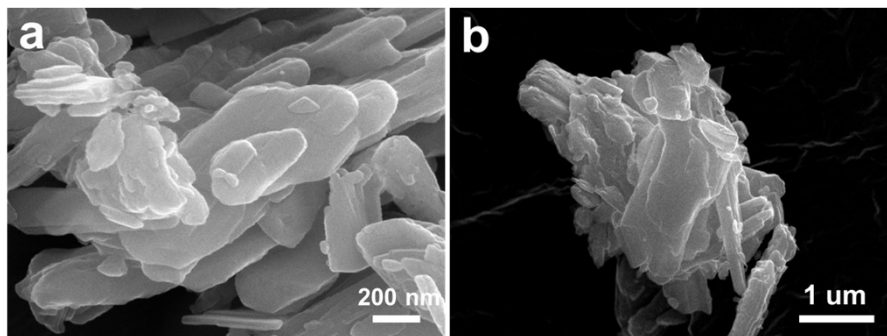
*Fangfang Wu,<sup>‡</sup> Dong Zheng,<sup>‡</sup> Youwei Wang,<sup>‡</sup> Dongshu Liu, Yuxi Wang, Shibo*

*Meng, Xilian Xu, Wenxian Liu, Wenhui Shi, Xiehong Cao\**

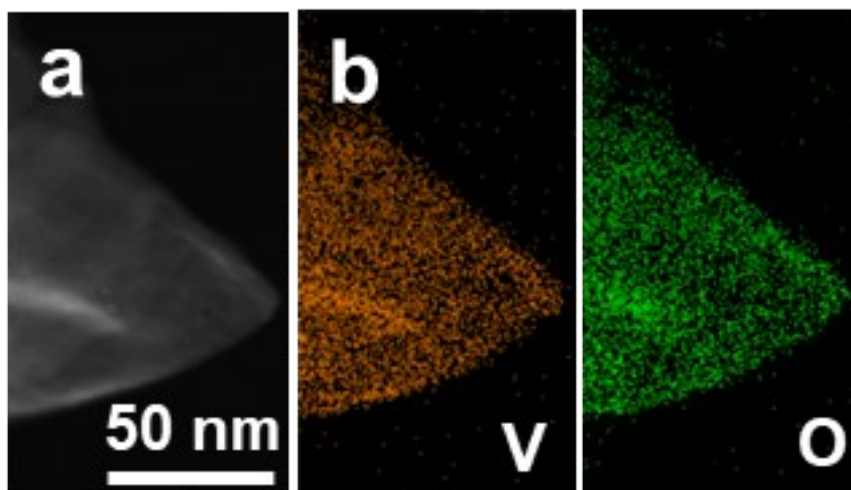
## Results and discussion



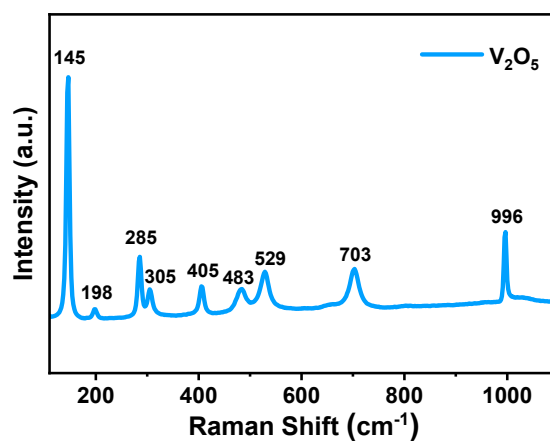
**Figure S1.** SEM image of the  $V_{10}O_{24} \cdot 12H_2O$ .



