Supporting Information

Co-intercalation strategy of constructing partial cation substitution of ammonium vanadate $\{(NH_4)_2V_6O_{16}\}$ for stable zinc ion storage

Rui Sun[a, b], Siyang Dong[a], Feng Xu[a], Zhiyong Li[a,b], Caihong Wang, Shengjun Lu[a]* and Haosen Fan[b]*

[a]College of Materials Science and Metallurgy Engineering, Guizhou University, Guiyang 550025, China

[b]School of Chemistry and Chemical Engineering, Guangzhou University, Guangzhou 510006, China

E-mail: sjlu@gzu.edu.cn; hsfan@gzhu.edu.cn

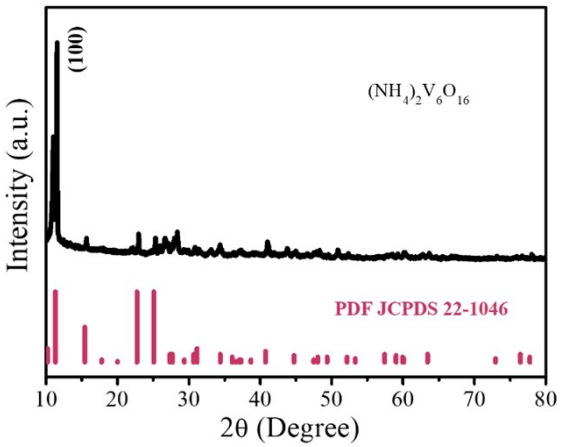

Fig. S1 XRD pattern of NVO.

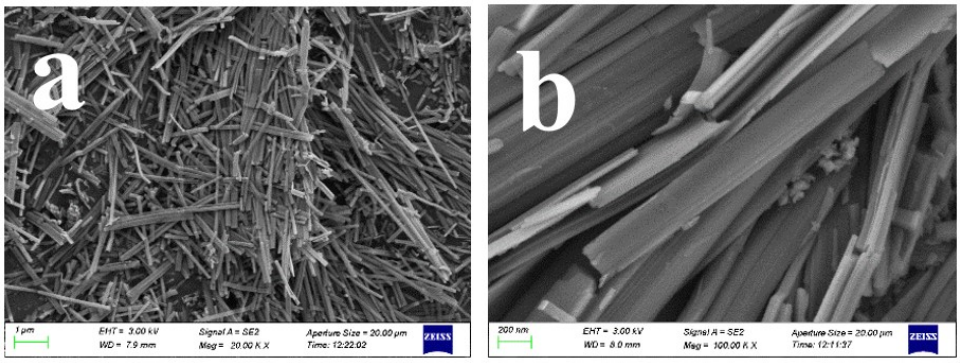

Fig. S2 (a, b) SEM images of NVO.

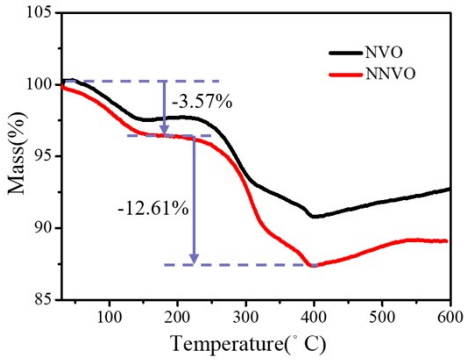

Fig. S3 The TG of NNVO and NVO. The TG analysis was tested in nitrogen.

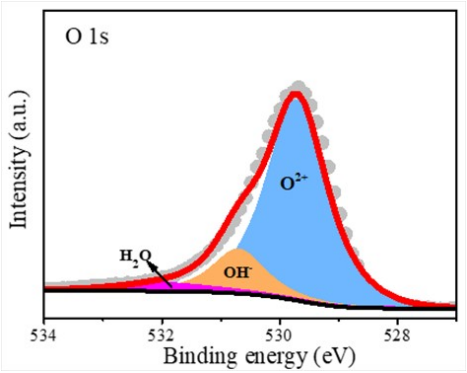

Fig. S4 O 1s regions of the XPS spectra of the NNVO.

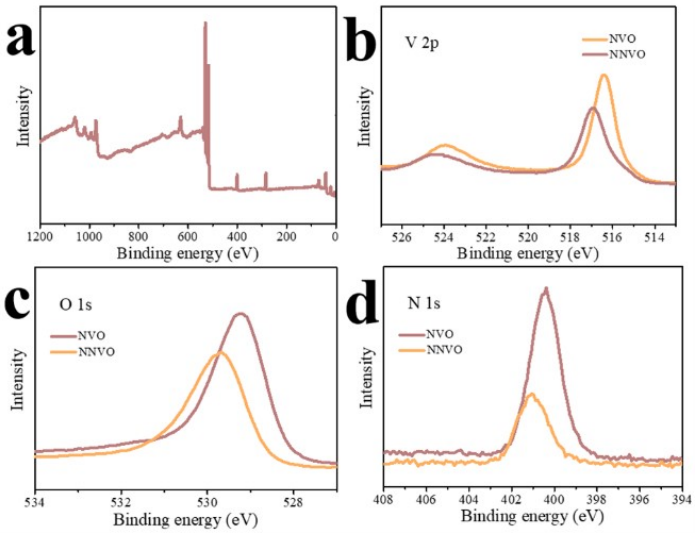

Fig. S5 (a) XPS spectra of the NVO composite. (b) V 2p, (c) N 1s, and (d) Na 1s regions of the XPS spectra of the NNVO and NVO.

