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Electronic Supporting Information

Nb_2O_5 Quantum Dots embedded in ZIF-8 derived Nitrogen-Doped Porous Carbon Dodecahedrons for Advanced Hybrid Supercapacitors Applications

Sainan Liu[a], Jiang Zhou[*a,b], Zhenyang Cai[a], Guozhao Fang[a], Yangsheng Cai[a], Anqiang Pan[a,b], and Shuquan Liang[*a,b]

[a] *School of Materials Science and Engineering, Central South University, Changsha 410083, Hunan, China*

[b] *Key Laboratory of Nonferrous Metal Materials Science and Engineering, Ministry of Education, Central South University, Changsha 410083, Hunan, China*

Corresponding author: Tel.: +86 0731-88836069. Fax: +86 0731-88876692.
E-mail address: zhou_jiang@csu.edu.cn (J. Zhou), lsq@csu.edu.cn (S. Liang)

Figures and Tables

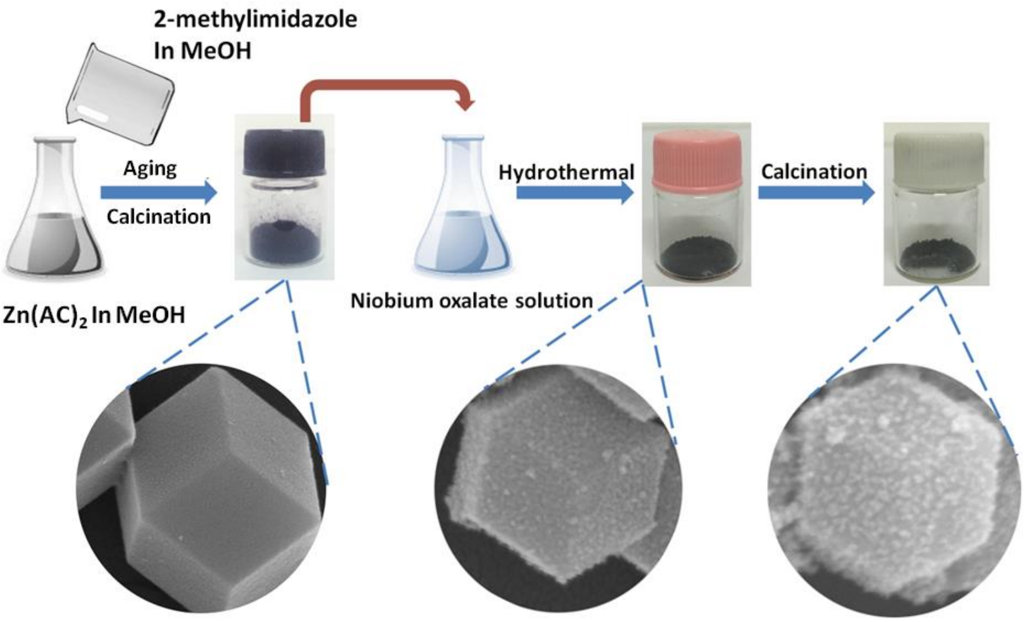

Figure S1 Schematic illustration of the fabrication of NQD-NC.

