Supporting Information

Tailoring vanadium oxide crystal orientation for high-performance aqueous zinc-ion batteries

Rong Li,[a, b] Yifei Yuan,[a, b] Linyu Yang,*[a, b] Jun Wang,*[c] Shuying Wang,*[a, b] Ablat Abliz,[a, b] Xuefang Xie,[a, b] Hongyu Mi,[d] Haibing Li [e]

[a] *Xinjiang Key Laboratory of Solid State Physics and Devices, Xinjiang University, Urumqi 830046, PR China. E-mail: yanglinyu0222@sina.com; wsysmilerr@sina.com*
[b] *School of physics and technology, Xin Jiang University, Urumqi, Xinjiang 830046, China.*
[c] *School of Innovation and Entrepreneurship, Southern University of Science and Technology, Shenzhen 518055, China. E-mail: wangj9@sustech.edu.cn*
[d] *School of Chemical Engineering and Technology, Xinjiang University, Urumqi 830046, China.*
[e] *Xinjiang Uygur Autonomous Region Research Institute of Measurement and Testing, Urumqi 830011, China.*

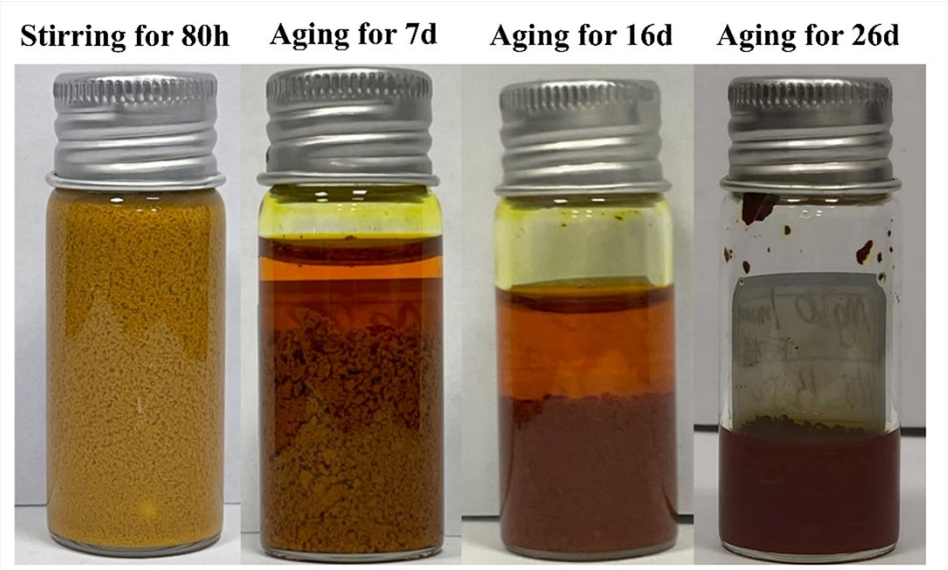

Figure S1. MgVO sample is stirred for 80h, aged for 7, 16 and 26 days respectively (Photographs taken after retrieval of samples).

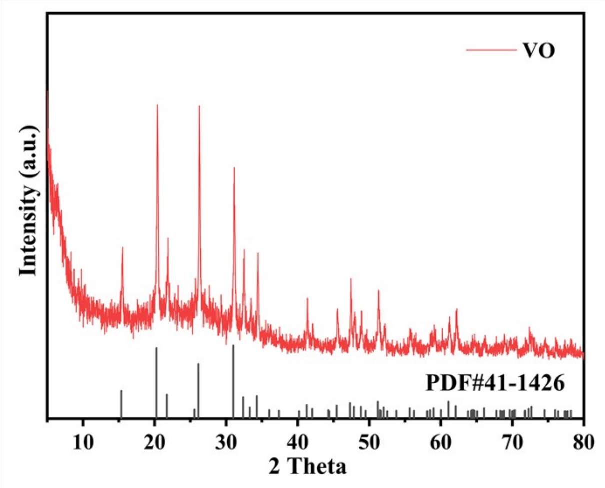

Figure S2. The XRDs of VO.