**Figure S2.** SEM images of the bulk  $V_2O_5$ .

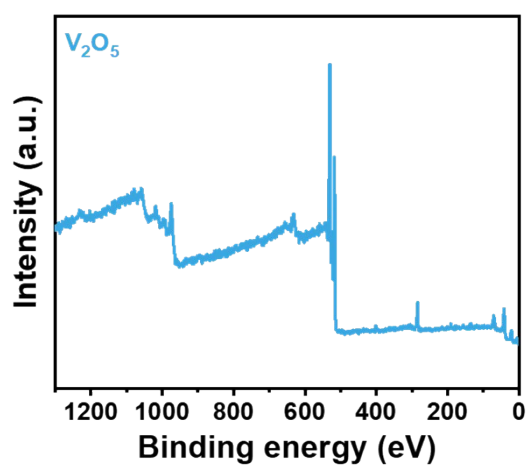


**Figure S3.** STEM-EDX elemental mapping images of the  $V_{10}O_{24} \cdot 12H_2O$ .

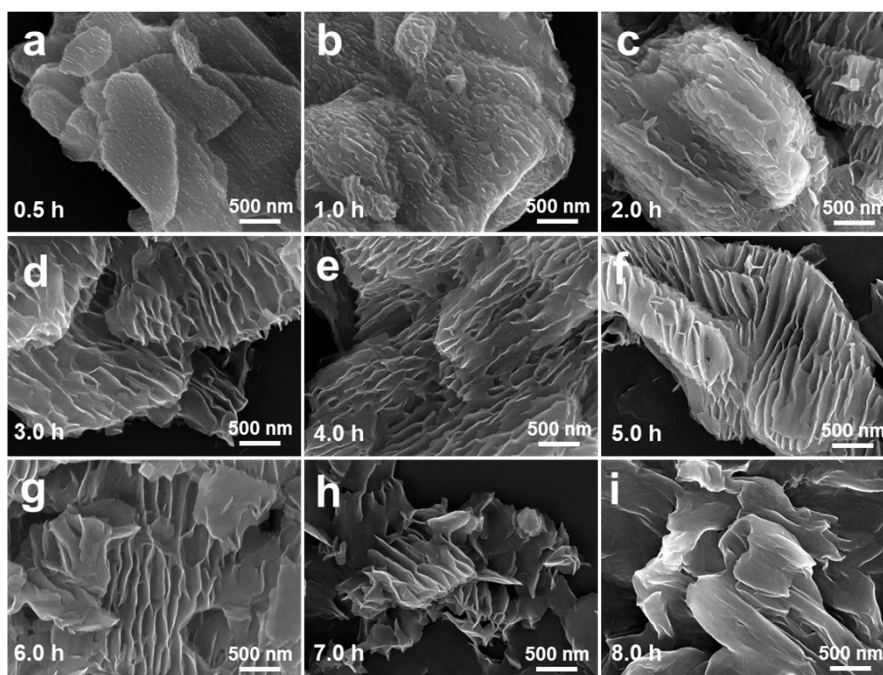


**Figure S4.** Raman spectrum of the bulk  $V_2O_5$ .

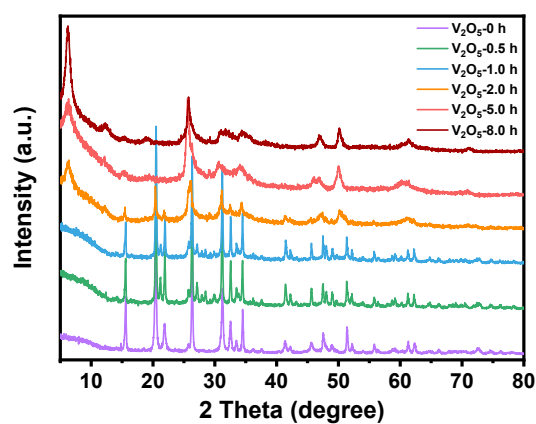
The Raman spectrum of  $V_2O_5$  shows the characteristic peaks at 145, 198  $cm^{-1}$  (relative motions of the chain translation), 285, 405  $cm^{-1}$  (bending vibration of  $V=O$ ), 529  $cm^{-1}$  (stretching vibration of the  $V_3-O$ ), 305, 483  $cm^{-1}$  (bending vibration of the  $V-O-V$ ), and 703, 996  $cm^{-1}$  (edge stretching vibration of the  $V=O$  and  $V_2-O$ ), which is consistent with the reported  $V_2O_5$  (*Adv. Mater.* **2009**, 21, 2436-2440; *Ionics* **2022**, DOI: 10.1007/s11581-022-04684-3).



