

Supporting Information

Rational selection of amorphous or crystalline V₂O₅ cathode for sodium-ion batteries

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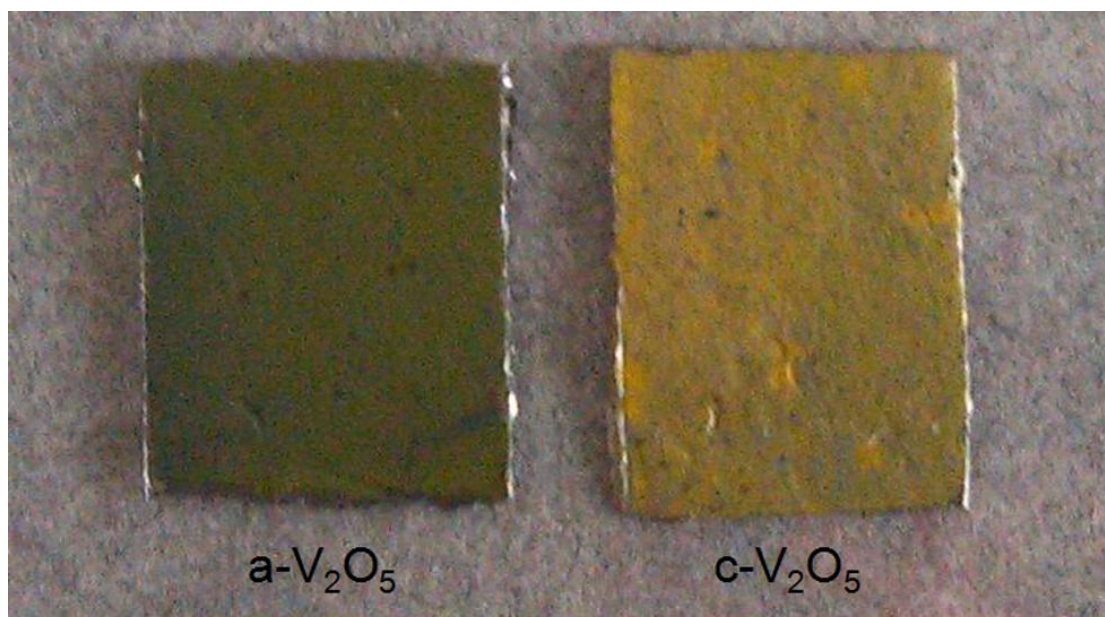


Fig. S1 Optical image of a-V₂O₅ and c-V₂O₅ samples directly grown on graphite paper substrate.

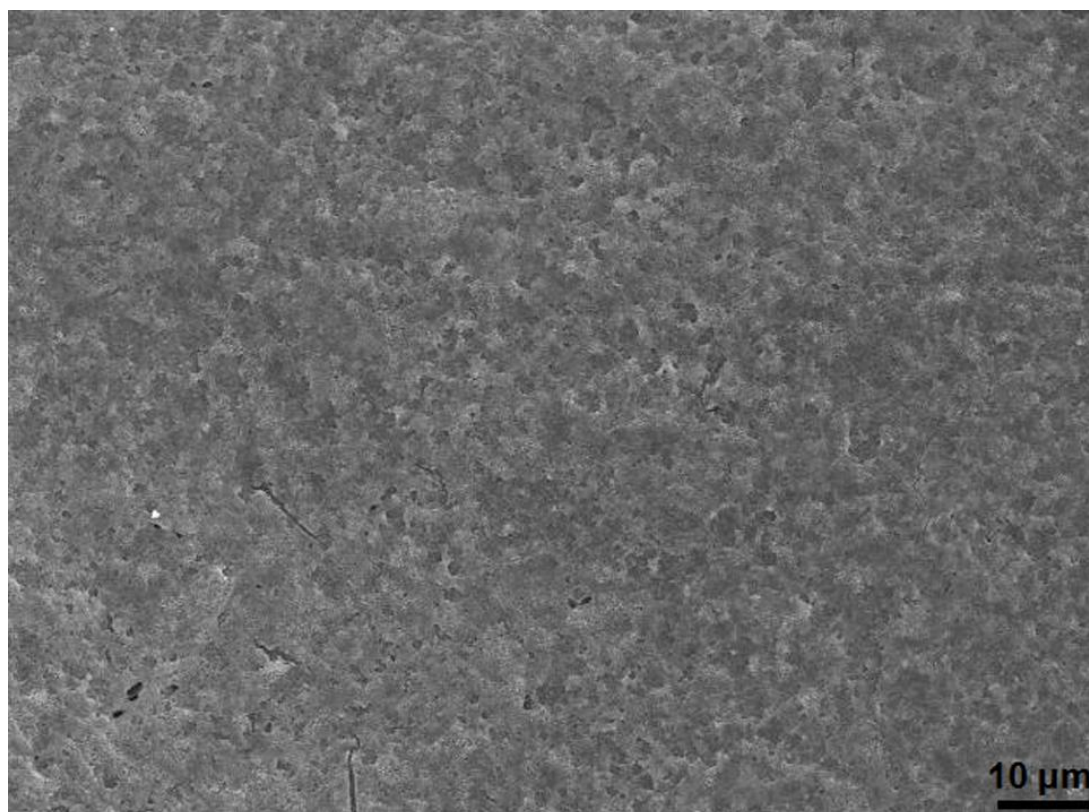


Fig. S2 Low magnification SEM image of the c-V₂O₅ sample.

