Supplementary Material

Carbon coated 3D Nb_2O_5 hollow nanospheres with superior performance as the anode for high energy Li-ion capacitors

Haoran Li, ‡[a] Dong Li, ‡[a] Jing Shi,*[a] Zeyin He,[a] Zongchen Zhao,[a] Huanlei Wang*[a]

[a] *School of Materials Science and Engineering, Ocean University of China, Qingdao 266100, People's Republic of China*

‡ These authors contribute equally to this work.

*Corresponding authors.

E-mail address: shijing@ouc.edu.cn (J. Shi); huanleiwang@gmail.com (H. Wang).

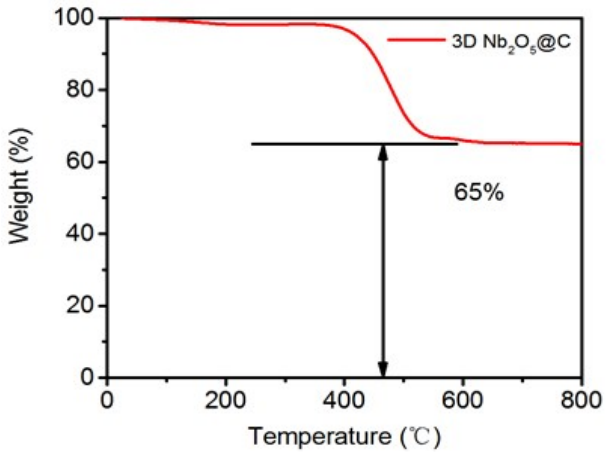

Fig. S1 Thermogravimetric curves of 3D Nb_2O_5@C hollow nanosphere composite in air.

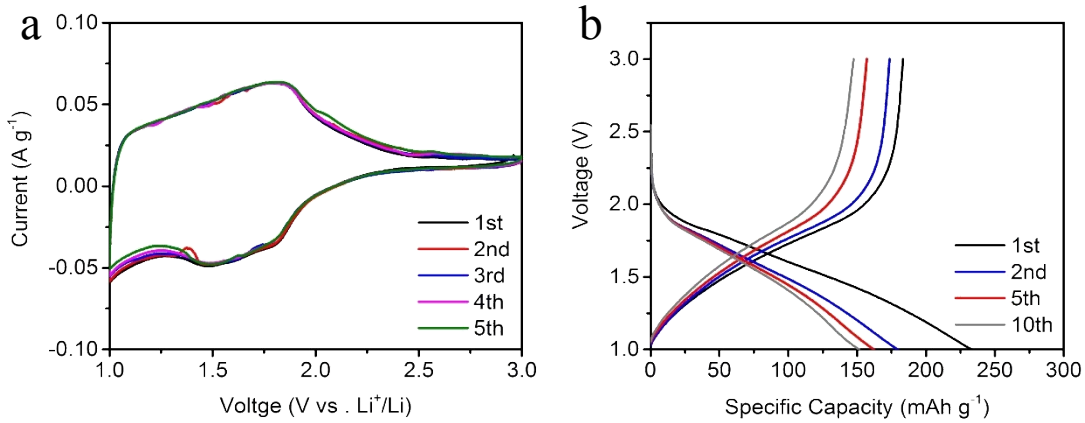

Fig. S2 (a) CV cures of Nb_2O_5 at 0.1 mV s^{-1}. (b) Galvanostaic charge-discharge profiles of Nb_2O_5 at 0.1 A g^{-1}.

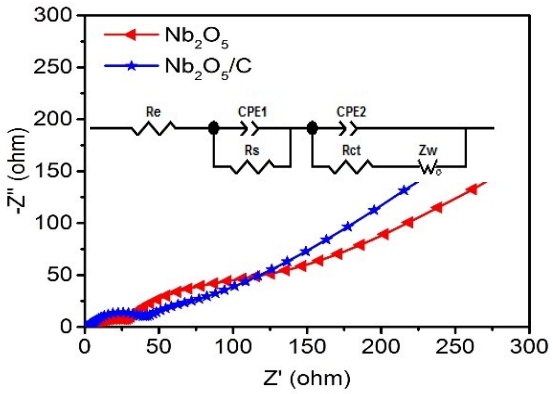

Fig. S3 Nyquist plots of Nb_2O_5 and 3D Nb_2O_5@C electrodes after 500 cycles and the corresponding equivalent circuit.

After 500 cycles, the impedance spectra are composed of three parts. The first semicircle is associated with the Li^+ migration in the electrode surface. The second semicircle is related to the charge transfer. The sloping line is bound up with the Li^+ diffusion. As shown in the corresponding equivalent circuits, R_e represents the ohmic resistance, R_{ct} is charge transfer resistance and W_s is the Warburg impedance