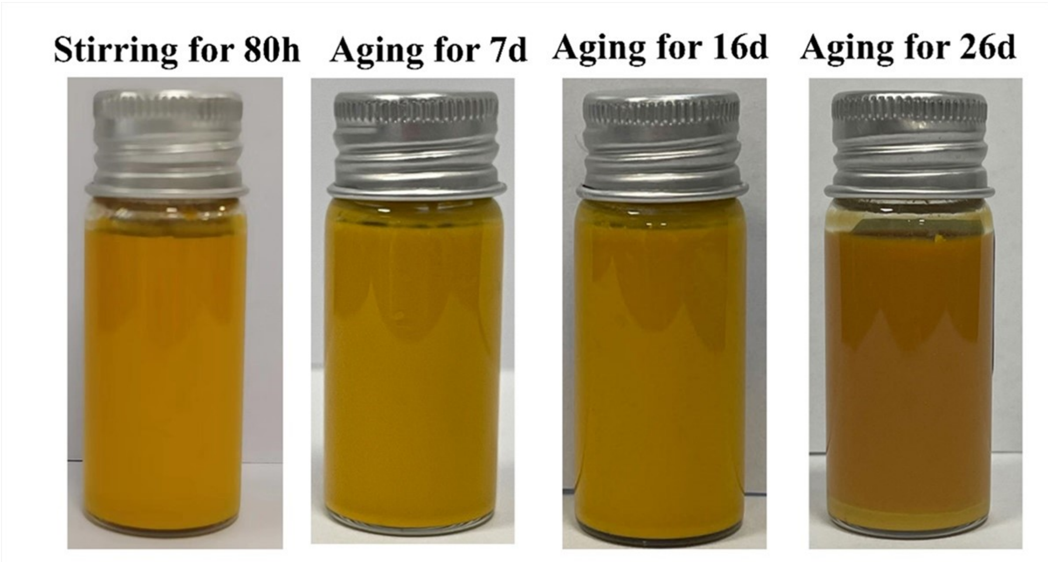

Figure S3. Commercialized V_2O_5 powder in DI water is stirred for 80h, aged for 7, 16 and 26 days respectively (Photographs taken after retrieval of samples and shaking well for the first three times and then shooting).

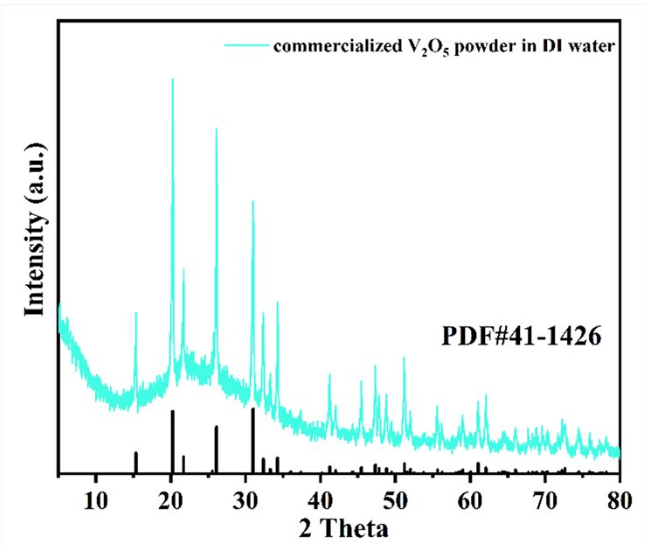

Figure S4. XRD of commercialized V_2O_5 powder in DI water sample.