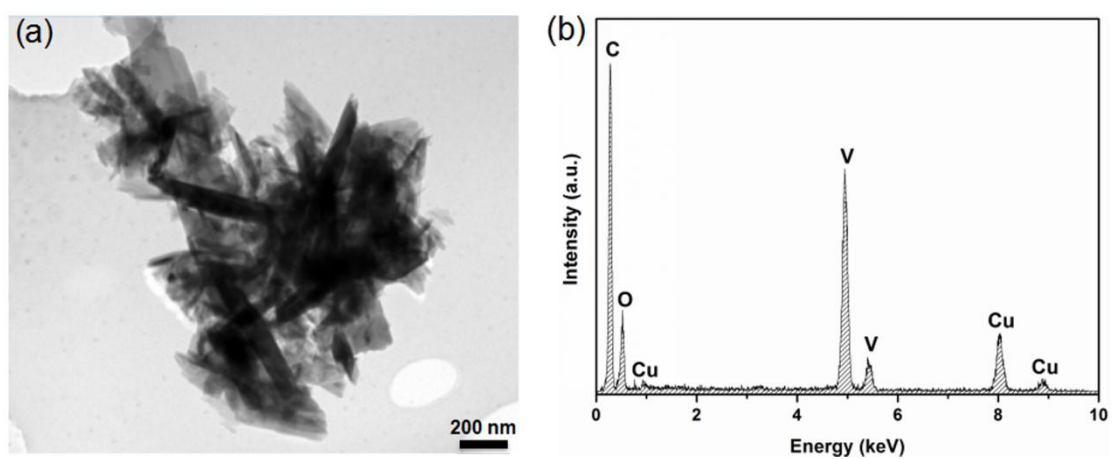


Fig. S3 (a) Low magnification TEM image and (b) energy dispersive X-ray spectroscopy (EDX) spectrum of the c-V₂O₅ sample.

