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Supporting Information

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Three-Dimensional Interconnected Vanadium Pentoxide Nanonetwork Cathode for High-Rate Long-Life Lithium Batteries

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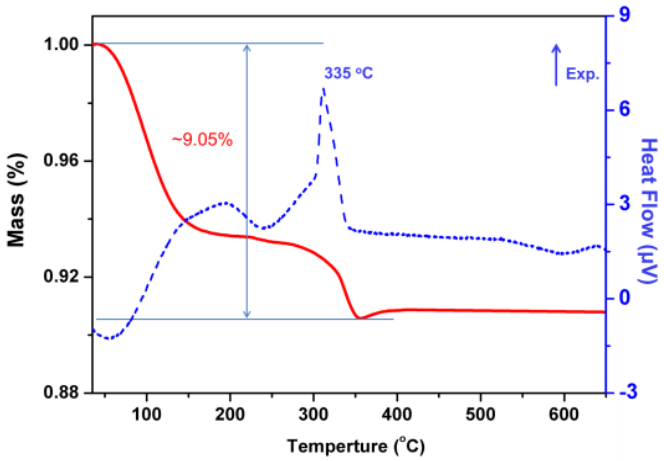

Figure S1. TG curve of the as-synthesized nanowire precursor, measured at a rate of 5 ^{o}C min^{-1} in air. About 9.05% weight loss, $n \approx 1.0$ is calculated in the $V_2O_5 \cdot nH_2O$.

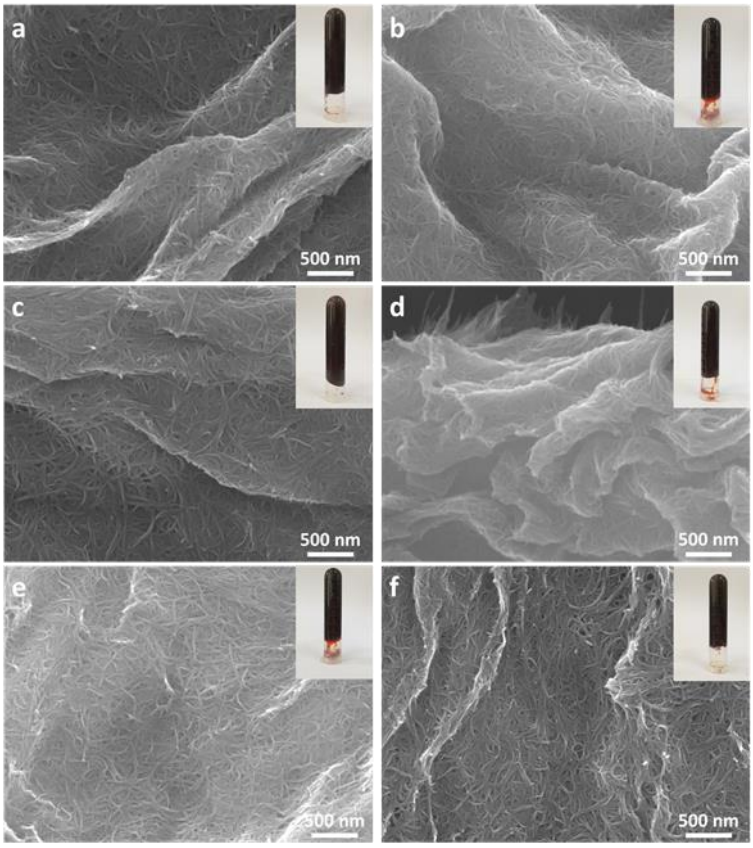

Figure S2. SEM images of the hydrogels synthesized by adding $(NH_4)_2SO_4$ (a), NH_4Cl (b), Li_2SO_4 (c), LiCl (d), Na_2SO_4 (e) and K_2SO_4 (f), respectively; insets are the related photographs.

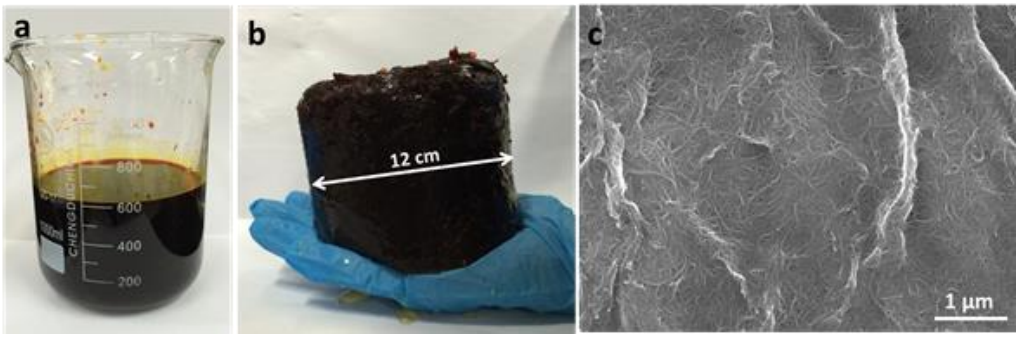

Figure S3. Photographs (a,b) and SEM image of the products obtained in a 600 mL reaction.

