Supporting Information

A high-performance oxygen electrode for Li-O_2 batteries: Mo_2C nanoparticles grown on carbon fibers

Yong Luo[a], Chao Jin[a,b*], Zhangjun Wang[a], Minghui Wei[a], Chenghao Yang[b*], Ruizhi Yang[a], Yu Chen[c], Meilin Liu[b, c*]

[a] *Soochow Institute for Energy and Materials InnovationS, College of Physics, Optoelectronics and Energy & Collaborative Innovation Center of Suzhou Nano Science and Technology, Soochow University, Suzhou 215006, China*

[b] *New Energy Research Institute, College of Environment and Energy, South China University of Technology, Guangzhou 510006, China*

[c] *School of Materials Science & Engineering, Georgia Institute of Technology, Atlanta, GA 30332-0245, USA*

[*] Corresponding author.
E-mail addresses: jinchao@suda.edu.cn (C. Jin);
esyangc@scut.edu.cn (C. Yang);
meilin.liu@mse.gatech.edu (M. Liu)

Results and discussion:

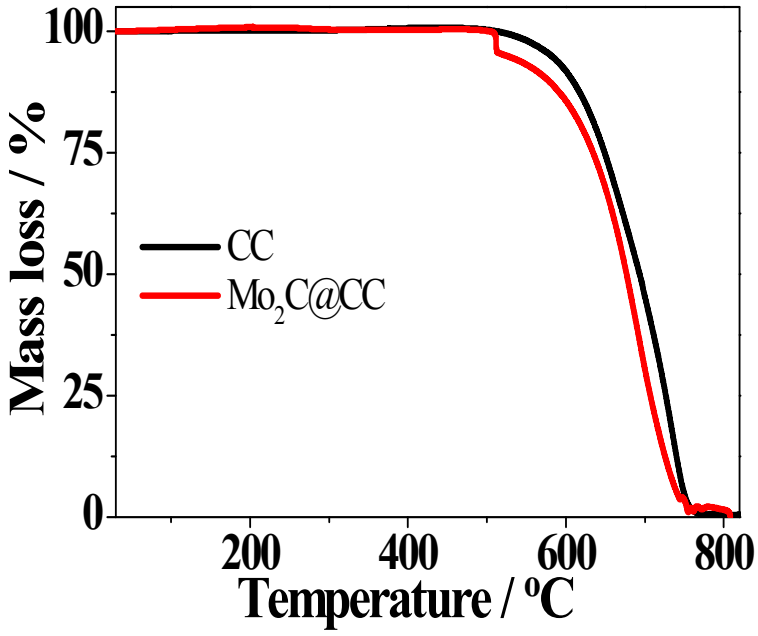


Figure S1. TG profiles of pure CC and Mo_2C@CC electrodes measuredat a heating rate of 10 $^oC\ min^{-1}$ under air flow, respectively.

TG analysis has been performed to measure the content of Mo_2C in Mo_2C@CC electrode. According to TG results and the following equation (S1), the average loading of Mo_2C in the CC wafer is calculated to be ~0.30 mg cm^{-2}.

$Mo_2C + 4O_2 = 2MoO_3 + CO_2$ (S1)