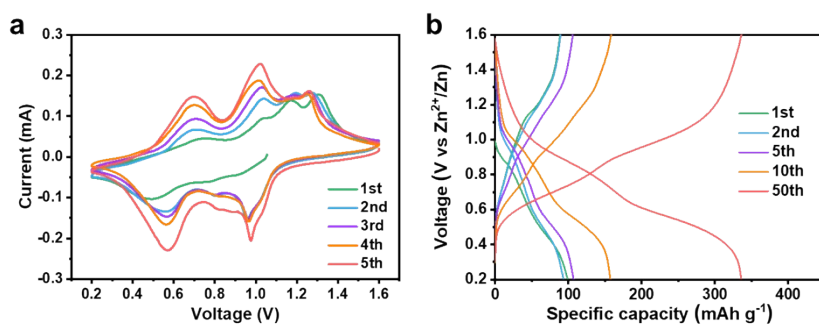
**Figure S5.** XPS survey spectrum of the bulk  $V_2O_5$ .



**Figure S6.** SEM images showing the morphological evolution from  $V_2O_5$  to  $V_{10}O_{24} \cdot 12H_2O$ .



**Figure S7.** XRD analysis of the transformation process of phase structure from  $V_2O_5$  to  $V_{10}O_{24} \cdot 12H_2O$ .



**Figure S8.** (a) CV curves at a scan rate of  $0.1 \text{ mV s}^{-1}$  and (b) galvanostatic discharge-charge curves of the bulk  $V_2O_5$ .

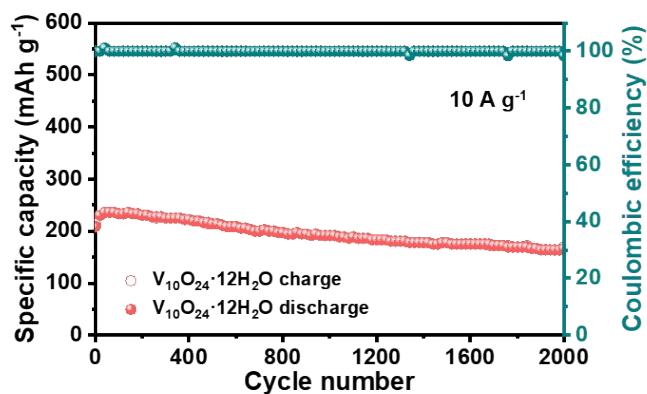


Figure S9. Cycling stability of  $V_{10}O_{24} \cdot 12H_2O$  at a current density of  $10 \text{ A g}^{-1}$ .

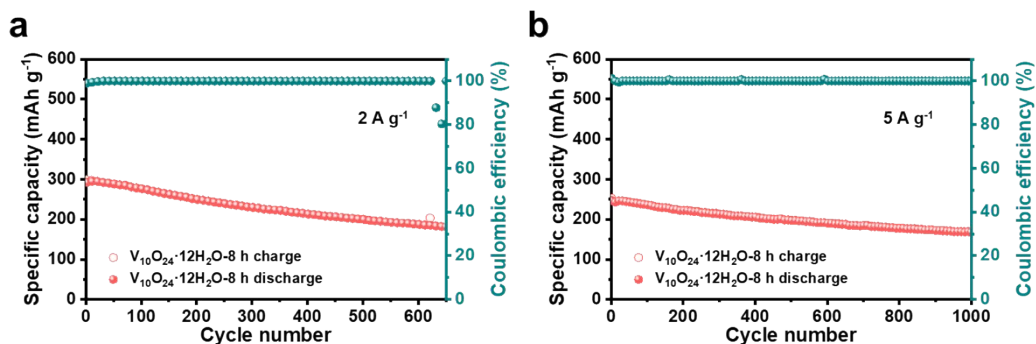


Figure S10. Cycling stability of  $V_{10}O_{24} \cdot 12H_2O$ -8 h at the current densities of  $2 \text{ A g}^{-1}$  and  $5 \text{ A g}^{-1}$ .