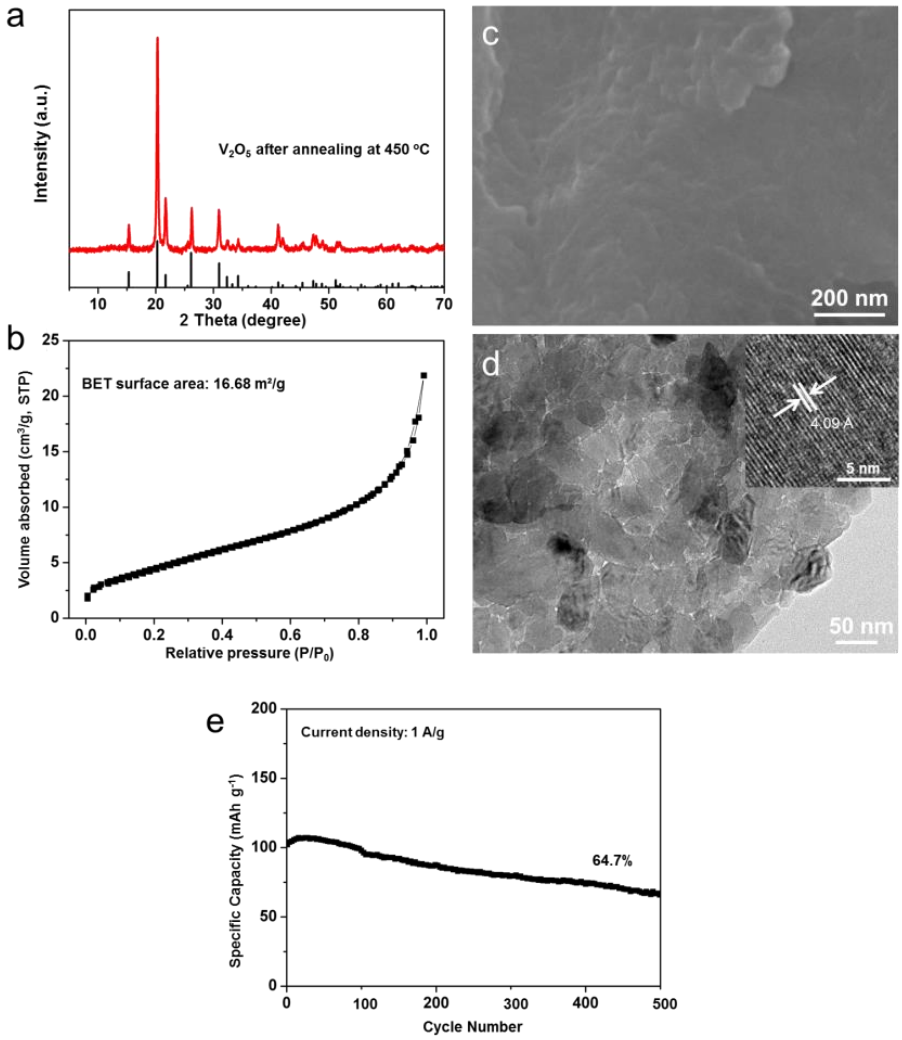

Figure S4. The XRD pattern (a), nitrogen adsorption-desorption isotherm (b), SEM image (c), and HRTEM image (d) of the V_2O_5 sample obtained after annealing the precursor at 450 °C in air. (e) The electrochemical performance also demonstrates that the sample annealed at 450 °C shows poor rate capability and cycling stability (only 64.7% capacity retained after 500 cycles at 1 A g^{-1}) when compared to the V_2O_5 networks (Figure 4a). These further demonstrate the advantage of the designed interconnected nanonetwork structure.