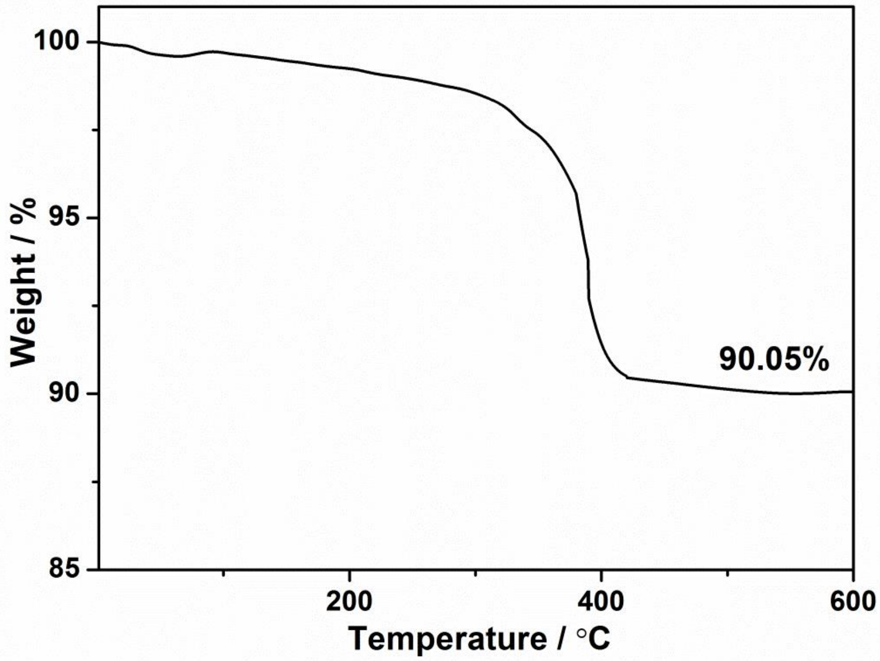

Figure S2 TGA curve of the NQD-NC.

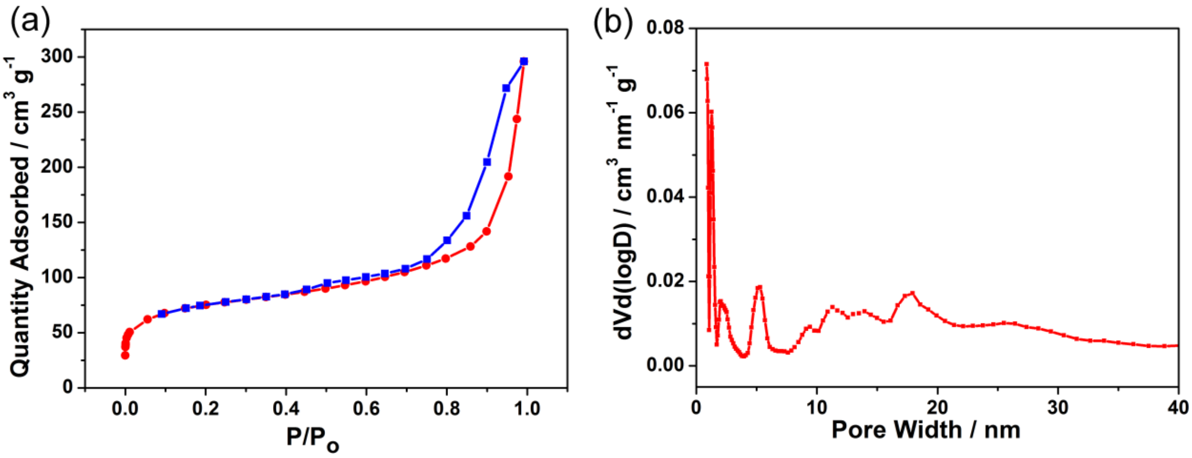

Figure S3 (a) N_2 adsorption-desorption isotherm for NQD-NC, (b) The corresponding pore size distribution.