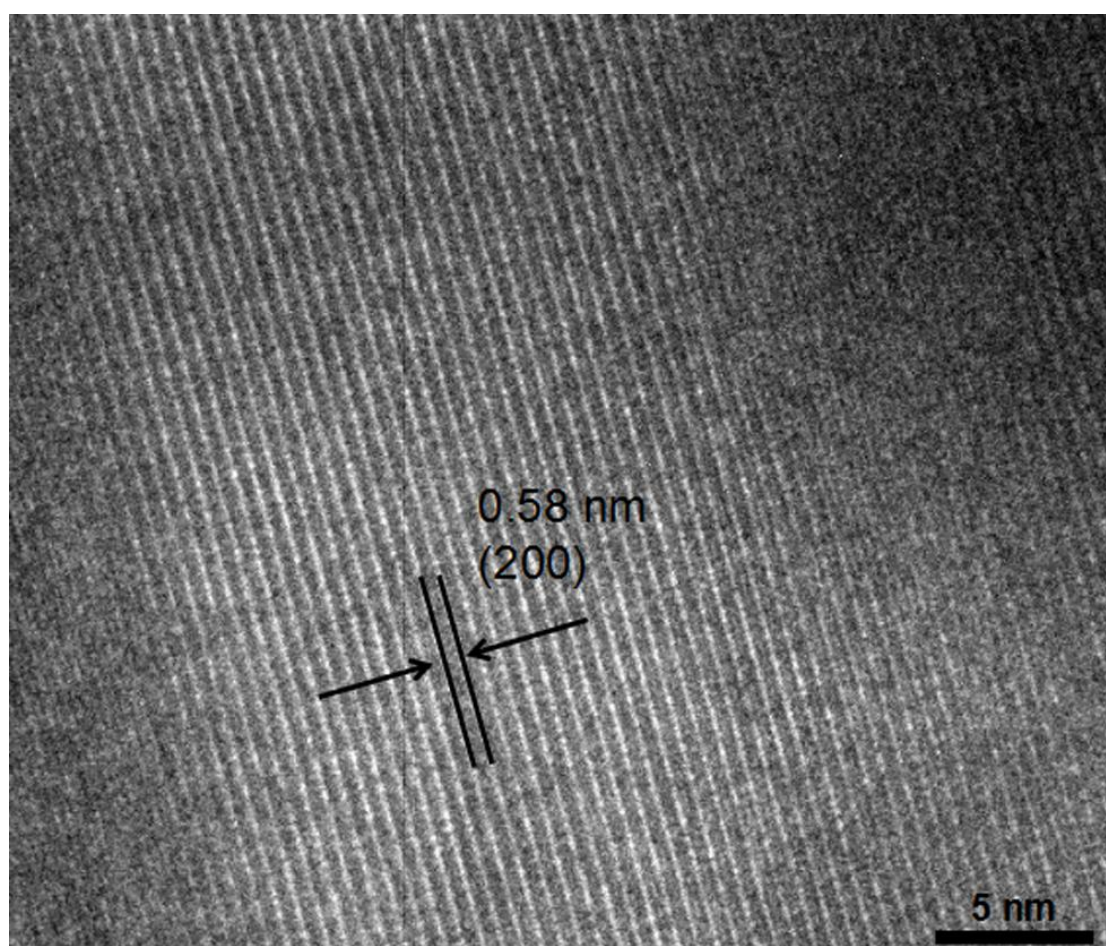


Fig. S4 HRTEM image of the c-V₂O₅ sample, showing a wider lattice fringes of (200) plane.

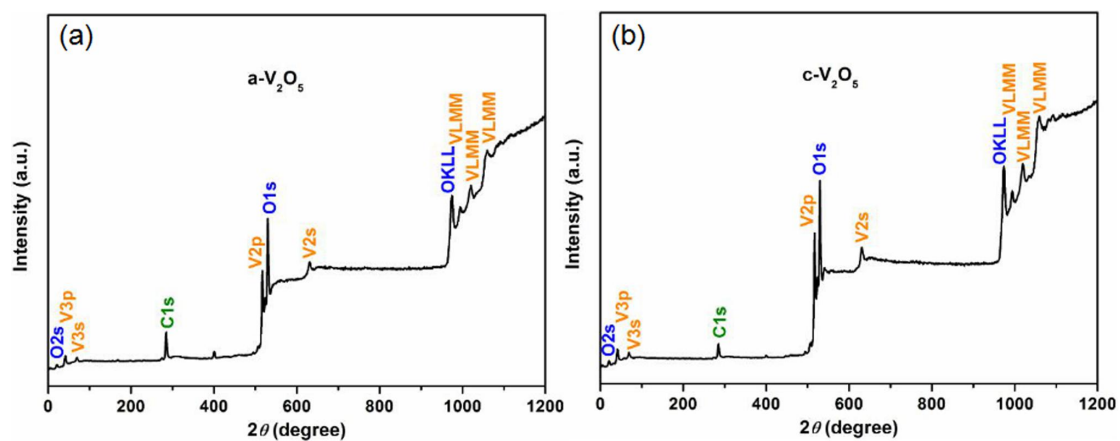


Fig. S5 The wide scan XPS spectra of (a) a-V₂O₅ sample and (b) c-V₂O₅ sample.

