Supporting Information

Robust VS_4@rGO Nanocomposite as a High-Capacity and Long-Life Cathode Material for Aqueous Zinc-Ion Batteries

Kaijian Chen, Xing Li*, Jinhao Zang, Zhuangfei Zhang, Ye Wang, Qing Lou, Yucheng Bai, Jiatian Fu, Chenfei Zhuang, Ying Zhang, Leilei Zhang, Shuge Dai*, Chongxin Shan*

Henan Key Laboratory of Diamond Optoelectronic Materials and Devices, Key Laboratory of Material Physics, Ministry of Education, School of Physics and Microelectronics, Zhengzhou University, Zhengzhou, 450052, China

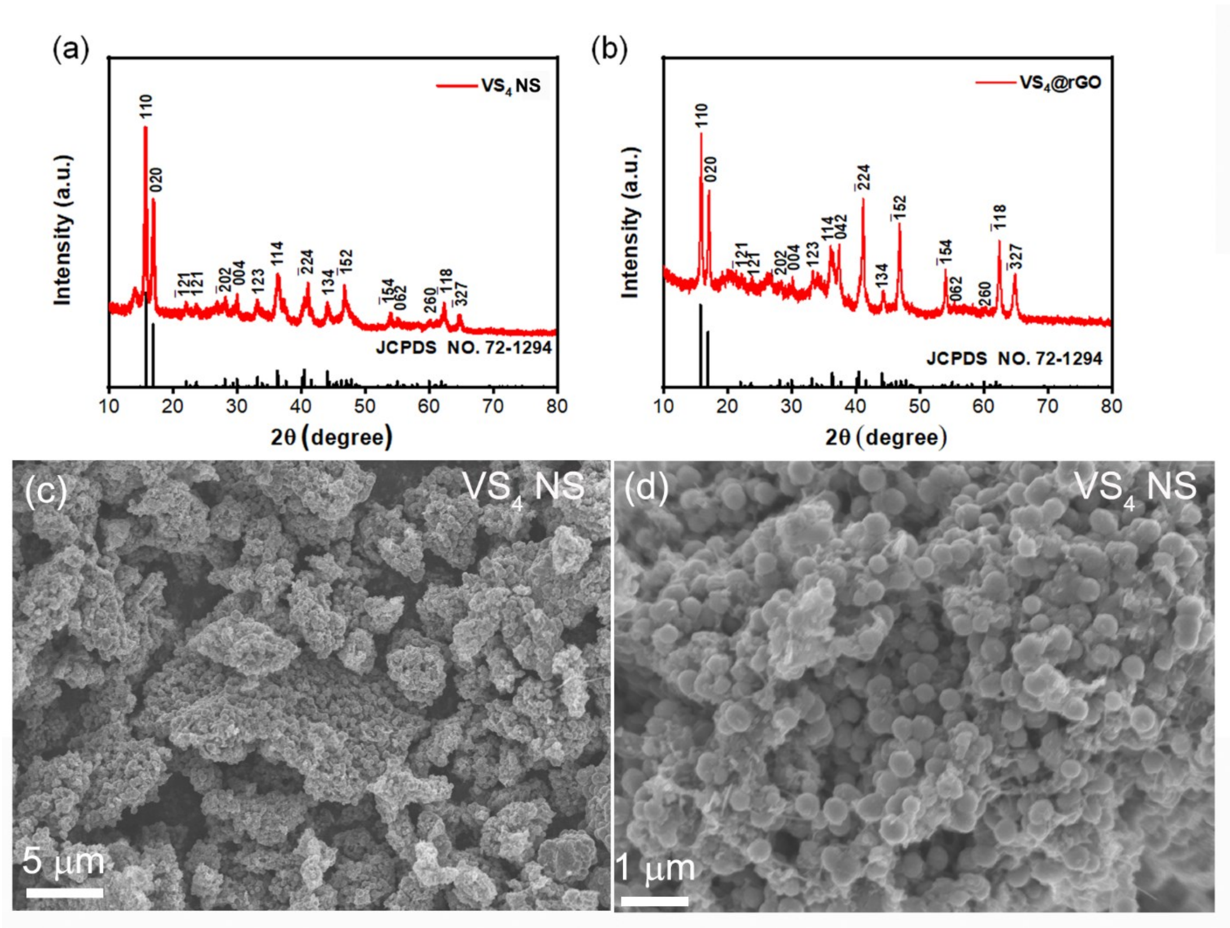

Fig. S1 XRD pattern of the (a) VS_4 NS and (b) VS_4@rGO sample. (c-d) Low-mag SEM images of VS_4 NS sample.