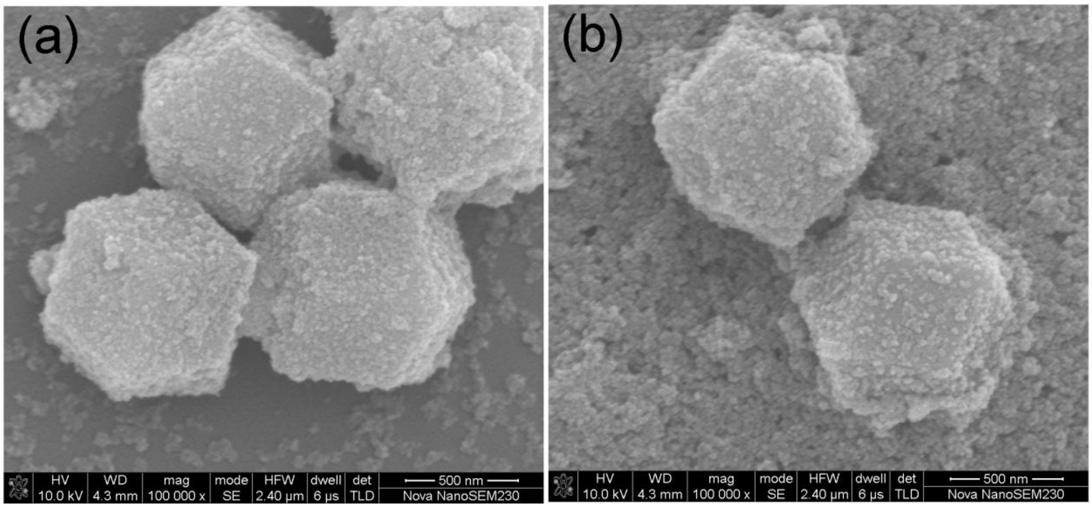

Figure S4 SEM images of NQD/NC electrode after (a) 500 cycles, (b) 1000 cycles at the current density of 1 A g^{-1}.

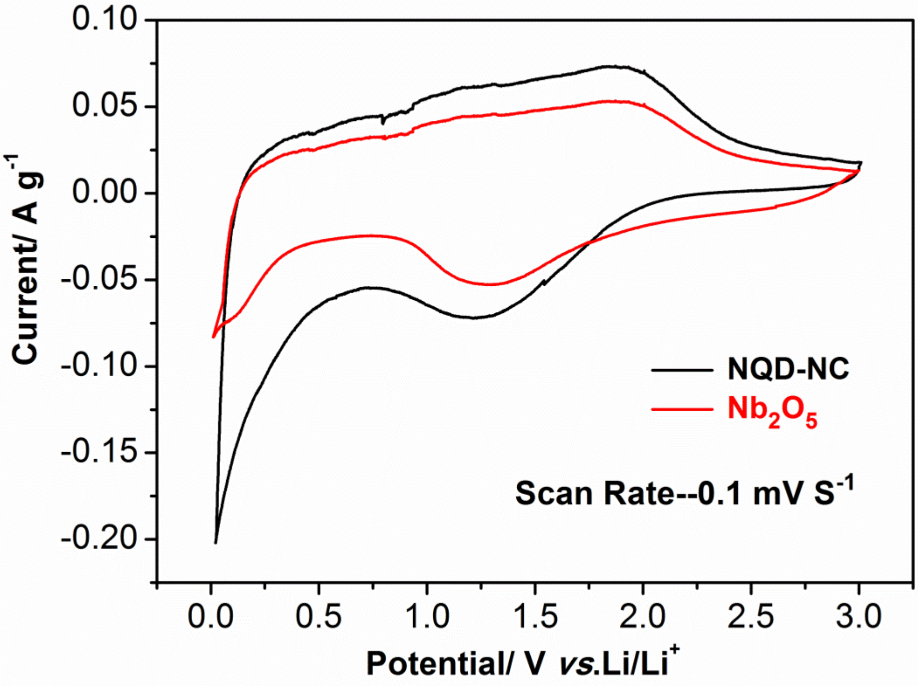

Figure S5 CV curves of NQD-NC and pure Nb_2O_5 sample at sweep rates of 0.1 mV S^{-1} in the potential range of 0.01-3.0 V (*vs. Li/Li*$^{+}$).