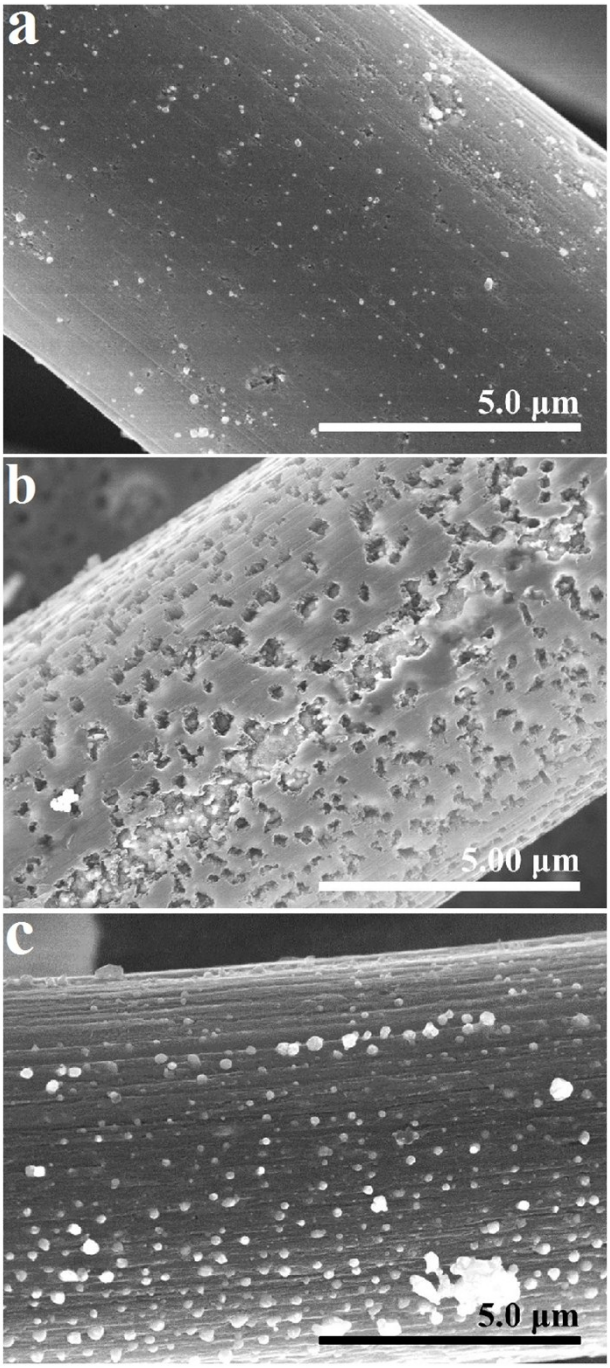


Figure S2. SEM images of Mo_2C@CC electrodes impregnated in different concentration $(NH_4)_6Mo_7O_{24}\cdot 4H_2O$ solution: 0.005 M (a), 0.015 M (b), 0.05 M (c).