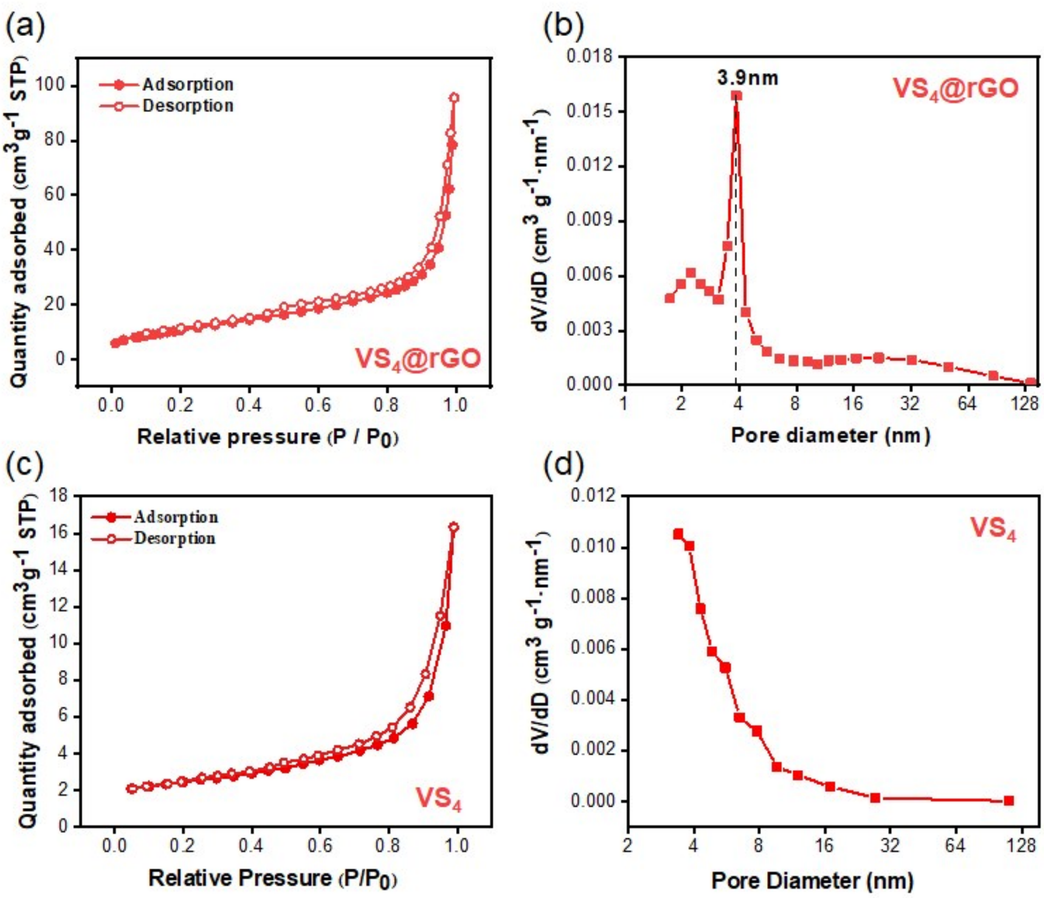

Fig. S2 (a) Nitrogen adsorption-desorption isotherm and (b) pore size distribution of the VS_4@rGO composite. (c) Nitrogen adsorption-desorption isotherm and (d) pore size distribution of the VS_4 NS sample.