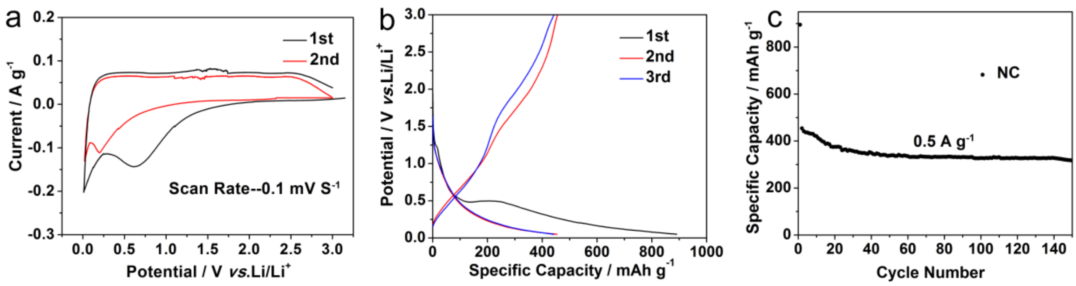

Figure S6 Electrochemical performance of NC/Li half-cells in the potential range of 0.01-3.0 V (*vs. Li/Li*$^+$). (a) CV curves of NC at a sweep rates 0.1 mV S^{-1}, (b) The selected discharge-charge curves of NC at 0.5 A g^{-1}, (c) Cycling performance of NC at 0.5 A g^{-1}.

The electrochemical performance of NC at a scan rate 0.1 mV s^{-1} in the voltage range of 0.01-3.0 V was evaluated in **Figure S6a**. The peaks of the first anodic scan are different from the second because of the formation of SEI and other side reactions. **Figure S6b** shows the discharge/charge profiles of the first three cycles for the NC at a current density of 0.5 A g^{-1}. The discharge curve in the first cycle is 851 mA h g^{-1}, while its first reversible specific capacity is only 455 mA h g^{-1}, an initial coulombic efficiency is only 53.5%. **Figure S6c** displays the cyclic stability of NC. After 150 cycles, the electrode maintains a discharge capacity of 317 mA h g^{-1}, which is approximately 70% of the second lap. As the discharge plateau of NC is between 0.01-0.5 V, it may contribute part of total capacity for NQD-NC nanocomposites in the voltage range of 0.01-3.0 V.