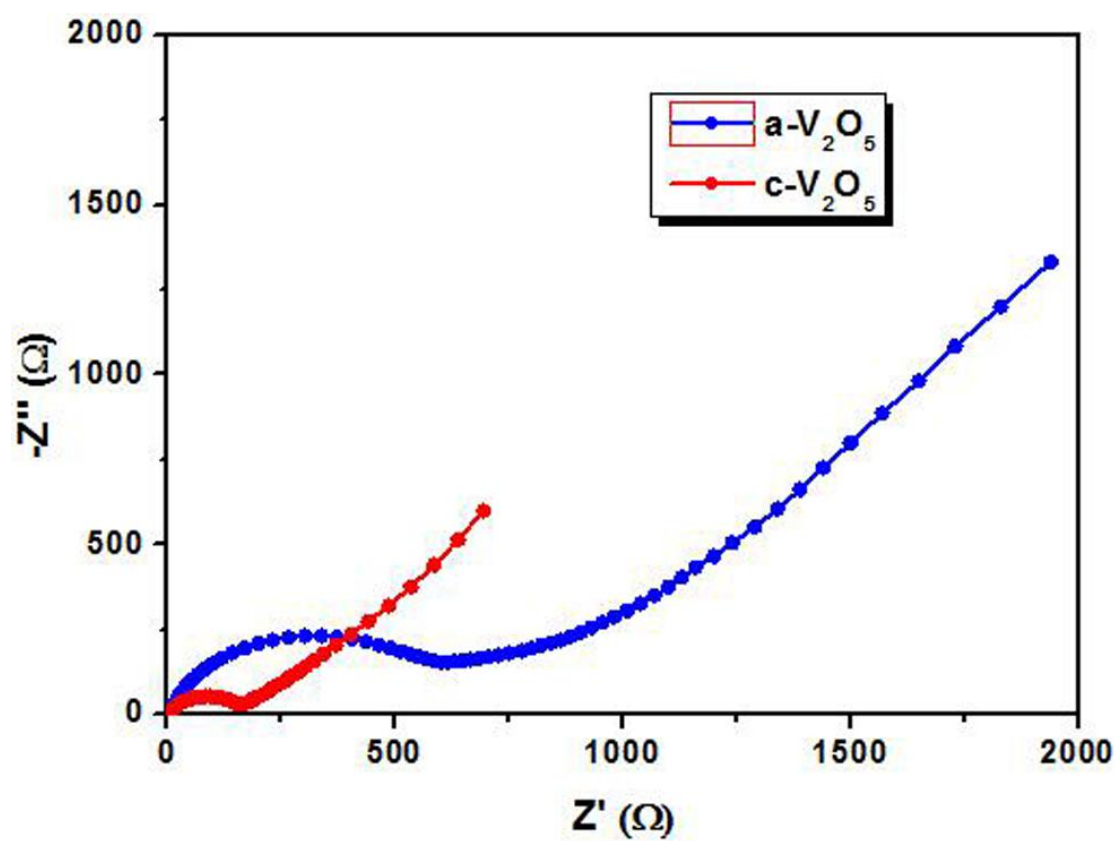


Fig. S6 Nyquist plots of the a-V₂O₅ cathode and c-V₂O₅ cathode.

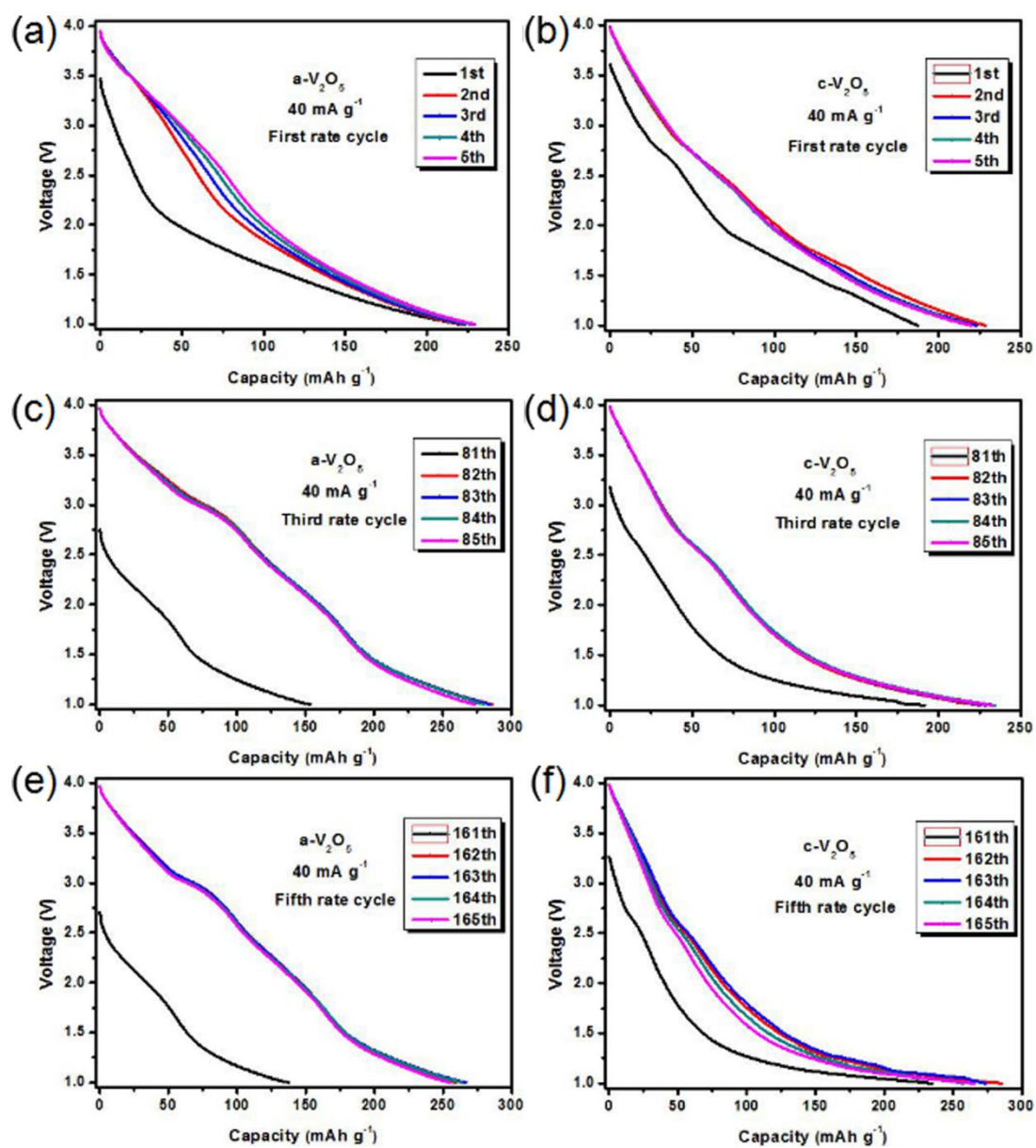


Fig. S7 The discharge curves of (a, c, e) $a\text{-V}_2\text{O}_5$ and (b, d, f) $c\text{-V}_2\text{O}_5$ at 40 mA g^{-1} for different number of rate cycles.