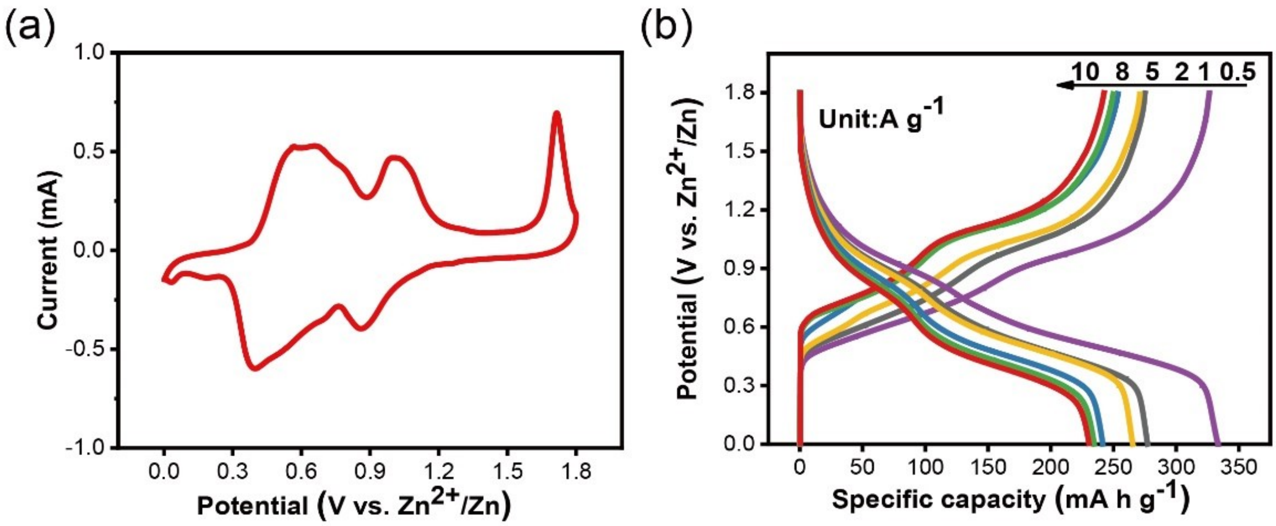

Fig. S3 Electrochemical performance of VS_4 NS. (a) CV curve at the scan rate of 0.5 mV s^{-1}. (b) GDC curves at different current densities.

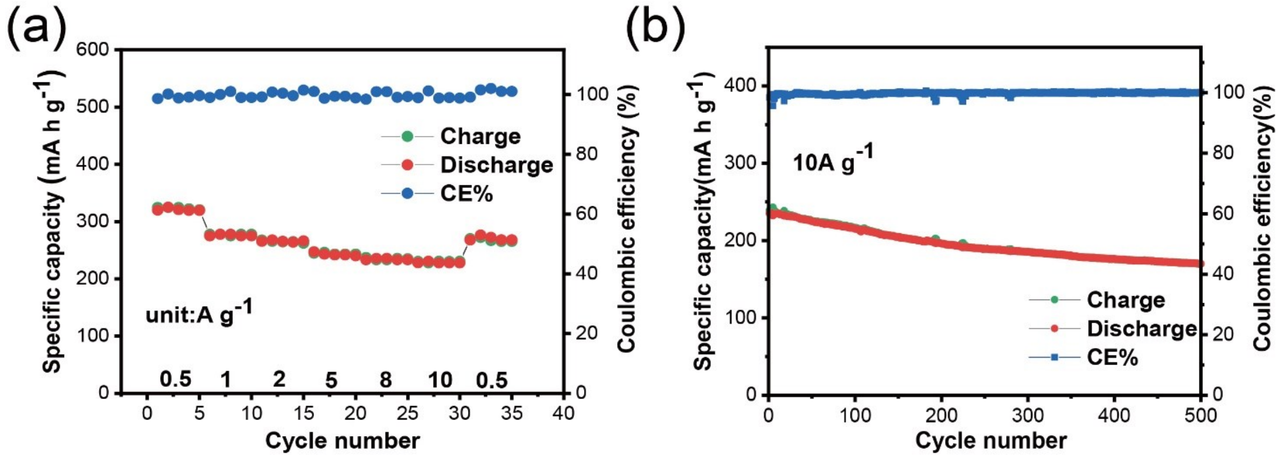

Fig. S4 (a) Rate performance of the VS_4 NS electrode at current densities of 0.5, 1, 2, 5, 8 and 10 A g^{-1}. (c) Cycle performance at the current density of 10 A g^{-1}.