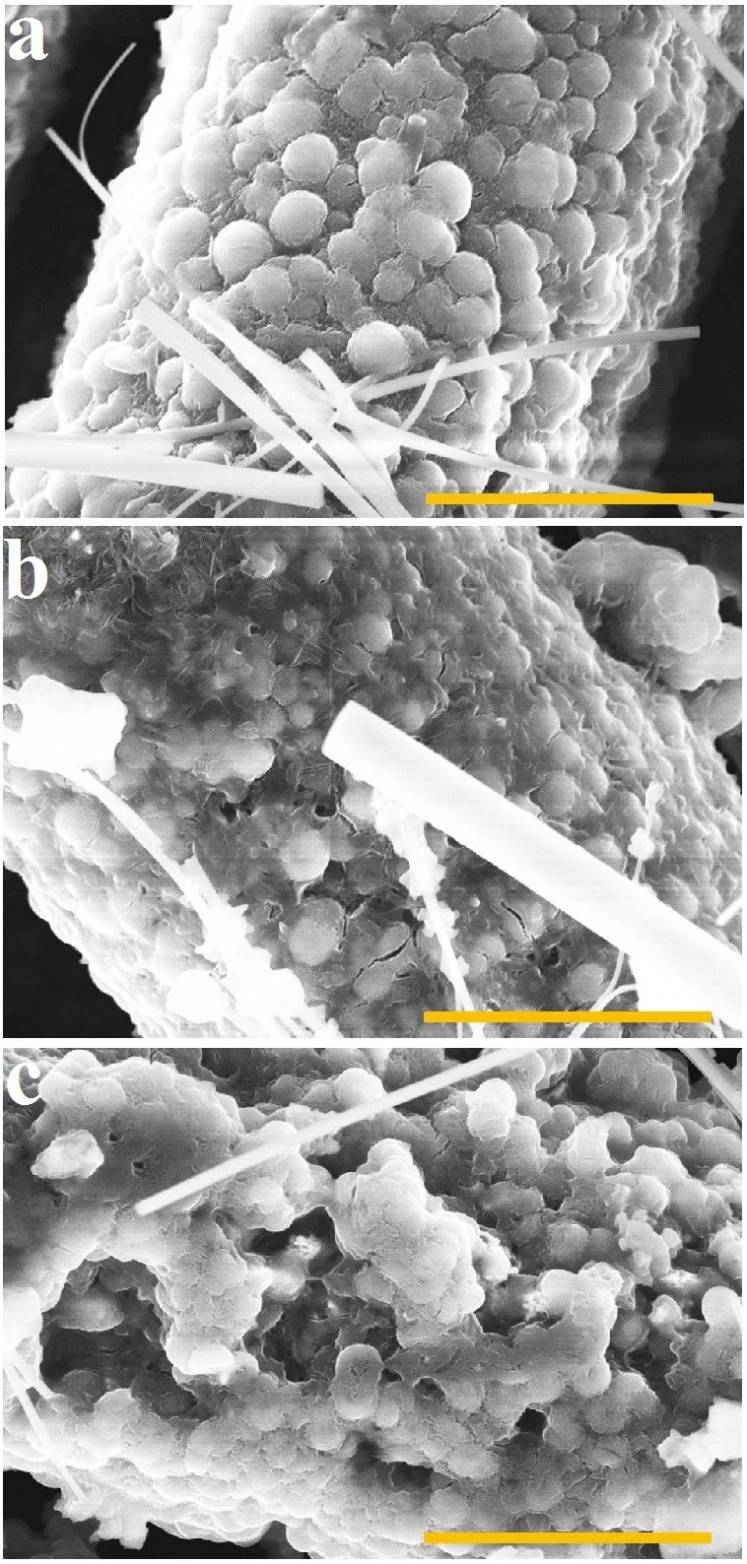


Figure S3. SEM images of Mo_2C@CC electrodes after discharged to 2.2 V under different current density. a, 200 mA g^{-1}; b, 500 mA g^{-1}; and c, 1000 mA g^{-1}, respectively. All bar is 5.0 μm

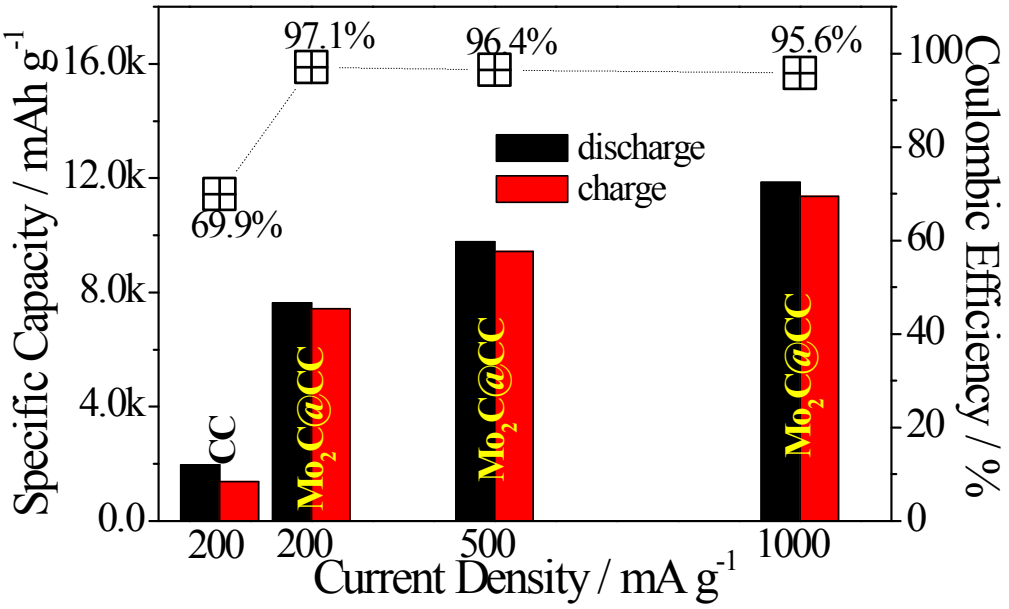


Figure S4. Discharge/charge specific capacity and corresponding coulombic efficiency at different current densities.