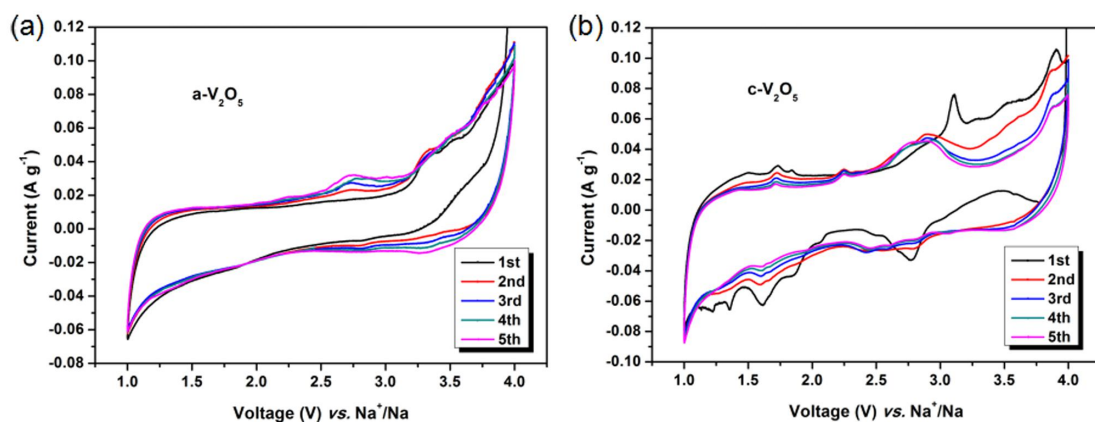


Fig. S8 CV curves of (a) a-V₂O₅ cathode and (b) c-V₂O₅ cathode between 1.0 and 4.0 V (versus Na/Na⁺) at a scan rate of 0.1 mV s⁻¹.

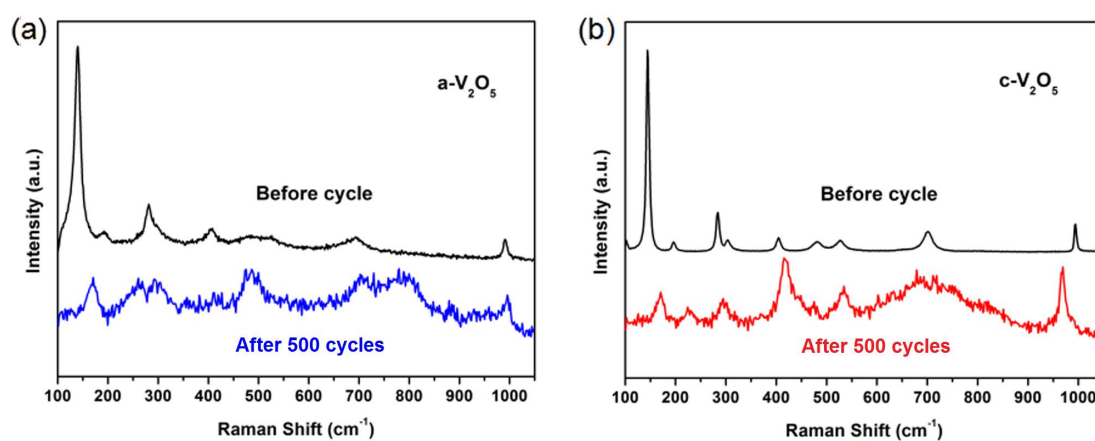


Fig. S9 Raman band changes of (a) a-V₂O₅ cathode and (b) c-V₂O₅ cathode after 500 cycles.