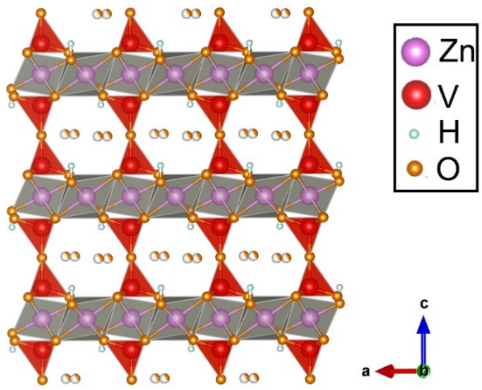

Fig. S5 Schematic illustration of the crystal structure of $Zn_3(OH)_2V_2O_7{\cdot}2H_2O$ viewed along (010) direction.

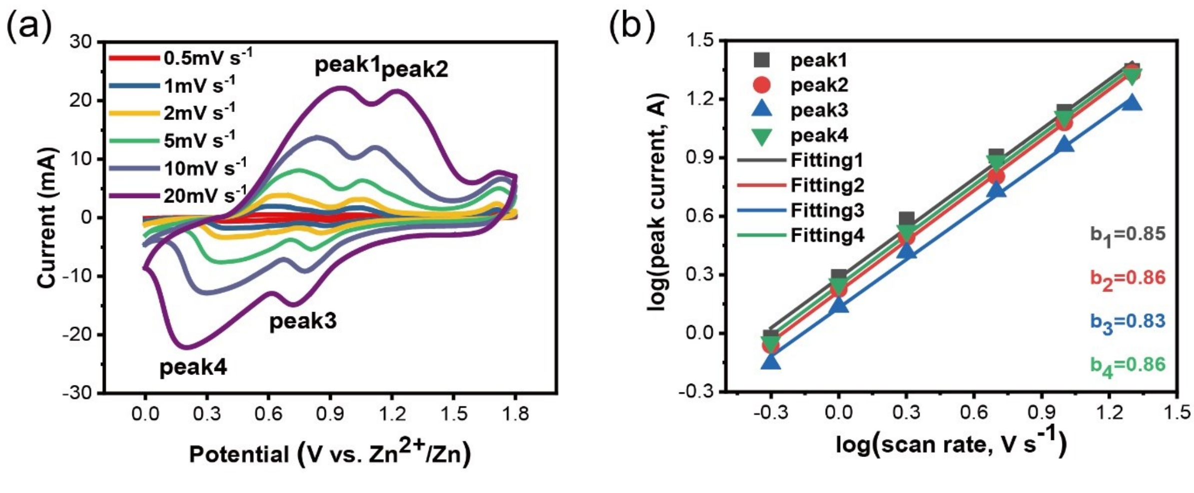

Fig. S6 (a) CV curves of the VS_4@rGO composite electrode at scan rates of 0.5, 1, 2, 5, 10 and 20 mV s^{-1}. (b) log(i) versus log(v) plots at different redox peaks of the composite electrode.