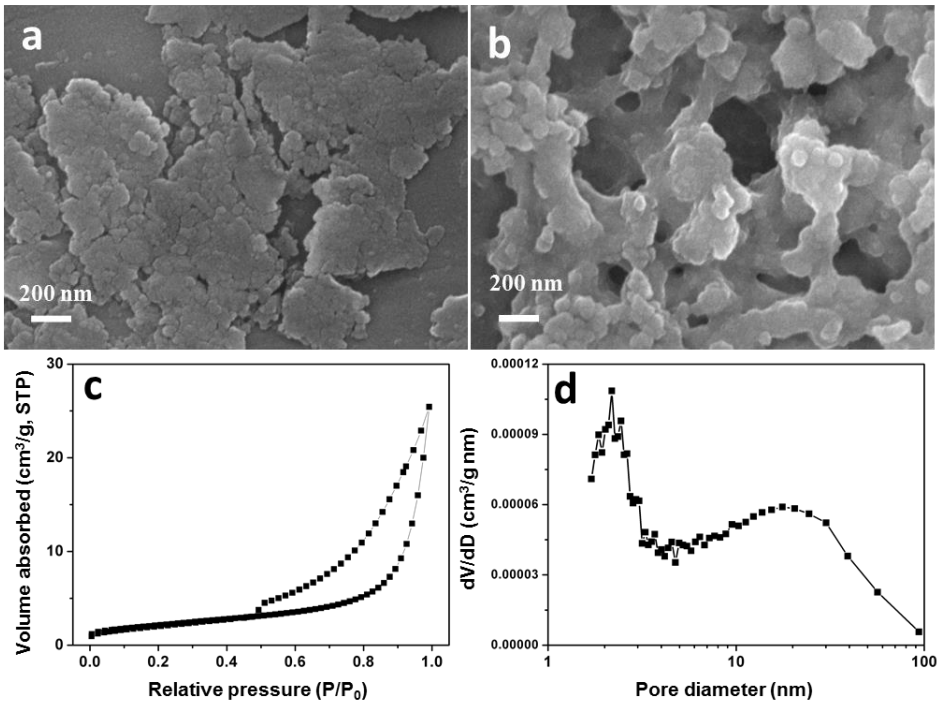

Figure S5. SEM images of the directly dried V_2O_5 sols (a) and annealed V_2O_5 particles (b). Nitrogen adsorption-desorption isotherm (c) and the corresponding pore-size-distribution curve (d) of the V_2O_5 particles

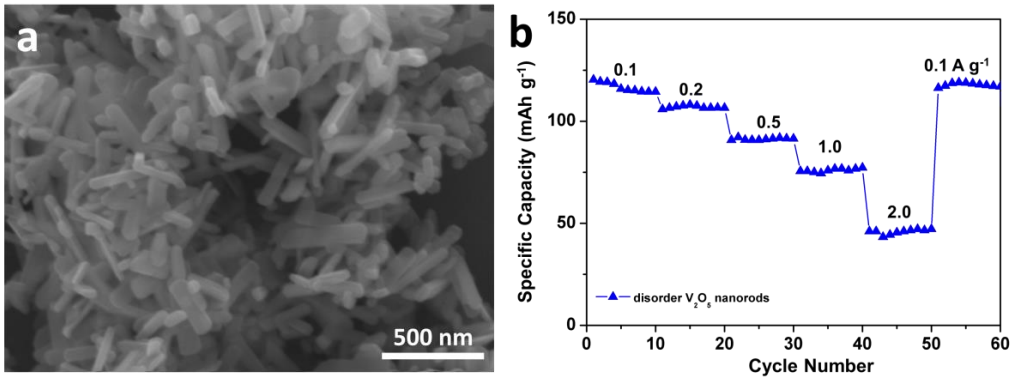

Figure S6. (a) SEM image of the disorder V_2O_5 nanorods. (b) Rate performance of the disorder V_2O_5 nanorods cycled in 2.4 to 4.0 V.

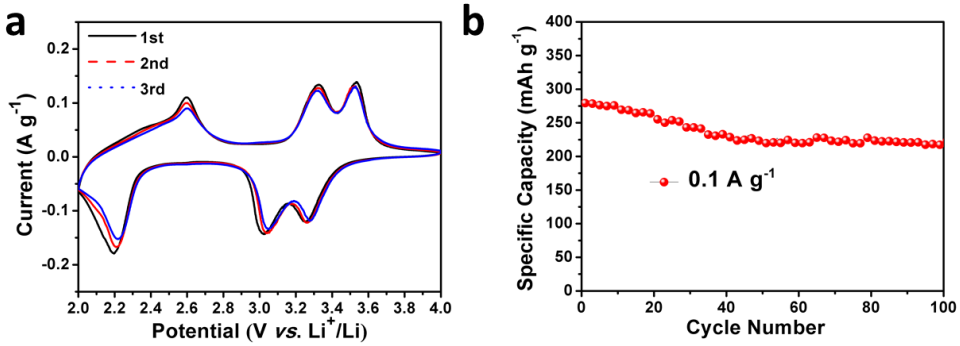

Figure S7. Cyclic voltammograms at a scan rate of 0.1 mV s^{-1} (a) and cycling performance at the current density of 0.1 A g^{-1} (b) of interconnected V_2O_5 nanonetworks in the potential range from 2.0 to 4.0 V.