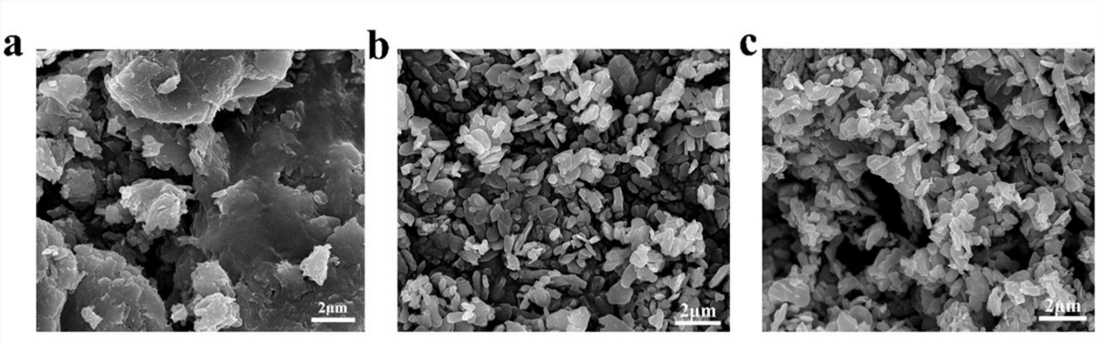

Figure S5. SEM images of VO (a), sample of commercialized V_2O_5 powder in DI water (b), and commercialized V_2O_5 powder (c).

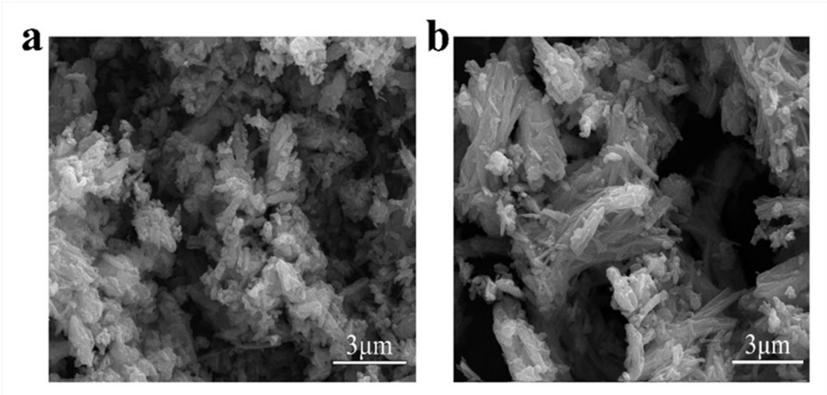

Figure S6. SEM images of MgVO Ⅰ (a) and MgVO Ⅱ (b).

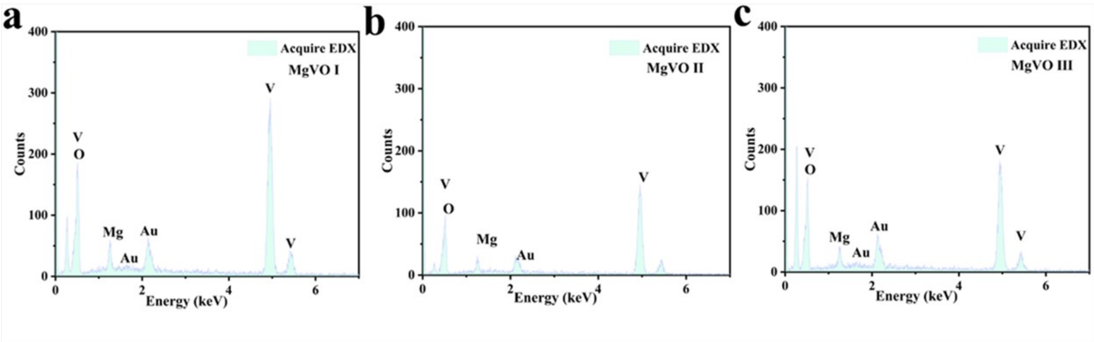

Figure S7. EDX patterns of MgVO Ⅰ (a)，MgVO Ⅱ (b) and MgVO Ⅲ (c).