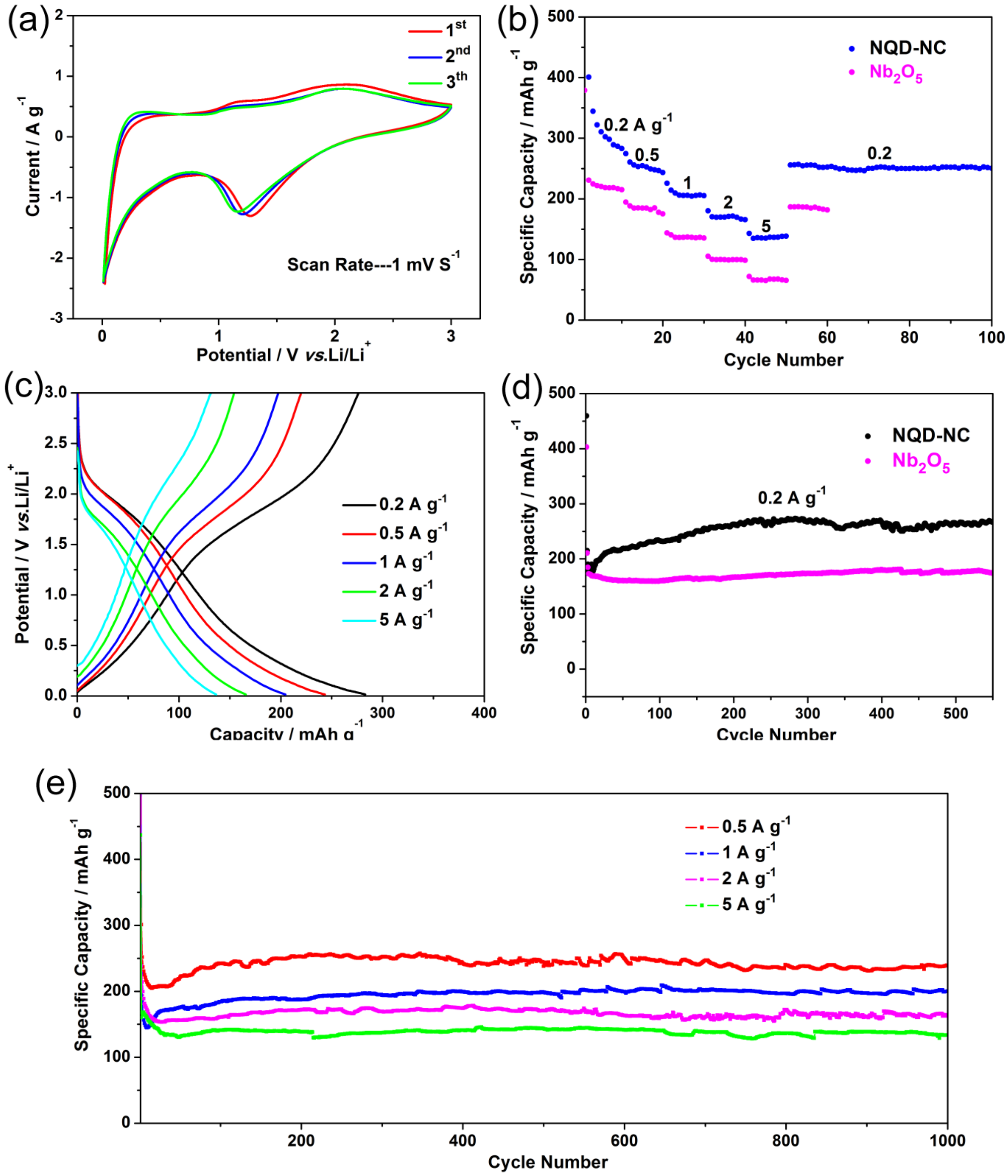

Figure S7 Electrochemical performance of NQD-NC/Li half-cells in the potential range of 0.01-3.0 V (*vs. Li/Li*$^+$). (a) The first three CV curves of NQD-NC at sweep rates of 1 mV S^{-1}, (b) Rate performance (from 0.2-5 A g^{-1}) of NQD-NC and pure Nb_2O_5, (c) The selected discharge-charge curves at different current densities of 0.2, 0.5, 1, 2 and 5 A g^{-1}, (d) Galvanostatic charge-discharge profiles of NQD-NC and pure Nb_2O_5 at 0.2 A g^{-1}, (e) Galvanostatic charge-discharge profiles of NQD-NC at 0.5 A g^{-1} and 1 A g^{-1}.