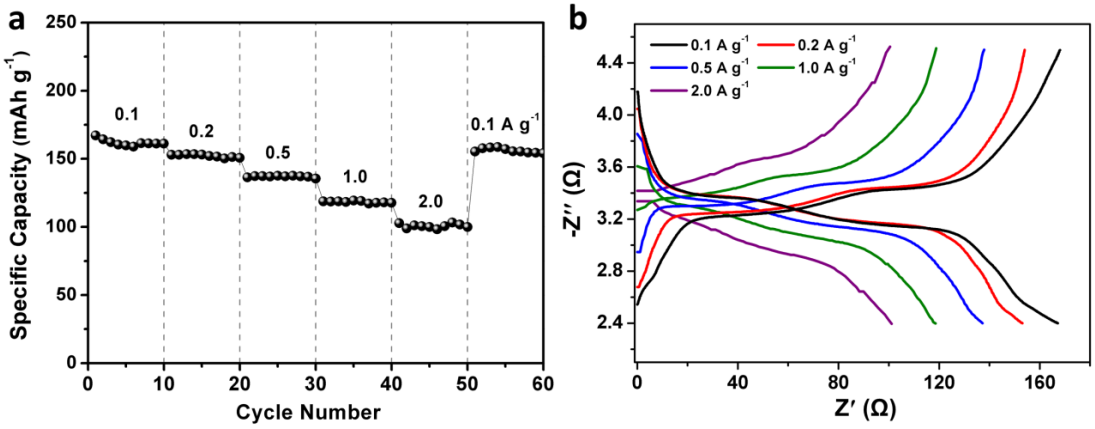

Figure S8. The rate performance (a) and corresponding discharge/charge curves (b) of interconnected V_2O_5 nanonetworks in the potential range from 2.4 to 4.5 V.

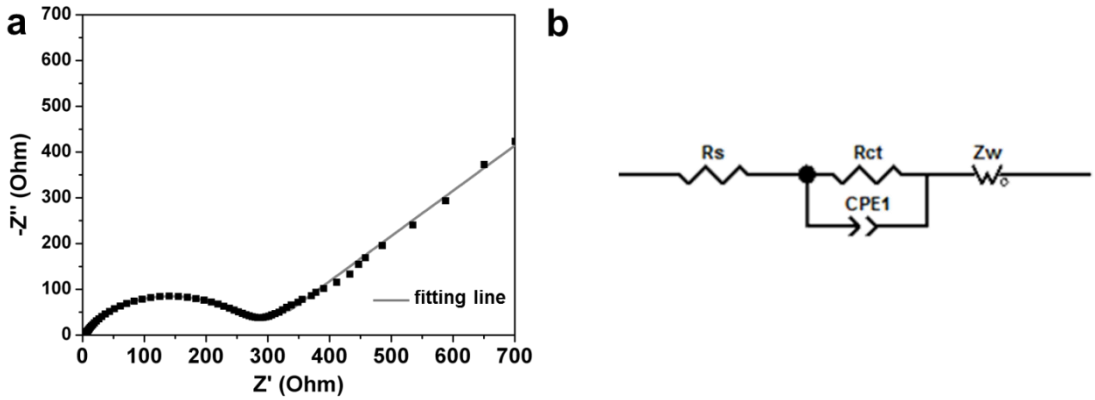

Figure S9. (a) AC impedance spectra of V_2O_5 particles cathode. (b) The related equivalent circuit of the cell.

Table S1. The fitting values based on the EIS data.

cell state	Rs (ohm)	Rct (ohm)
V_2O_5 particles after 10 cycles	4	281
V_2O_5 nanonetworks after 10 cycles	4	155
V_2O_5 nanonetworks after 50 cycles	4	147
V_2O_5 nanonetworks after 100 cycles	5	153
V_2O_5 nanonetworks after 1000 cycles	5	168

Table S2. The electrochemical performances (cycling performance at relevant current rate or density, and rate capability) of the interconnected V_2O_5 nanonetworks and the other reported V_2O_5 materials.

Sample	Voltage range	Capacity (mAh g^{-1})/ Cycle number	Current rate or density	Rate capacity (mAh g^{-1}) at relevant current rate or density
3D interconnected V_2O_5 nanonetworks (our work)	**2.4 – 4 V**	**106/1000**	**1 A g^{-1}**	**100 at 2 A g^{-1}**
V_2O_5 microspheres[1]	2.5 – 4 V	~ 135/100	~ 0.3 A g^{-1}	92.2 at 2.25 A g^{-1}
V_2O_5/CNTs composites[2]	2 – 4 V	104/200	0.75 A g^{-1}	169 at 1.5 A g^{-1}
Porous V_2O_5 nanotubes[3]	2.5 – 4 V	105/250	2 A g^{-1}	62.5 at 15 A g^{-1}
3D porous V_2O_5[4]	2.5 – 4 V	110/200	1.5 A g^{-1}	86.7 at 8.4 A g^{-1} (charge at 0.15 A g^{-1})

References

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