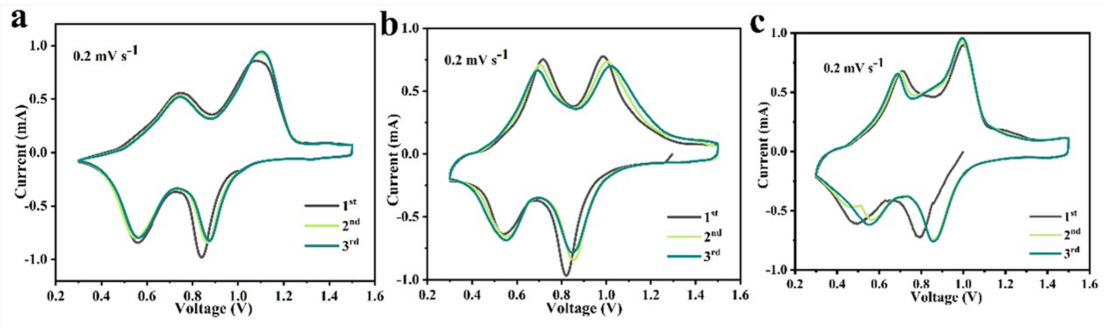

Figure S8. CV curves of MgVO at a scan rate of 0.2 mV s^{-1}: (a) VO, (b) MgVO Ⅰ, (c) MgVO Ⅱ.

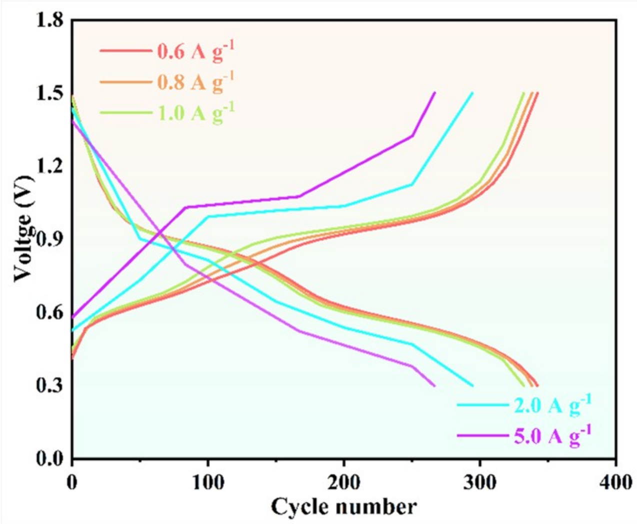

Figure S9. GCD plot of MgVO Ⅲ at different current densities.

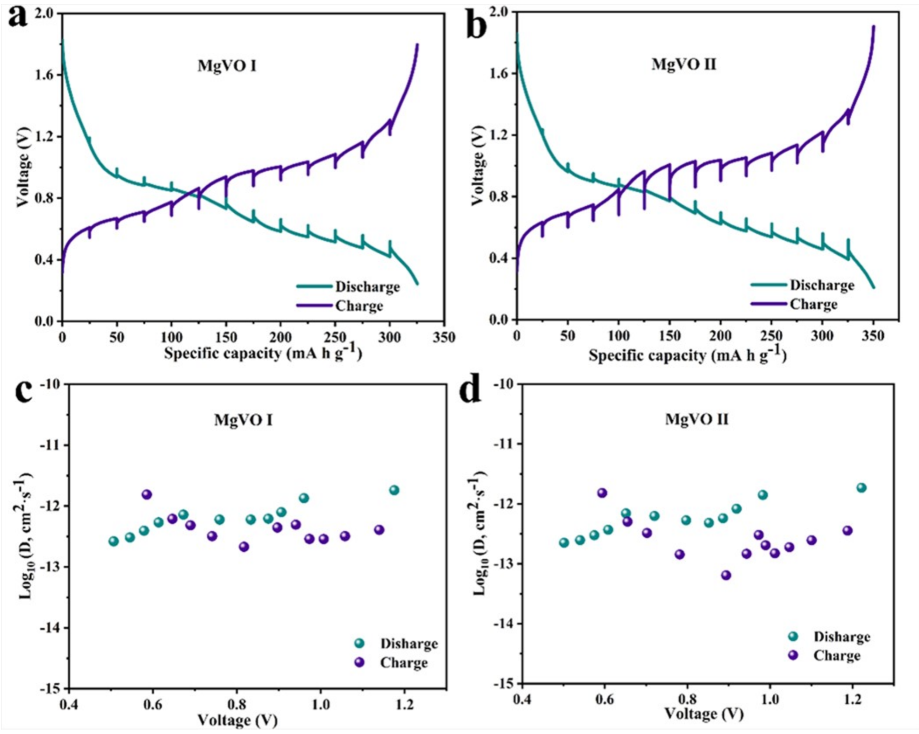

Figure S10. (**a, c) Discharge-charge curve of MgVO Ⅰ in the GITT measurement and the corresponding diffusivity coefficient of Zn^{2+}, (b, d) Discharge-charge curve of MgVO Ⅱ in the GITT measurement and the corresponding diffusivity coefficient of Zn^{2+}.**

