Electronic Supplementary Information

Mesoporous Mo_2C/N-doped carbon heteronanowires as high-rate and long-life anode materials for Li-ion batteries

Lichun Yang,[a] Xiang Li,[a] Sina He,[b] Gaohui Du,[c] Xiang Yu,[b] Jiangwen Liu,[a] Qingsheng Gao,[b]* Renzong Hu,[a] Min Zhu[a]*

[a] School of Materials Science and Engineering, Guangdong Provincial Key Laboratory of Advanced Energy Storage Materials, South China University of Technology, Guangzhou, 510641, P. R. China.
E-mail: memzhu@scut.edu.cn; Tel: +86-20-87112762
[b] Department of Chemistry, Jinan University, Guangzhou, 510632, P. R. China.
E-mail: tqsgao@jnu.edu.cn; Tel: +86-20-85226506
[c] Institute of Physical Chemistry, Zhejiang Normal University, Jinhua, 321004, P. R. China

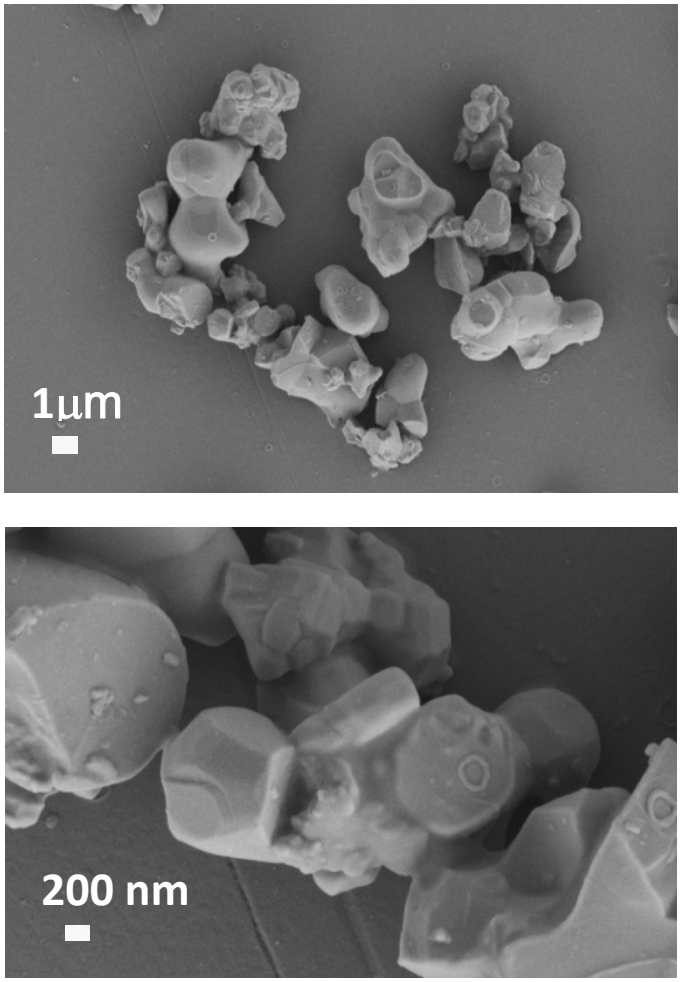

Fig. S1 SEM images of Mo_2C MPs purchased from Alfa Aesar.

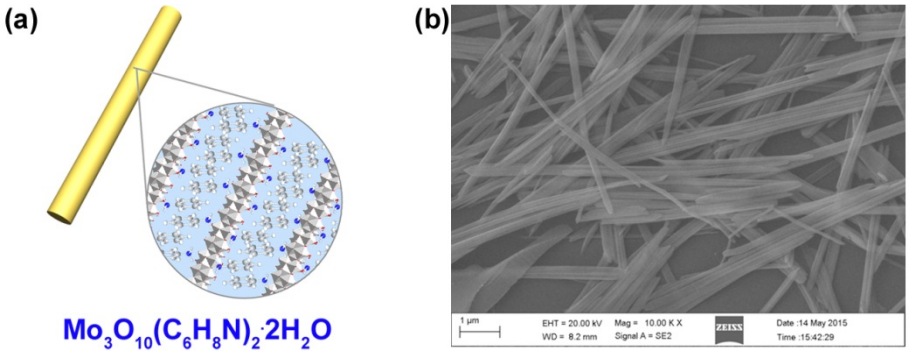

Fig. S2 (a) Illustration of the structure and (b) SEM image of the $Mo_3O_{10}(C_6H_8N)_2 \cdot 2H_2O$ NWs