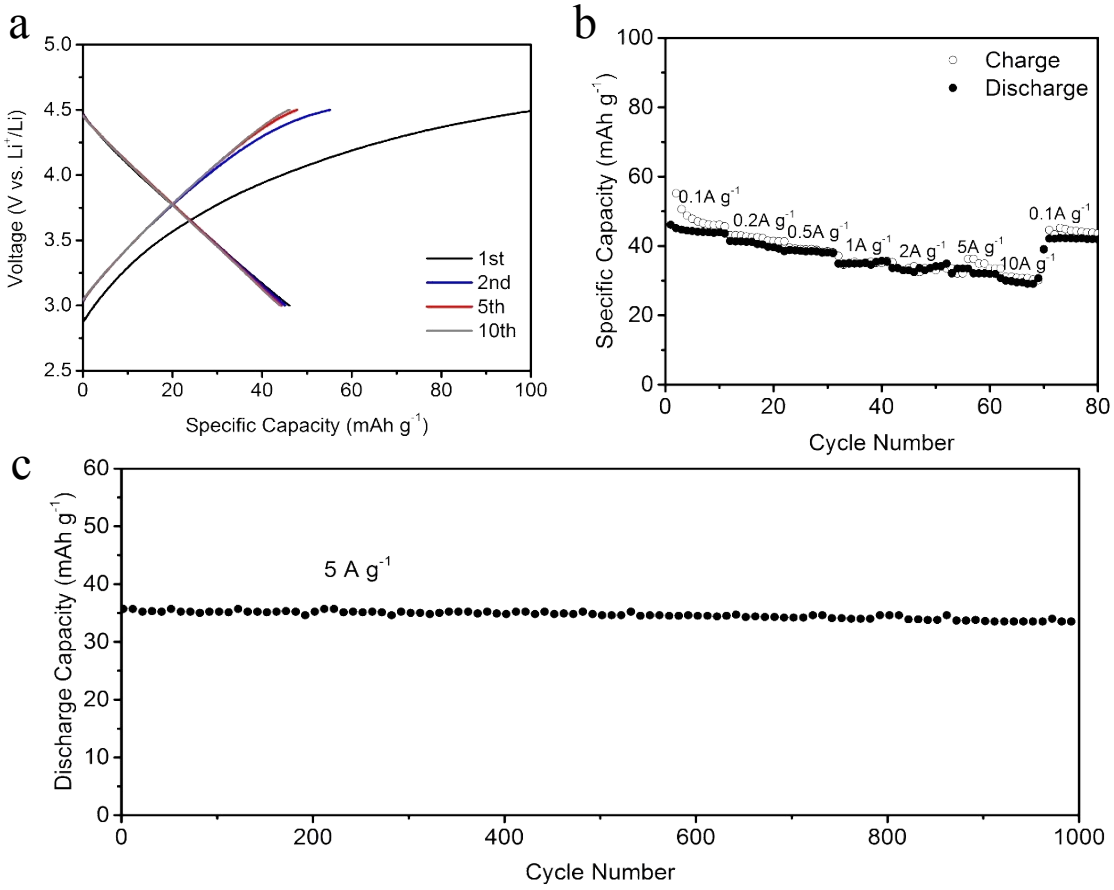

Fig. S4 (a) Galvanostaic charge-discharge profiles of GCN at 0.1 A g^{-1}. (b) Rate capacities at various current densities from 0.1 to 10 A g^{-1}. (c) Cycling performance and the related coulombic efficiency for GCN at 5 A g^{-1} for 1000 cycle.

Table S1 Comparison with the performance of previously reported Li-ion capacitors.

Hybrid system	Voltage Window	Energy Density/ Power Density	Cyclability	Ref.
3DNb_2O_5@C//GCN (Li^+)	0-3.5 V	96.8 Wh kg^{-1} at 435.5 W kg^{-1} 12.6 Wh kg^{-1} at 41000 W kg^{-1}	75% after 3000 cycles at 5A g^{-1}	This work
CNT/Nb_2O_5//AC (Li^+)	0.5-3 V	33.5Wh kg^{-1} at 83 W kg^{-1} ~4 Wh kg^{-1} at 4000 W kg^{-1}	–	1
Nb_2O_5//AC (Li^+)	1-3.5 V	95.55 Wh kg^{-1} at 191 W kg^{-1} 65/39 Wh kg^{-1}at 5350.9 W kg^{-1}	–	2
CNT_S-Nb_2O_5//AC (Li^+)	0.5-3 V	~50 Wh kg^{-1} at 86.46 W kg^{-1} 14.77 Wh kg^{-1} at 6753.5 W kg^{-1}	–	3
T-Nb_2O_5 /graphene//MC (Li^+)	0.8-3 V	48 Wh kg^{-1} at 690 W kg^{-1} 13 Wh kg^{-1} at 16000 W kg^{-1}	~92% after 3000 cycles at 1A g^{-1}	4
m-Nb_2O_5-C//MSP-20 (Li^+)	0-3 V	20 Wh kg^{-1} at 12137 W kg^{-1} 15 Wh kg^{-1} at 18510 W kg^{-1}	90% after 1000 cycles at 1A g^{-1}	5
T-Nb_2O_5@C//MSP-20 (Li^+)	1-3.5 V	63 Wh kg^{-1} at 70 W kg^{-1} 5 Wh kg^{-1} at 16528 W kg^{-1}	~80% after 1000 cycles at 1A g^{-1}	6
MnO/C//CNS (Li^+)	1-4 V	100 Wh kg^{-1} at 83 W kg^{-1} 30 Wh kg^{-1} at 20000 W kg^{-1}	70% after 5000 cycles at 5A g^{-1}	7
MnO-C//AC (Li^+)	0-4 V	227 Wh kg^{-1} at ~60 W kg^{-1} ~20 Wh kg^{-1} at 2952 W kg^{-1}	92.5% after 3500 cycles at 4 A g^{-1}	8
TiO_2//CNT-AC (Li^+)	1-3 V	59.6 Wh kg^{-1} at 120 W kg^{-1} 31.2 Wh kg^{-1} at 7000 W kg^{-1}	–	9

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