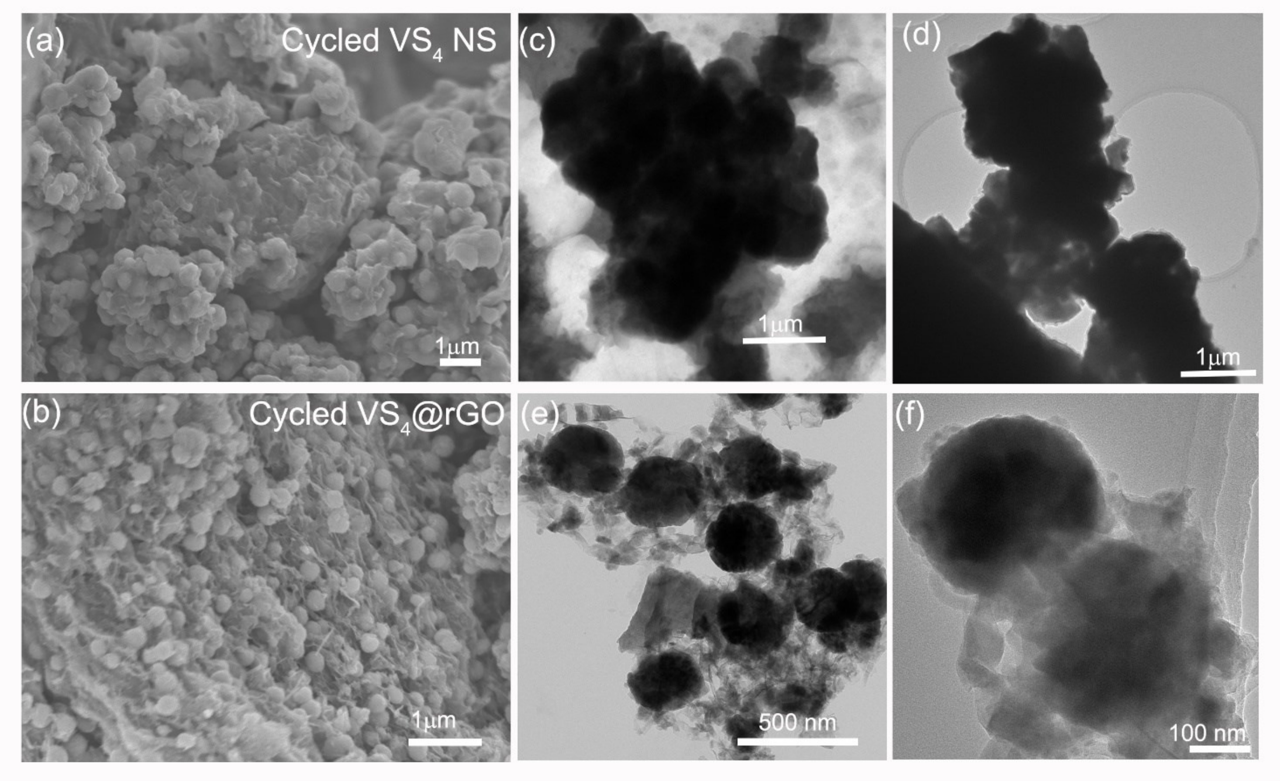

Fig. S7 (a) SEM and (c-d) TEM images of the VS_4 NS electrode after 1000 cycles at 10A g^{-1}. (b) SEM and (e-f) TEM images of the VS_4@rGO electrode after 1000 cycles at 10A g^{-1}.

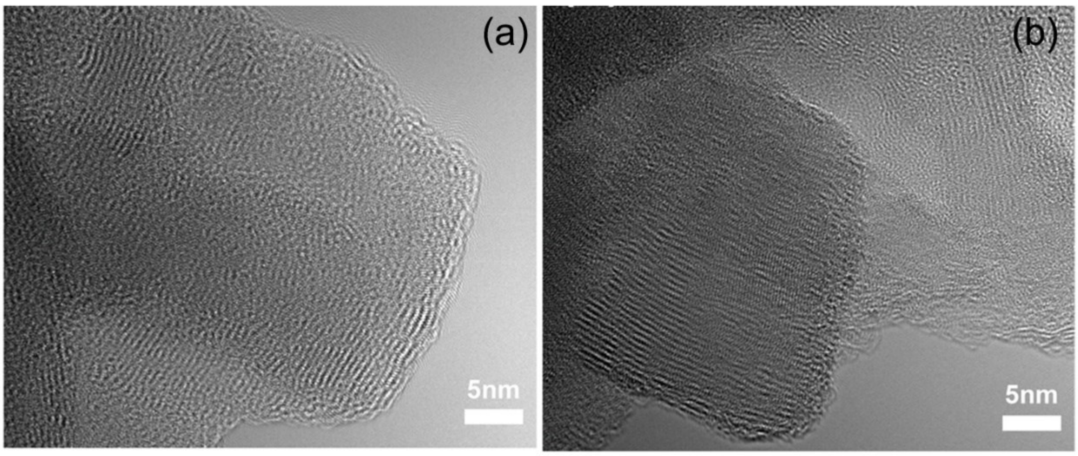

Fig. S8 HRTEM images of the cycled VS_4@r-GO.