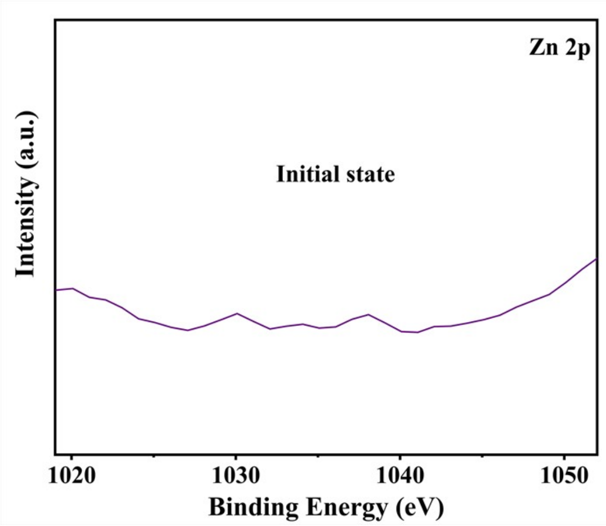

Figure S11. The XPS spectrum of MgVO Ⅲ: Zn 2p.

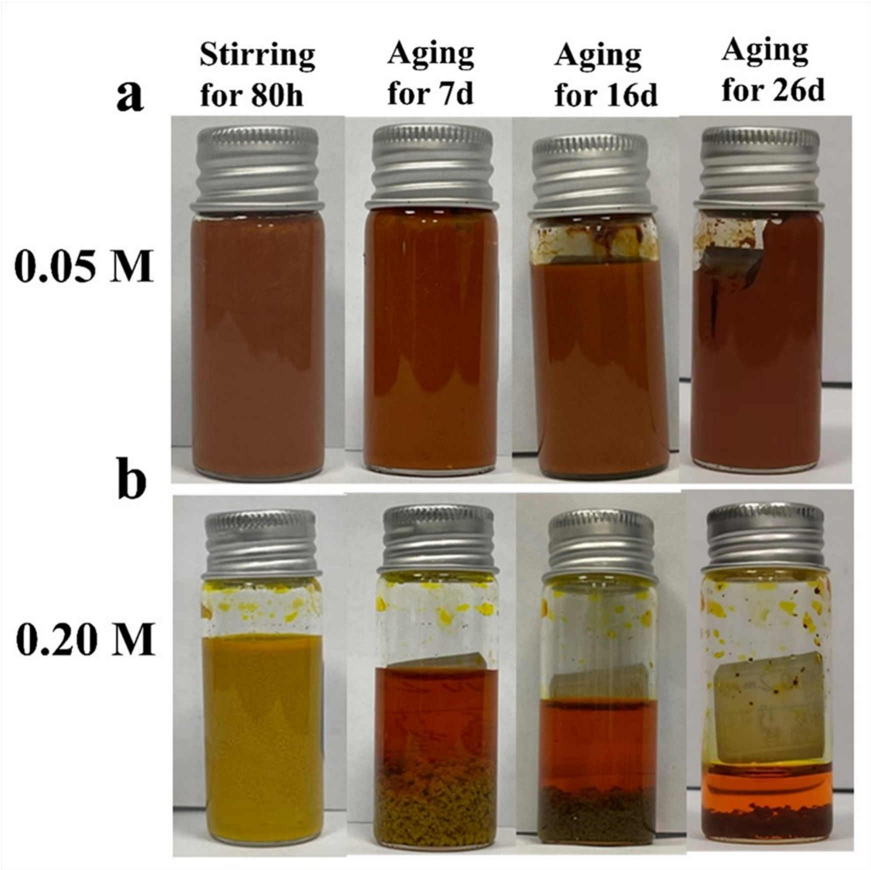

Figure S12. MgVO 0.5 (a) and MgVO 2.0 (b) samples are stirred for 80h, aged for 7, 16 and 26 days respectively (Photographs taken after retrieval of samples).