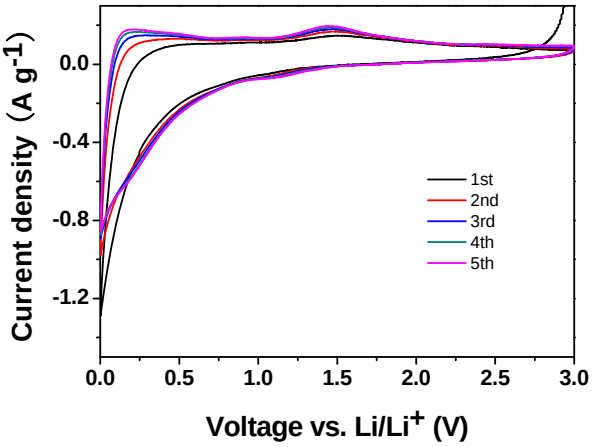

Fig. S3 CV profiles of the Mo_2C MPs in the initial five successive cycles at a scan rate of 0.5 mV s^{-1}.

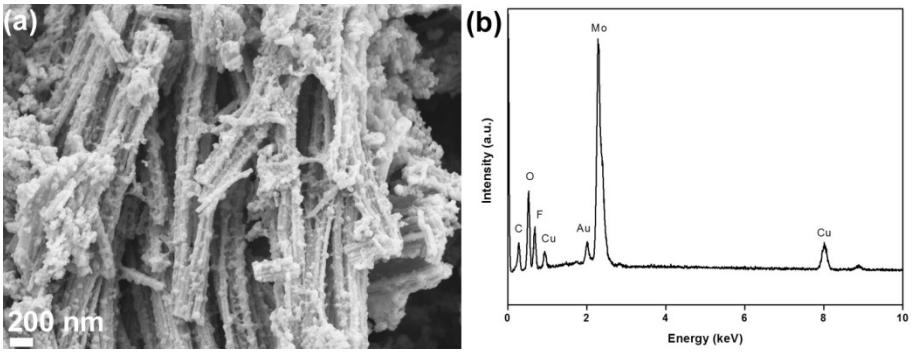

Fig. S4 (a) SEM image and (b) EDS of the Mo_2C/N-C MHNWs after 100 discharge/charge cycles at a current density of 2 A g^{-1}. The nanowire structure of the Mo_2C/N-C MHNWs is well maintained during the cycling, which enables the high capacity retention. The presence of Au is associated with the pre-treatment in SEM investigation, and that of F and Cu is owing to the $LiPF_6$ electrolyte and Cu collector.

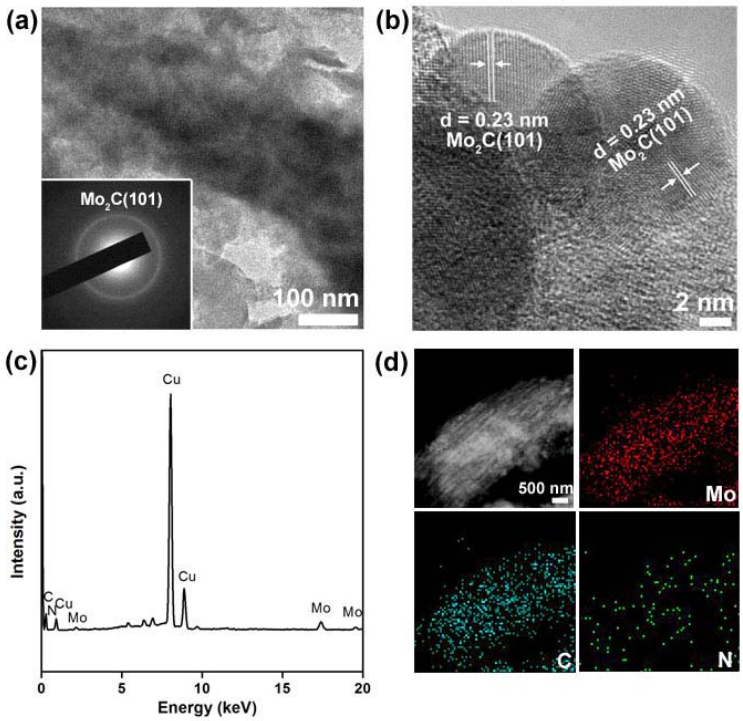

Fig. S5 (a) TEM and (b) HR-TEM images, (c) EDS and (d) elemental mapping of the Mo_2C/N-C MHNWs after 100 discharge/charge cycles at a current density of 2 A g^{-1}. The inset of (a) displays the SAED pattern obtained on the nanowire after cycles.