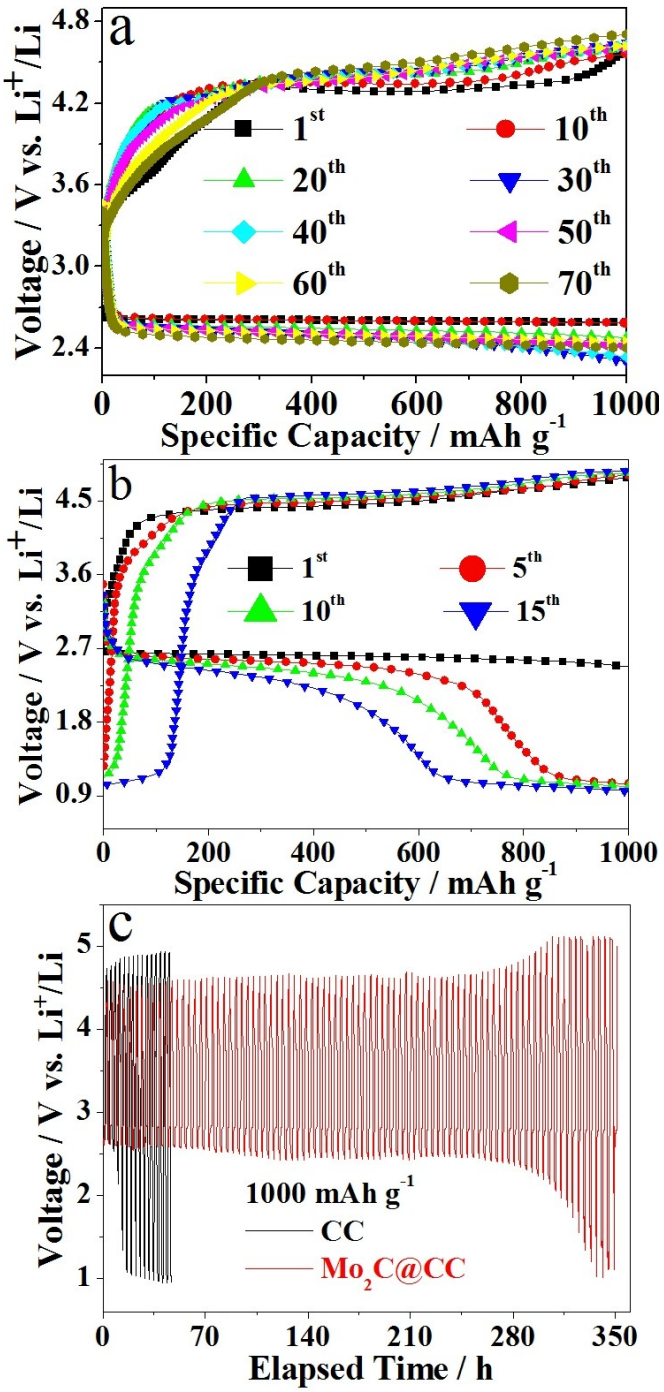
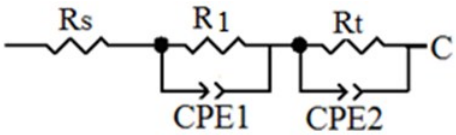


Figure S5. Cycling performances of CC (a and c) and Mo_2C@CC (b and c) electrode based LOBs at a current density of 1000 mA g^{-1} with a cut-off capacity of 1000 mAh g^{-1}, respectively.



	R_s / Ω	R_1 / Ω	CPE1/uF	n_1	R_t / Ω	CPE2/uF	n_2
2.98 V	22.90	5.72	1.20	0.994	73.70	27.2	0.867
2.55 V	26.30	9.14	18.70	0.885	163.00	52.90	0.856
2.20 V	28.40	9.28	3.98	0.991	197.00	77.70	0.806
4.00 V	29.60	5.89	2.60	0.955	125.00	91.60	0.799

Figure S6. Simplified equivalent circuit to simulate the Nyquist plots of Mo_2C@CC based LOBs at different statuses as shown in Figure 4a (top) and the fitting results (buttom). The R_s, R_1, R_{ct} and CPE represent solution resistance, interface resistance, charge transfer resistance and constant phase element, respectively.

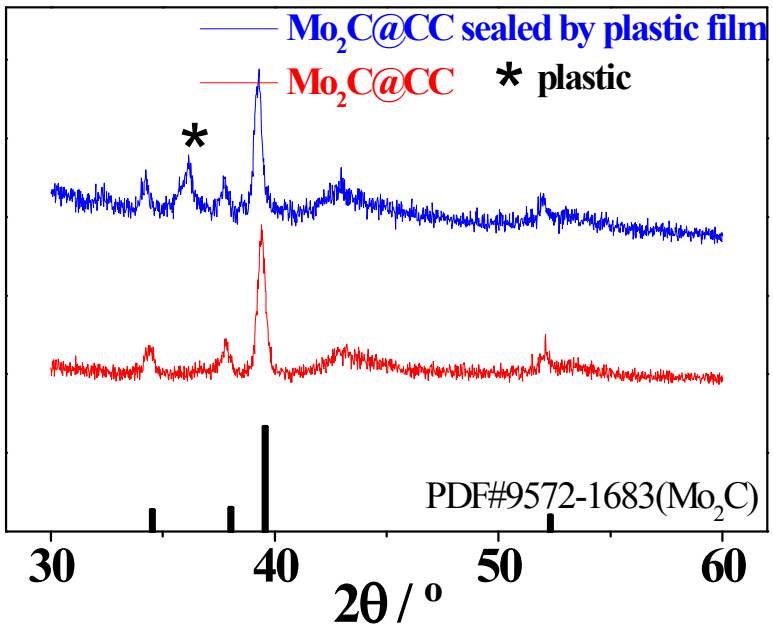


Figure S7. XRD patterns of Mo_2C@CC with and without sealed by plastic film.