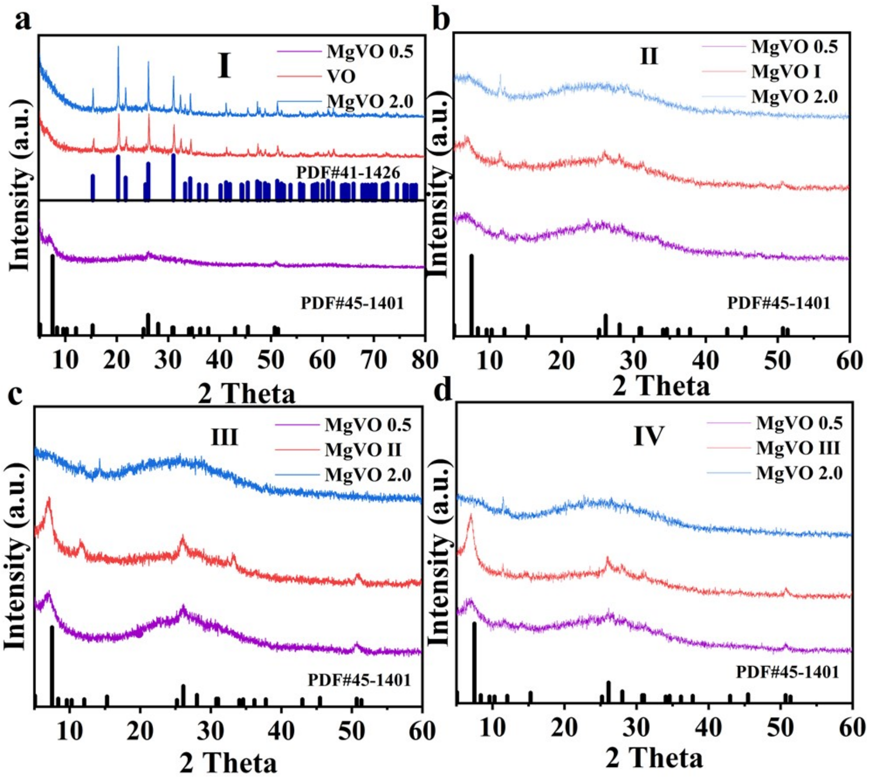

Figure S13. XRD of MgVO 0.5, MgVO, MgVO 2.0 samples: (a) stirring for 80h, (b) aging for 7 days, (c)aging for 16 days, (d) aging for 26 days.

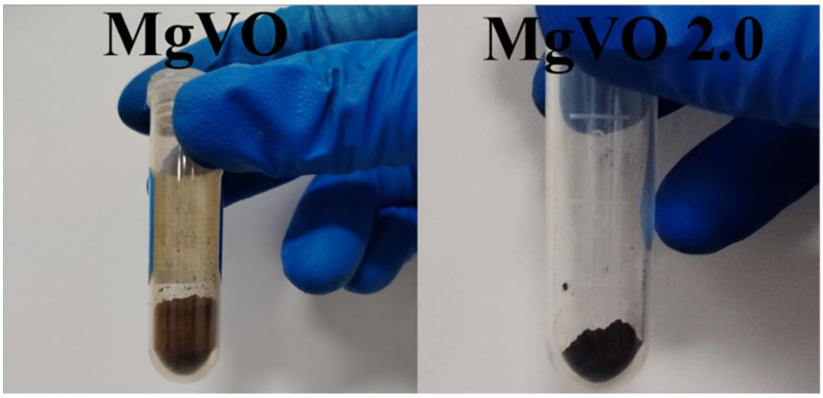

Figure S14. Powders after centrifugal drying of MgVO and MgVO 2.0.