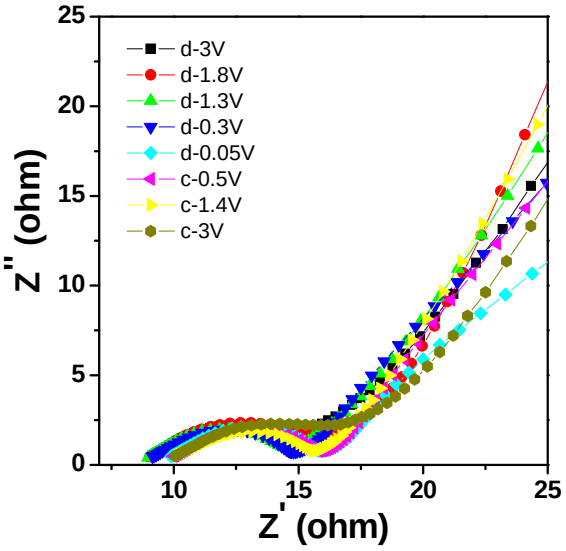

Fig. S6 Nyquist plots of the Mo_2C/N-C MHNWs tested in selected states of discharge and charge in the 20th cycle.

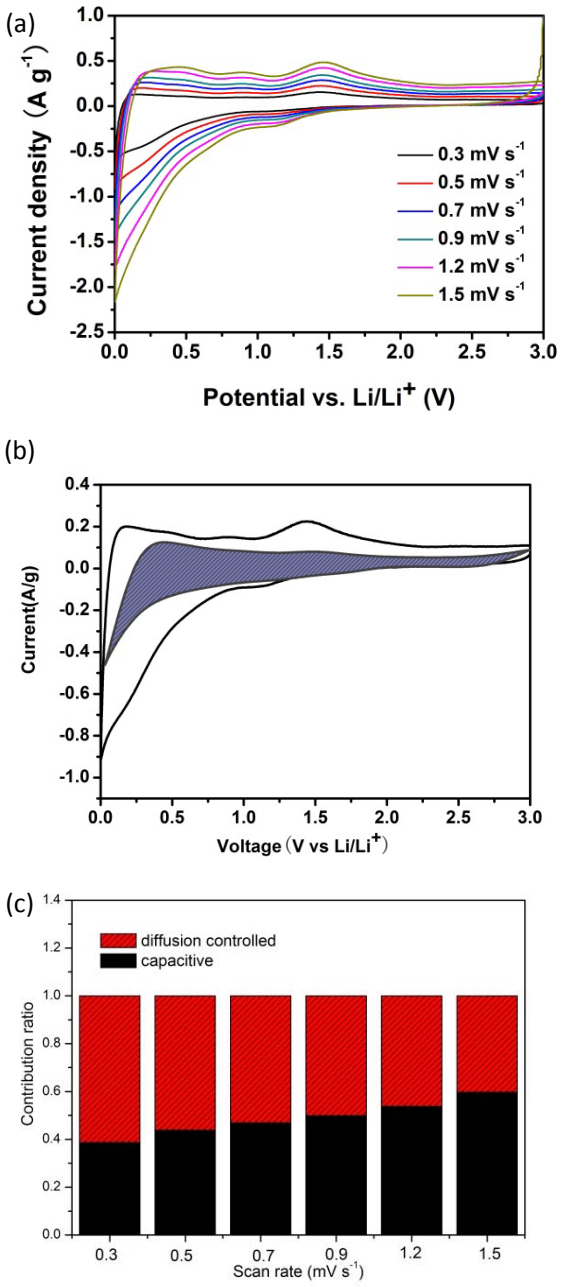

Fig. S7 Kinetics analysis of the electrochemical behavior towards Li^+ for the Mo_2C MPs. (a) CV profiles at various scan rates (0.3, 0.5, 0.7, 0.9, 1.2, 1.5 mV s^{-1}) after the initial 5 successive cycles (0.5 mV s^{-1}), (b) separation of the capacitive and diffusion currents at a scan rate of 0.5 mV s^{-1}, the capacitive contribution to the total current is shown by the shaded region and (c) contribution ratio of the capacitive and diffusion controlled charge *vs.* scan rate.

Table S1 Fitted parameters of the Nyquist plots recorded with the Mo_2C/N-C MHNWs as the working electrode during the 80st discharge/charge cycle at various voltages.

Cell voltage (V)	R_e (ohm)	R_{sf+ct} (ohm)	Equivalent circuit
d-3	8.6	24.0	II
d-1.8	8.5	23.9	II
d-1.3	9.3	5.0	II
d-0.3	9.4	5.0	II
d-0.05	9.2	4.8	II
c-0.5	9.3	4.8	II
c-1.4	9.6	5.2	II
c-3	8.8	26.7	II

Table S2 comparison of fitted R_e and R_{sf+ct} of the Mo_2C/N-C MHNWs and the Mo_2C MPs tested in the discharged state of 0.05 V in the 80th cycle.

Sample	R_e (ohm)	R_{sf+ct} (ohm)	Equivalent circuit
Mo_2C/N-C MHNWs	9.2	4.8	II
Mo_2C MPs	7.0	10.6	II