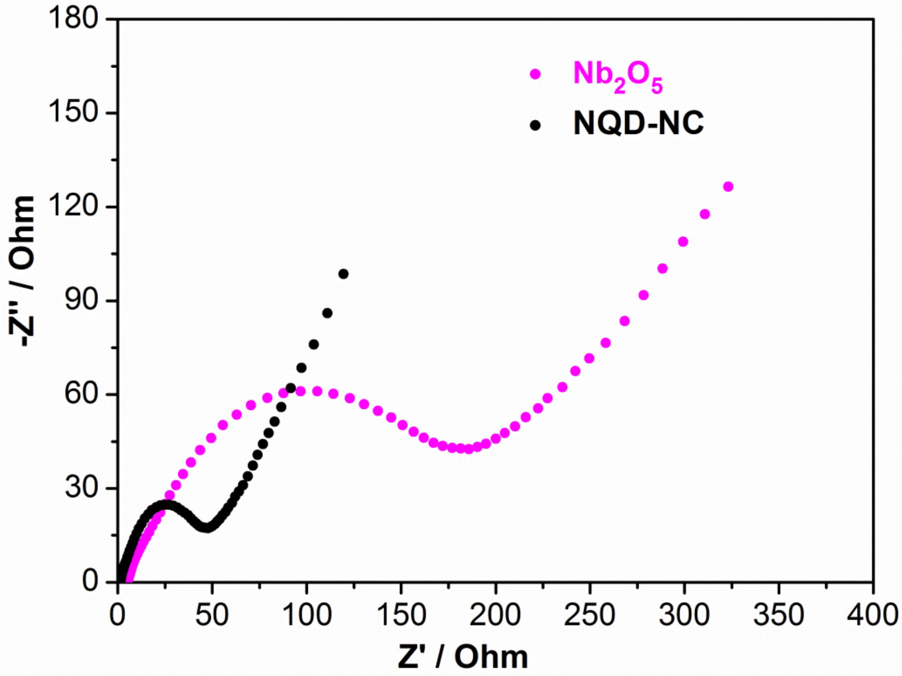

Figure S8 Electrochemical impedance spectroscopy of LIBs employing the NQD-NC composite and pure Nb_2O_5 anodes.

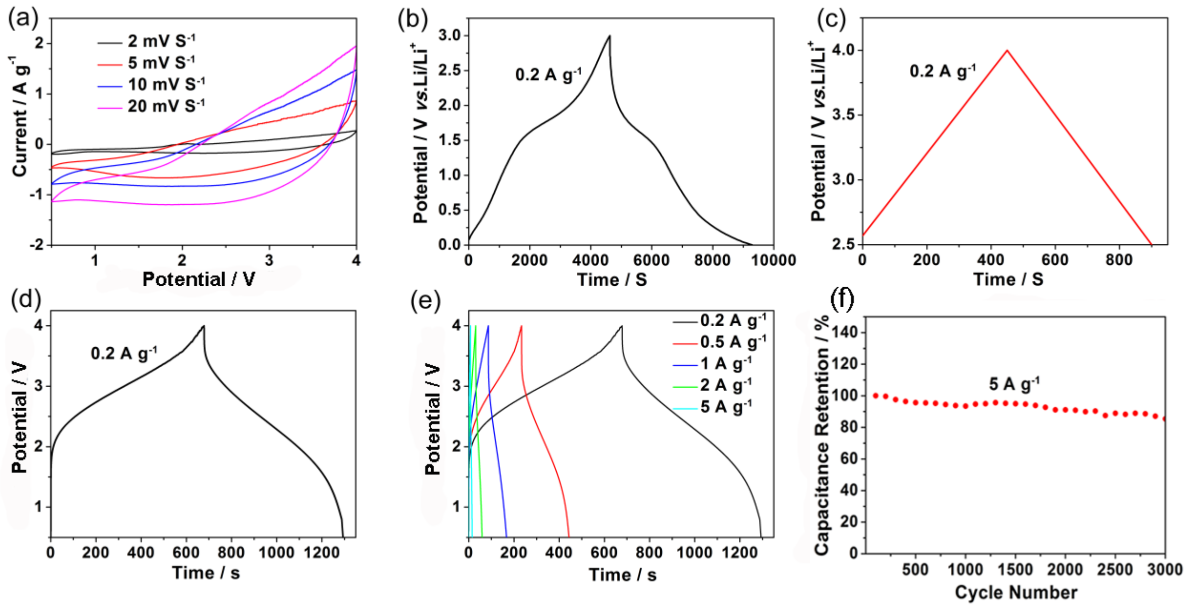

Figure S9 (a) CV curves at different scan rates between 2 and 20 mV S^{-1} with potential range of 0.5–4.0 V, (b) Charge-discharge profile of NQD-NC/Li half-cells in the potential range of 0.01-3.0 V (*vs. Li/Li*$^+$) at 0.2 A g^{-1}, (c) Charge-discharge profile of AC/Li half-cells in the voltage range of 2.5-4.0 V (*vs. Li/Li*$^+$) at 0.2 A g^{-1}, (d) Charge-discharge profile of AC//NQD-NC hybrid supercapacitor in the voltage range of 0.5-4.0 V at 0.2 A g^{-1}, (e) Charge-discharge profiles of AC//NQD-NC HSCs device in the potential range of 0.5-4.0 V at different current densities of 0.2, 0.5, 1, 2 and 5 A g^{-1}, (f) Cycle stability for around 3000 cycles at the current density of 5 A g^{-1}.