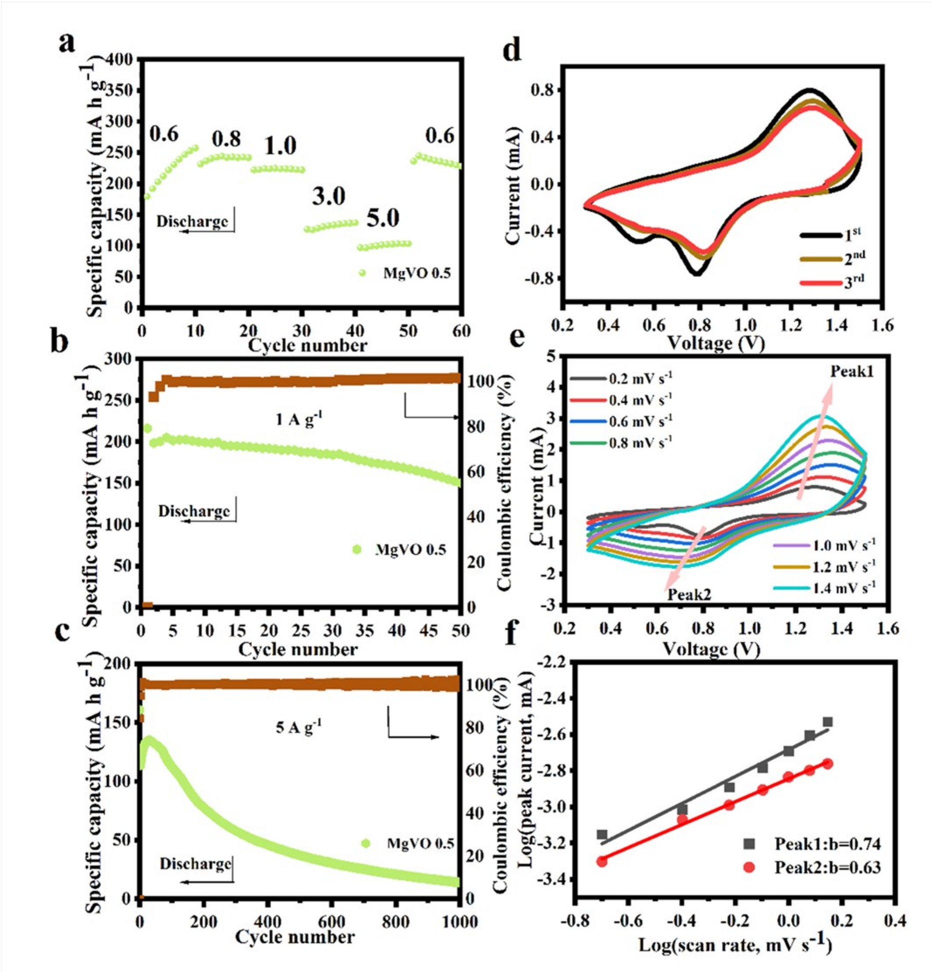

Figure S15. The electrochemical behavior of MgVO 0.5 when the cell is discharge: (a) Rate performance, (b-c) Cycling performance at a current density of 1 A g^{-1}, 5A g^{-1}, respectively. The reaction kinetics of MgVO 0.5 (d) The CV of MgVO 0.5 in the first three cycles at 0.2 mV s^{-1}. (e) The CV of MgVO 0.5 at scan rates of 0.2 mV s^{-1}-1.4 mV s^{-1}, and (f) Log(*i*) vs log(*v*) plot of MgVO 0.5.

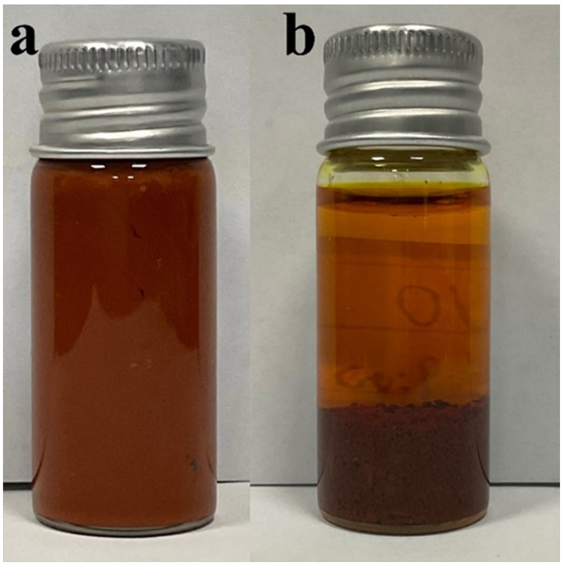

Figure S16. (a) CuVO, and (b) ZnVO sample.