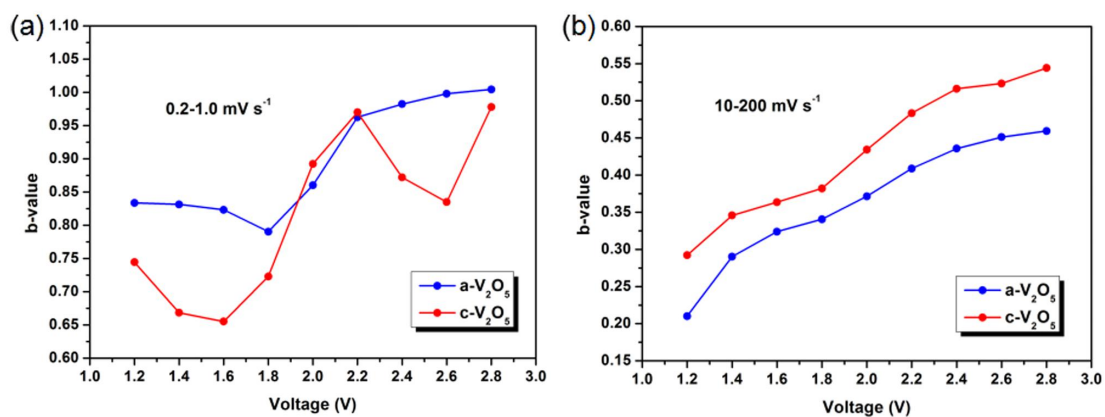


Fig. S10 Comparison of *b*-values for the both cathodes (a) at low scan rates and (b) at high scan rates.

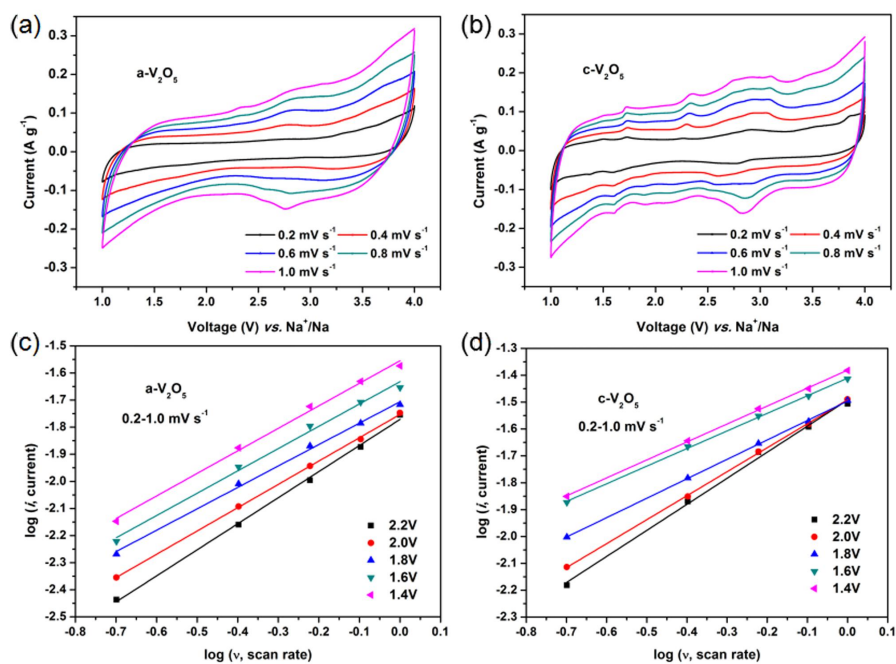


Fig. S11 CV curves of (a) a-V₂O₅ cathode and (b) c-V₂O₅ cathode at different low scan rates, log(*i*) versus log(*v*) plots of (c) a-V₂O₅ cathode and (d) c-V₂O₅ cathode at different voltage states.

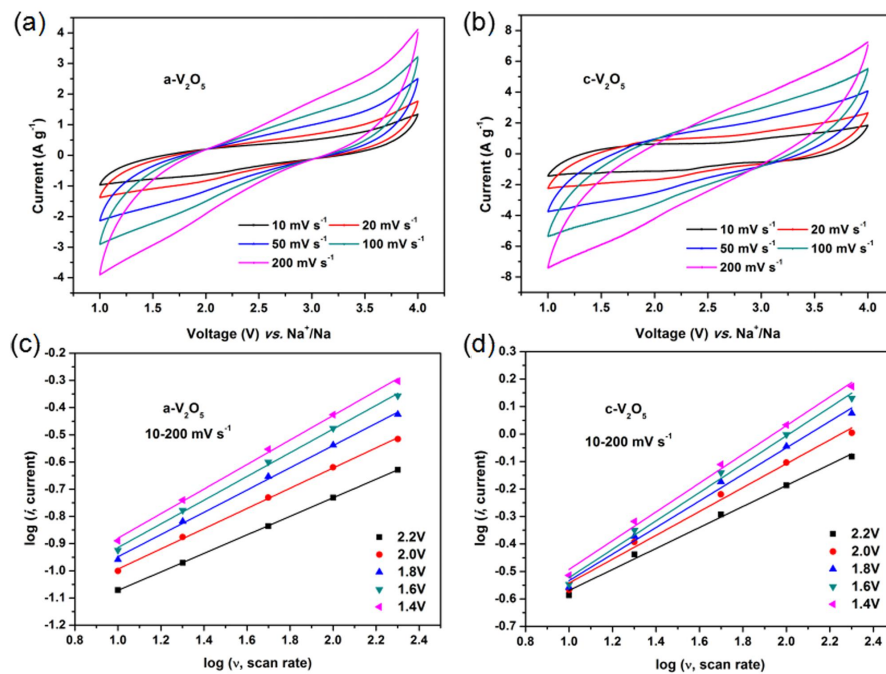


Fig. S12 CV curves of (a) a-V₂O₅ cathode and (b) c-V₂O₅ cathode at different high scan rates, log(*i*) versus log(*v*) plots of (c) a-V₂O₅ cathode and (d) c-V₂O₅ cathode at different voltage states.