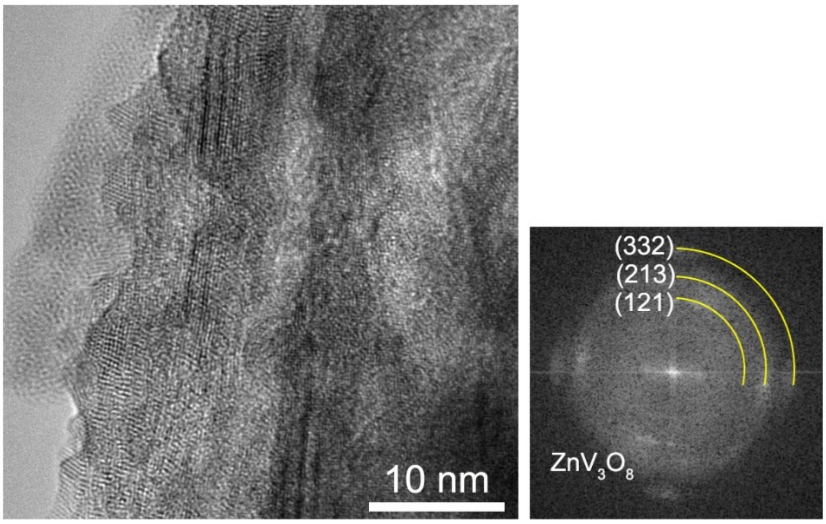

Fig. S9 HRTEM image of the cycled VS_4@rGO.

Table S1. Fitting results of the R_s and R_{ct} values in Nyquist curves (Fig. 3e)

Cycle Number	OCV (**VS_4@rGO**)	50 (**VS_4@rGO**)	OCV (VS_4 NS)
R_s (Ω)	5.53	5.75	6.39
R_{ct} (Ω)	39.74	20.30	76.10

Table S2 Comparison of operational voltage and discharge capacity of various cathode materials in aqueous Zn-ion batteries

Cathode material	Testing voltage (V)	Main operating voltage (V)	Discharge Capacity (mA h g-1)	Reference
VS_4@rGO	0-1.8	0.89, 0.43	450@0.5A g^{-1}	Our work
VS_4@rGO	0.35-1.8	0.89, 0.54	225@0.5A g^{-1}	1
VS_4	0.2-1.6	0.89, 0.53	260@0.25A g^{-1}	2
VS_2	0.4-1.0	0.68, 0.6	178@0.1A g^{-1}	3
rGO-VS_2	0.2-1.8	0.92, 0.61	174@0.5A g^{-1}	4
VS_2@VOOH	0.4-1.0	0.68, 0.59	142.8@0.5A g^{-1}	5
VS_2	0.4-1.0	0.69, 0.58	168@0.5A g^{-1}	6
VS_2	0.4-1.0	0.75, 0.58	136.8@0.5A g^{-1}	7
p-V_2O_5	0.3-1.5	0.91, 0.54	242@0.5 A g^{-1}	8
V_2O_3/C	0.3-1.5	0.92, 0.56	272.4@0.5 A g^{-1}	9
$Zn_3V_2O_7(OH)_2·2H_2O$	0.2-1.8	0.85, 0.58	122@0.5 A g^{-1}	10
$Na_2V_6O_{16}·2.14H_2O$	0.2-1.6	0.73, 0.45	346@0.5 A g^{-1}	11
$(NH_4)_2V_6O_{16}·1.5H_2O$	0.4-1.6	0.70, 0.49	307@0.5 A g^{-1}	12

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