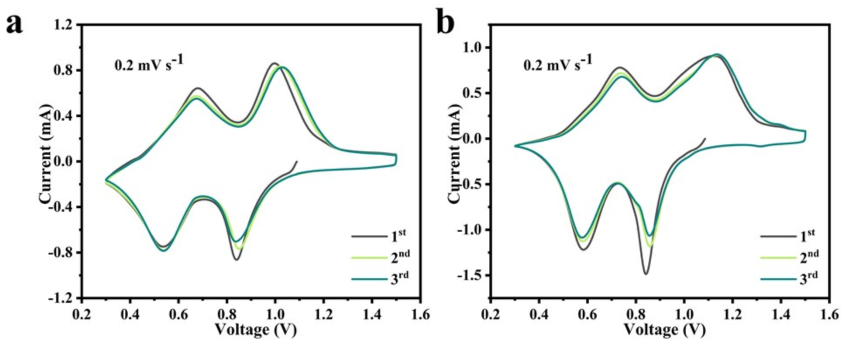

Figure S17. The first three cycles of CV curves of (a) CuVO, and (b) ZnVO at a scan rate of 0.2 mV s^{-1}.

Table S1. Texture coefficient ratio of $TC_{(001)}/TC_{(MgVO Ⅲ (001))}$.

(001) plane	TC (%)
MgVO Ⅰ (001)/MgVO Ⅲ (001)	0.30
MgVO Ⅱ (001)/MgVO Ⅲ (001)	0.63
MgVO Ⅲ (001)/MgVO Ⅲ (001)	1.00

Table S2. EDX data for MgVO (Ⅰ, Ⅱ, Ⅲ)

Sample	Element	Weight (%)	Atom (%)
MgVO Ⅰ	Mg	2.80	2.60
	V	41.00	18.16
MgVO Ⅱ	Mg	2.96	2.81
	V	43.04	19.46
MgVO Ⅲ	Mg	2.75	2.48
	V	37.84	16.26

Table S3. ICP-MS data for MgVO Ⅲ

Element	Elemental content C_x (mg/kg)	Elemental content W (%)
V	482995.95	48.300%
Mg	26356.28	2.636%

Table S4. Performance comparison of MgVO Ⅲ and other vanadium-based materials

Cathode materials	Electrochemical performance	Reference
$Mg_{0.57}V_5O_{12}·2.3H_2O$	5 A g^{-1}, 232.5 mA h g^{-1} after 1400 cycles, 94%	This work
$Ba_{0.26}V_2O_5·0.92H_2O$	5 A g^{-1}, maximum capacity up to 133.4 mA h g^{-1}	1
$V_3O_7·H_2O$	5 A g^{-1}, 171.6 mA h g^{-1} after 1000 cycles, 85%	2
CuV_2O_6	5 A g^{-1}, 143 mA h g^{-1} after 1200 cycles	3
Od-HVO/rG	5 A g^{-1}, 276 mA h g^{-1} after 750 cycles, 119.4%	4
$H_{11}Al_2V_6O_{23.2}$	5 A g^{-1}, 141 mA h g^{-1} after 7000 cycles, 118% of the initial capacity	5
$Cr_{0.09}V_2O_5(H_2O)_2·H_2O$	5 A g^{-1}, 205 mA h g^{-1} after 1000 cycles,96%	6

Table S5. Charge/discharge of MgVO Ⅲ corresponds to EDX

Operational status	Element	Weight (%)	Atom (%)
Discharge	Mg	0.13	0.11
	V	4.07	1.63
	Zn	26.13	8.17
Charge	Mg	0.08	0.05
	V	22.44	7.33
	Zn	3.29	0.84

Notes and references:

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