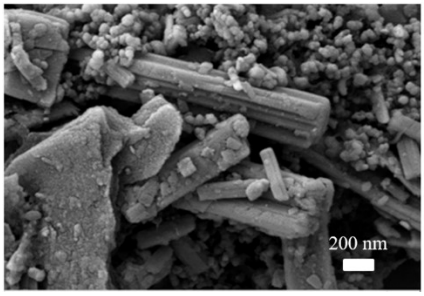

Fig. S6 The SEM image of NNVO after cycles at 0.1 A g^{-1}.

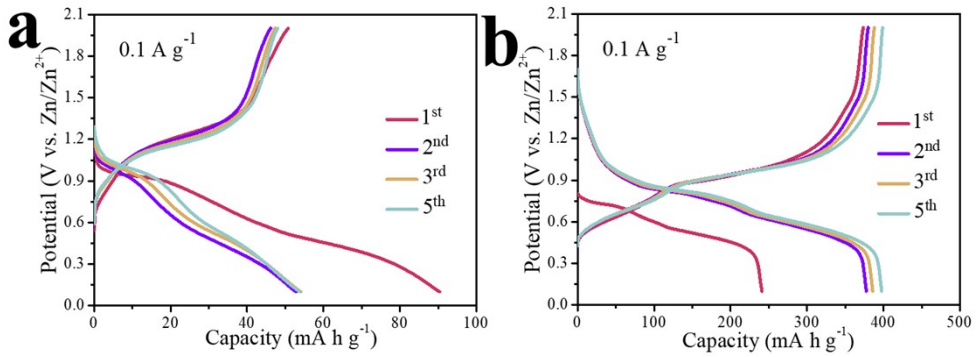

Fig. S7 Galvanostatic discharge-charge curves of V_2O_5 and NVO at 0.1 A g^{-1}, respectively.

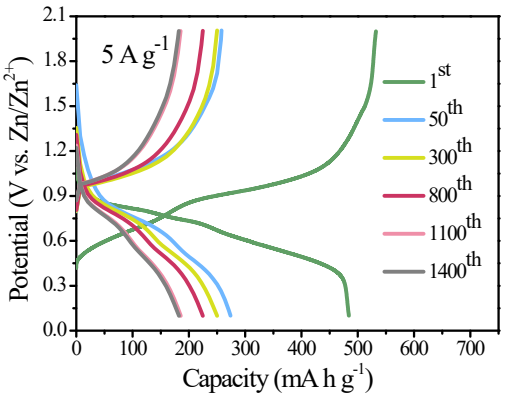

Fig. S8 Galvanostatic discharge-charge curves of NNVO at 5 A g^{-1}.

Table S1. comparison of the electrochemical performance among NNVO and other reported V-based cathode materials.

Materials	Electrolyte	Voltage window (V vs Zn/Zn^{2+})	The energy density (Wh kg^{-1})	Cyclic capacity (mAh g^{-1}/th/A g^{-1})	Ref.
$(NH_4)_2V_6O_{16}$	3 M $Zn(CF_3SO_3)_2$	0.3-1.7	249	238.7/2000/5	1
$CaV_6O_{16}·3H_2O$	3 M $Zn(CF_3SO_3)_2$	0.01-2.0	-	230/300/1	2
$Na_2V_6O_{16}·2.14H_2O$	1 M $ZnSO_4·7H_2O$ and 0.2 M Na_2SO_4	0.2-1.6	312	210/500/5	3
$Na_{1+x}V_3O_8$	2 M $ZnSO_4$	0.4-1.4	-	Ca.280/50/1	4
$CrVO_3$	3 M $ZnSO_4$	0.4-1.7	231.9	85.7/1000/4	5
β-$AgVO_3$	1.5 M $ZnSO_4$	0.4-1.3	90	95/1000/2	6
NNOD	**3 M $Zn(CF_3SO_3)_2$**	**0.1-2.0**	**350.3**	**423.9/90/0.1; 182.5/1400/5**	**This work**

References

1. L. Xu, Y. Zhang, H. Jiang, J. Zheng, X. Dong, T. Hu and C. Meng, *Colloids and Surfaces A: Colloid surface A*, 2020, **593**, 124621.
2. N. Xu, X. Lian, H. Huang, Y. Ma, L. Li and S. Peng, *Mater. Lett.*, 2021, **287**, 129285.
3. F. Hu, D. Xie, D. Zhao, G. Song and K. Zhu, *J. Energy Chem.*, 2019, **38**, 185-191.
4. S. J. Kim, C. R. Tang, G. Singh, L. M. Housel, S. Yang, K. J. Takeuchi, A. C. Marschilok, E. S. Takeuchi and Y. Zhu, *Chem. Mater.*, 2020, **32**, 2053-2060.
5. Y. Bai, H. Zhang, B. Xiang, Y. Zhou, L. Dou and G. Dong, *J. Colloid Inter. Sci.*, 2021, **597**, 422-428.
6. H. Liu, J. G. Wang, H. Sun, Y. Li, J. Yang, C. Wei and F. Kang, *J. Colloid Inter. Sci*, 2020, **560**, 659-666.