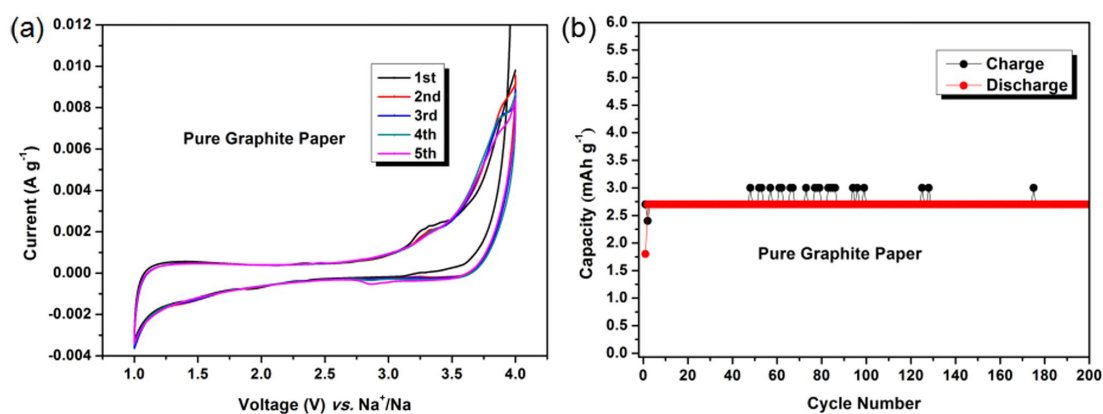


Fig. S13 Electrochemical behaviour of pure graphite paper substrate between 1.0 and 4.0 V (versus Na/Na⁺). (a) CV curves at a scan rate of 0.1 mV s⁻¹, (b) cycling performance for 200 cycles at 80 mA g⁻¹.

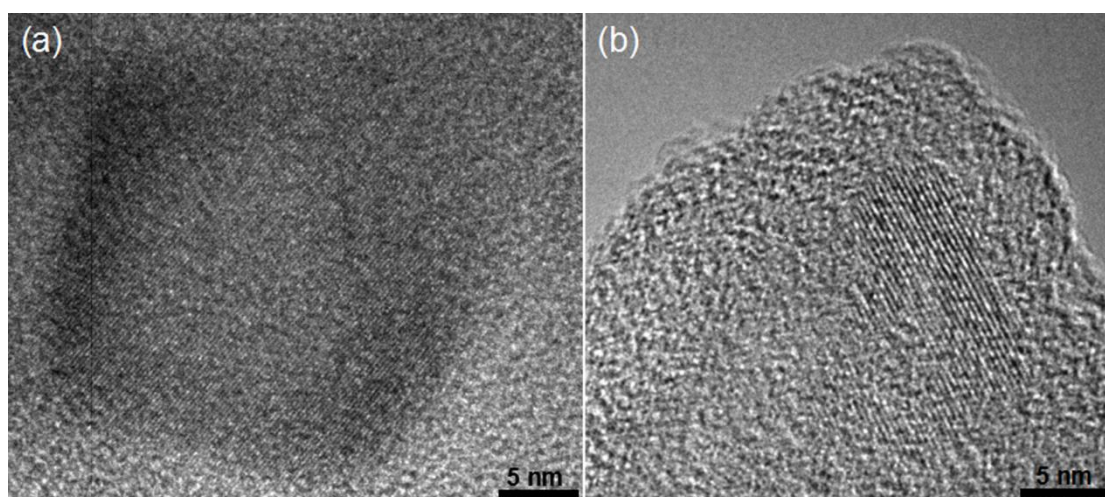


Fig. S14 HRTEM images of (a) a-V₂O₅ cathode and (b) c-V₂O₅ cathode taken after five rate cycles.