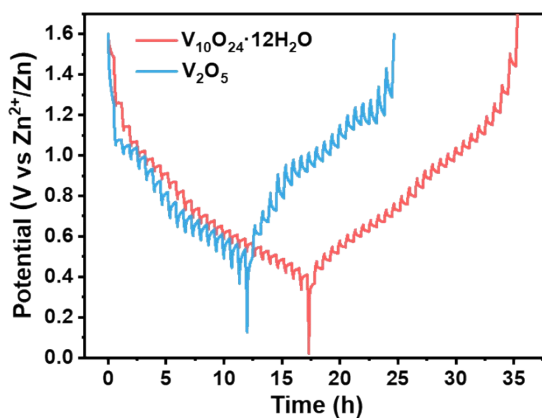
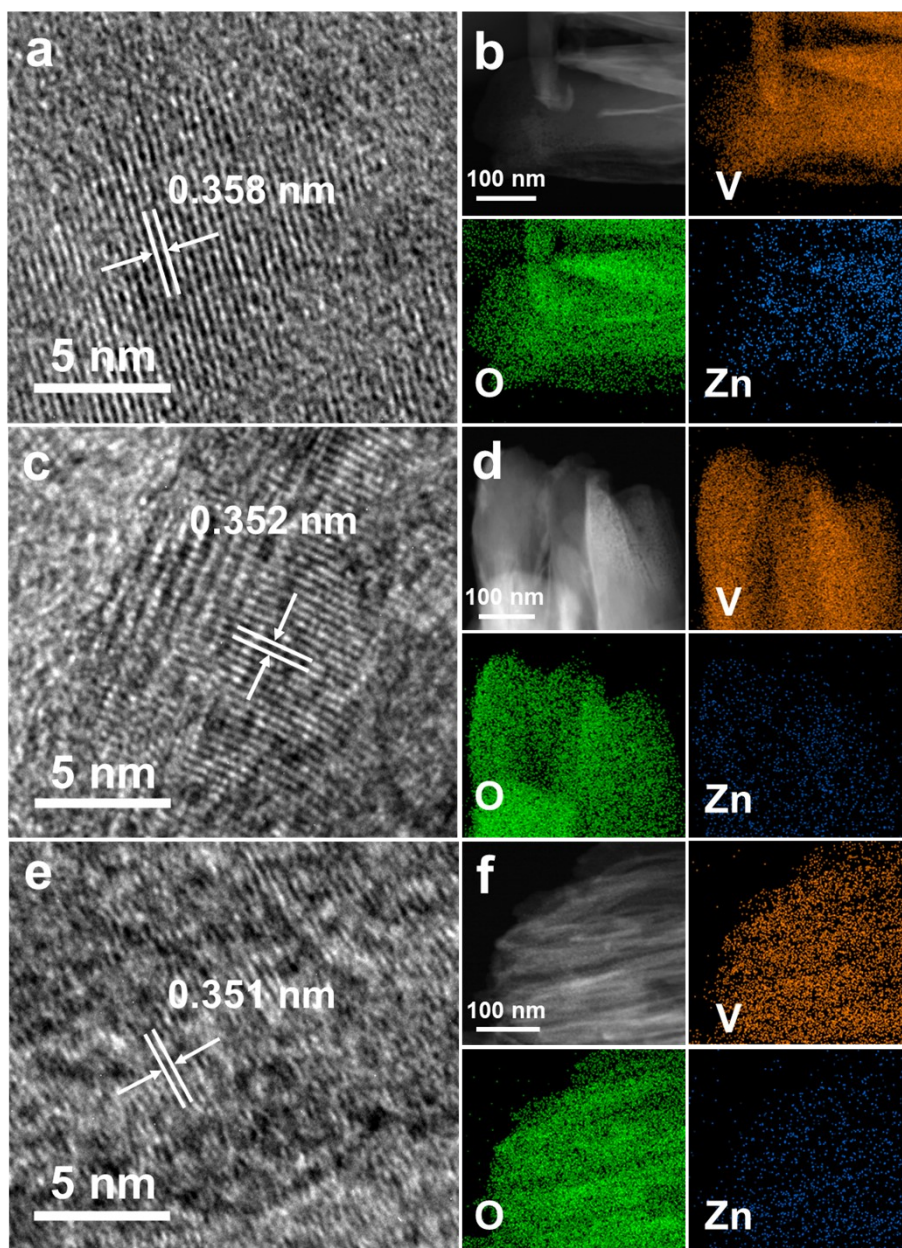


Figure S11. Discharge/charge curves of  $V_2O_5$  and  $V_{10}O_{24} \cdot 12H_2O$  by GITT.





**Figure S12.** HRTEM images and TEM-EDX element mappings in different states. (a, b) fully discharged in the first cycle; (c, d) fully charged in the first cycle; (e, f) cycled for 100 times.