

Supplementary Information for

**Si-doped Vanadium Pentoxide/Graphene Xerogel Nanocomposite
Cathodes with Excellent Cycle Life for Li-Ion Batteries**

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Synthesis method:

Synthesis method for Graphene Oxide (GO)

GO was prepared using a two-step method. First, 2 g of graphite flakes were mixed with 10 ml of concentrated H_2SO_4 , 2 g of $\text{K}_2\text{S}_2\text{O}_8$ and 2 g of P_2O_5 . The resulting mixture was heated at 80 °C for 4 hours with constant stirring. Afterward, the mixture was filtered and thoroughly washed with deionized (DI) water. After drying at 80 C overnight, the pre-oxidized graphite was then subjected to oxidation using Hummer's method. Second, 2 g of pre-oxidized graphite, 1 g of sodium nitrate and 46 ml of sulfuric acid were mixed and stirred for 15 min in an ice bath. Then, 6 g of potassium permanganate was slowly added to the obtained suspension solution for another 15 min. After that, 92 ml DI water was slowly added to the suspension, while the temperature was kept constant at about 98 °C for 15 min. After the suspension was diluted by 280 mL of DI water, 10 ml of 30% H_2O_2 was added to reduce the unreacted permanganate. The resulting suspension was centrifuged several times to remove the unreacted acids and salts. The purified GO was dispersed in DI water by sonication for 1 h to form a 0.2 mg mL⁻¹ solution. Then the GO dispersion was subjected to another centrifugation to remove the un-exfoliated GO. The resulting diluted GO solution will be used as the substrate for V_2O_5 and Si- V_2O_5 composites.

Figure

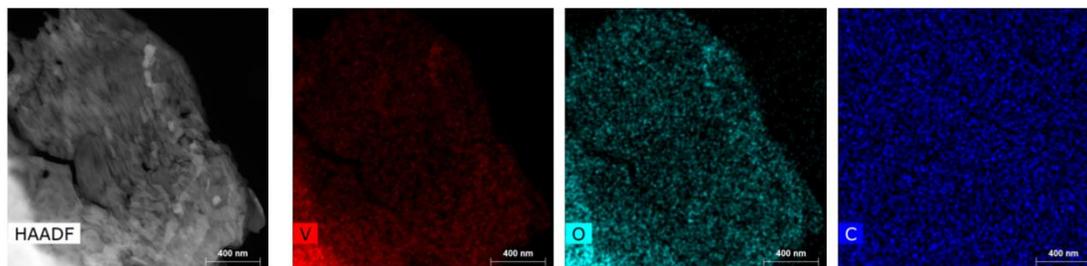


Figure S1. STEM EDXS mapping of V_2O_5 @G.

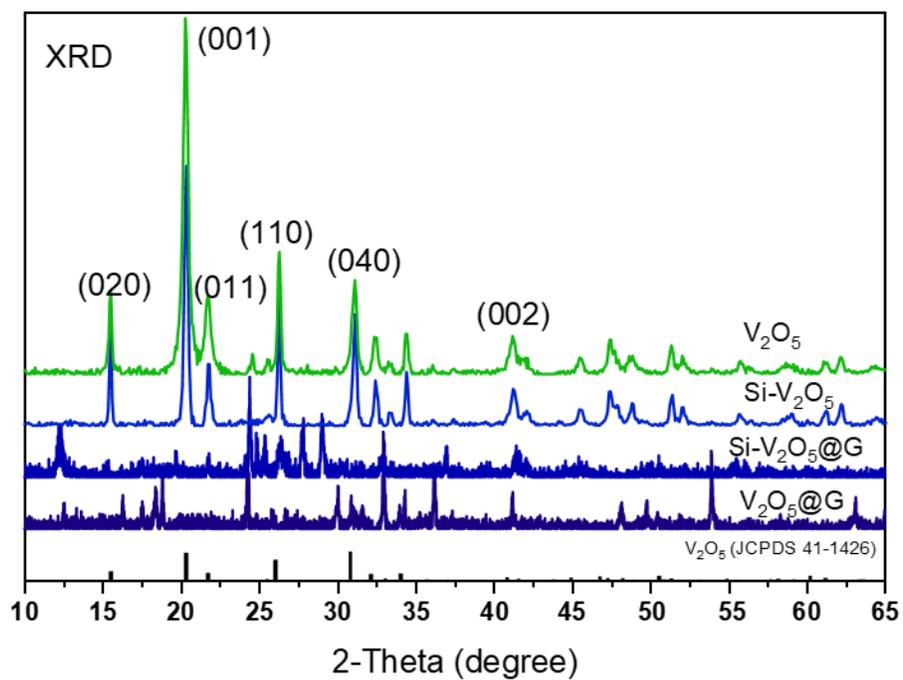


Figure S2. XRD patterns of V_2O_5 samples.

Table

Table S1. Comparison of the electrochemical performance of Si-V₂O₅ Hybrids and other work in coin cell configuration

Number	Sample	Initial Capacity			Cycle performance	
		mA hg ⁻¹	C-rate or current density	Voltage range	Cycle number	C-rate or current density
1	Ga ₄ -V ₂ O ₅ ¹	252.8	200 mA g ⁻¹	1.5-4V	150 (0.27% capacity fade per cycles)	200 mA g ⁻¹
2	Ce _{0.1} V ₂ O ₅ ²	239	0.5 C	2-4V	50 (0.29% capacity fade per cycles)	0.5C
3	TiO ₂ -V ₂ O ₅ nanocrystal ³	331.1	100 mA g ⁻¹	1.5-4V	100 No capacity loss	100 mA g ⁻¹
4	Ni, Co doped V ₂ O ₅ ⁴	111.42	0.5 C	2-4V	100 (0.19% capacity fade per cycles)	0.5 C
5	Carbon-Coated Electrospun V ₂ O ₅ Nanofibers ⁵	160	0.75 C	2-4V	300 (0.13% capacity fade per cycles)	0.75C
6	V ₂ O ₅ nanorods ⁶	284.6	100 mA g ⁻¹	2-4V	100 (0.45% capacity fade per cycles)	100 mA g ⁻¹
7	V ₂ O ₅ /single wall carbon nanotube ⁷	390	0.1 C	1.6-3.8V	200 (0.2% capacity fade per cycles)	0.1 C
8	V ₂ O ₅ nanocomposite /	265	0.1C	2-4V	100 (0.2% capacity	0.1 C

	multiple wall carbon nanotube ⁸				fade per cycles)	
9	V ₂ O ₅ coated NCA ⁹	184.5	1 C	2.7-4.3V	200 (0.06% capacity fade per cycles)	1 C
This work	Si-V ₂ O ₅ nanoribbons on	315	1C	1.5-4V	590 (0.03% capacity fade per cycles)	1 C

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