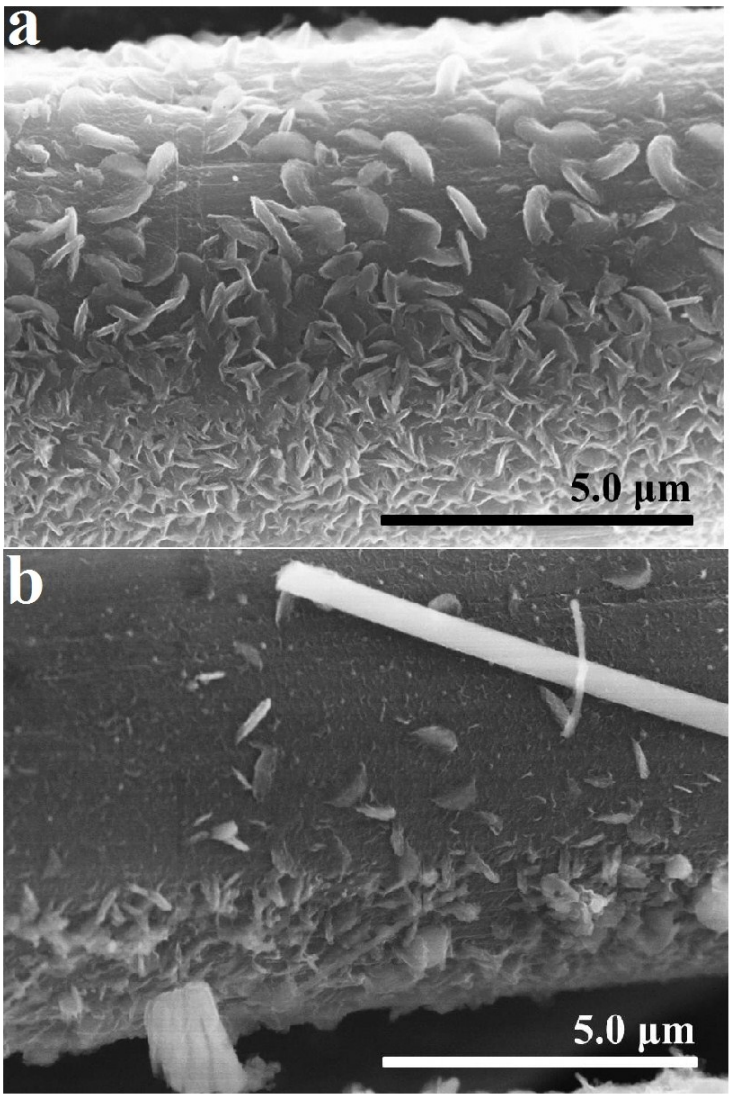


Figure S8. SEM images of CC electrode after discharged at 2.2 V (a) and charged at 4.0 V (b).

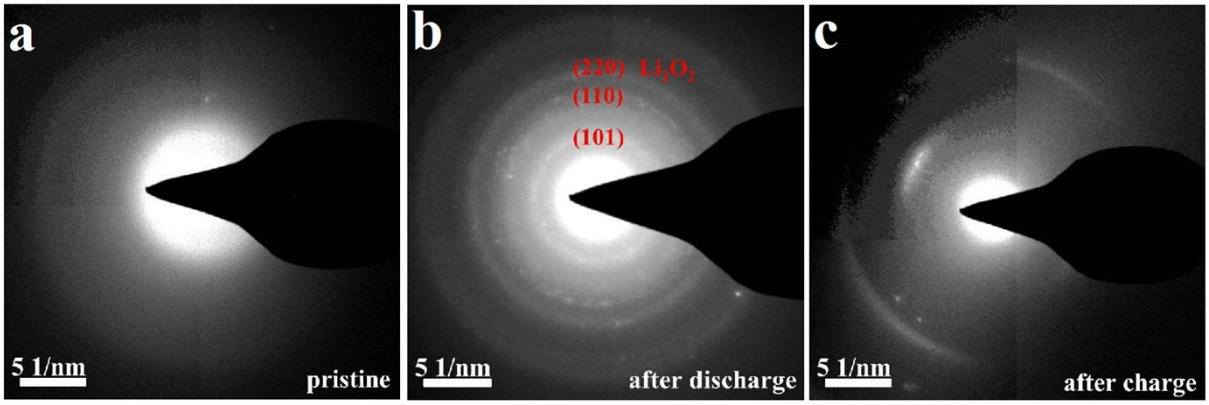


Figure S9. SAED patterns of pristine Mo_2C@CC electrode (a), Mo_2C@CC electrode after discharged at 2.2 V for 5 h (b), and Mo_2C@CC electrode after recharged at 4.0 V for 5 h (c), respectively.