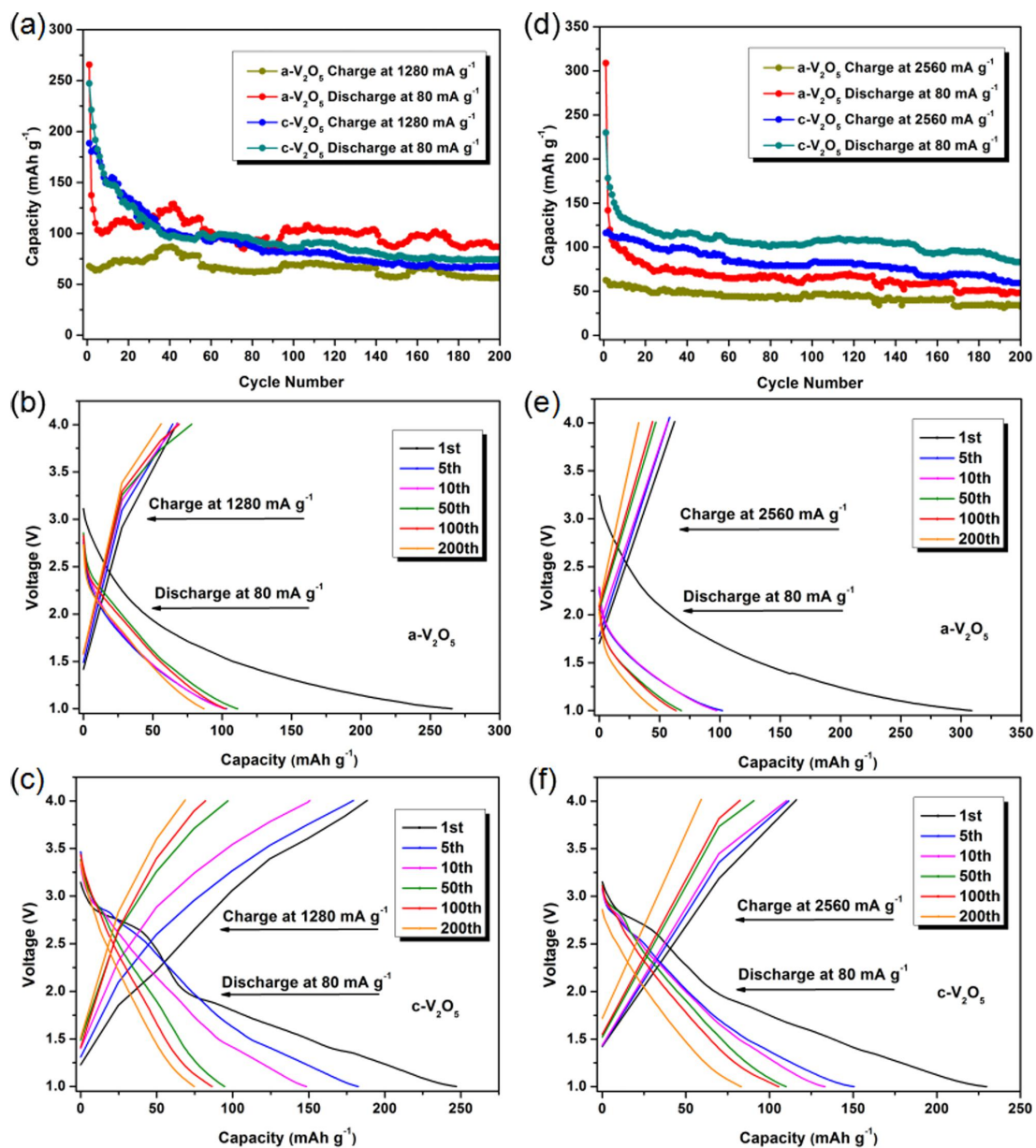


Fig. S15 Electrochemical performances of both cathodes (a,b,c) discharged at 80 mA g⁻¹ and charged at 1280 mA g⁻¹, (d,e,f) discharged at 80 mA g⁻¹ and charged at 2560 mA g⁻¹.

Table S1 Different parameters of V 2p_{3/2} spectra for a-V₂O₅ and c-V₂O₅ samples.

Sample	Peak position (eV)	Area	FWHM (eV)	%GL
a-V ₂ O ₅	517.41 (V ⁵⁺)	2124.921	1.431	80%
	516.13 (V ⁴⁺)	398.118	1.235	80%
c-V ₂ O ₅	517.34 (V ⁵⁺)	3121.027	1.251	80%
	516.00 (V ⁴⁺)	435.708	1.660	80%

Table S2 Reversible specific capacities of a-V₂O₅ and c-V₂O₅ cathodes after different cycle numbers at various current densities and the absolute differences of specific capacities for both cathodes.

Current density (mA g ⁻¹)	Cycle number	Reversible specific capacity (mAh g ⁻¹)		
		a-V ₂ O ₅	c-V ₂ O ₅	Absolute difference
80	150	239.3	157.6	81.7
160	500	146.4	112.0	34.4
320	1000	110.9	112.2	1.3
640	1000	67.7	108.9	41.2
1280	5000	44.0	87.0	43.0
2560	10000	21.5	54.0	32.5