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Electronic Supplementary Information

Soil/Vulcan XC-72 hybrid as a high-effective catalytic cathode for rechargeable Li−O_2 batteries

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Contents

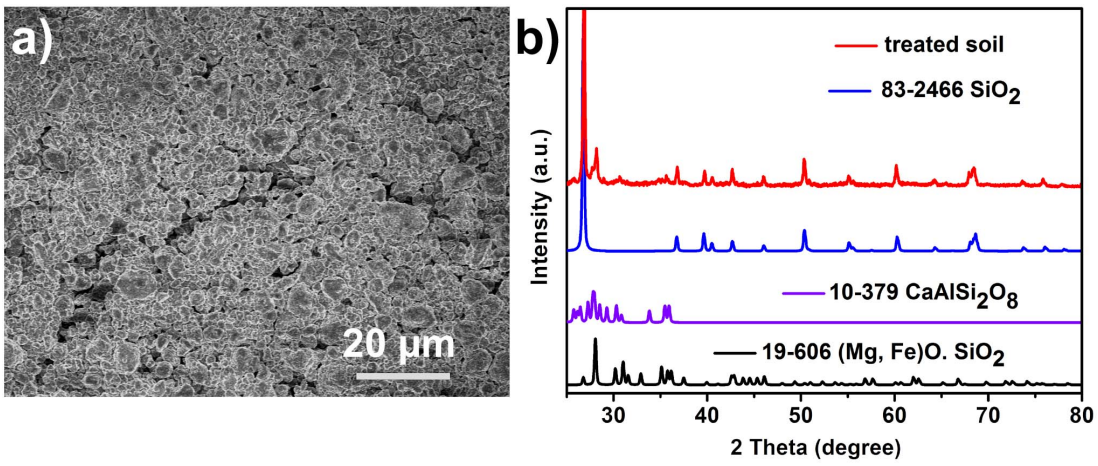

Fig. S1 (a) SEM image and (b) XRD of treated soil particles.

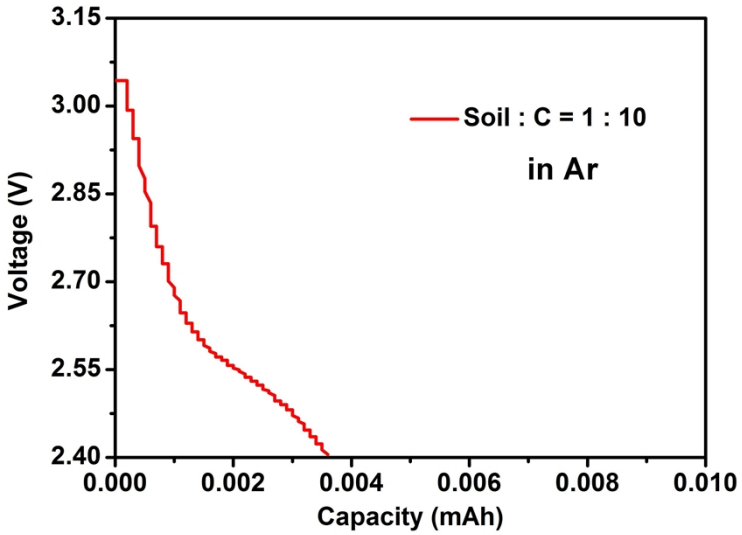

Fig. S2 Discharge cure of Li–O_2 batteries in Ar at 100 mA g^{-1}.

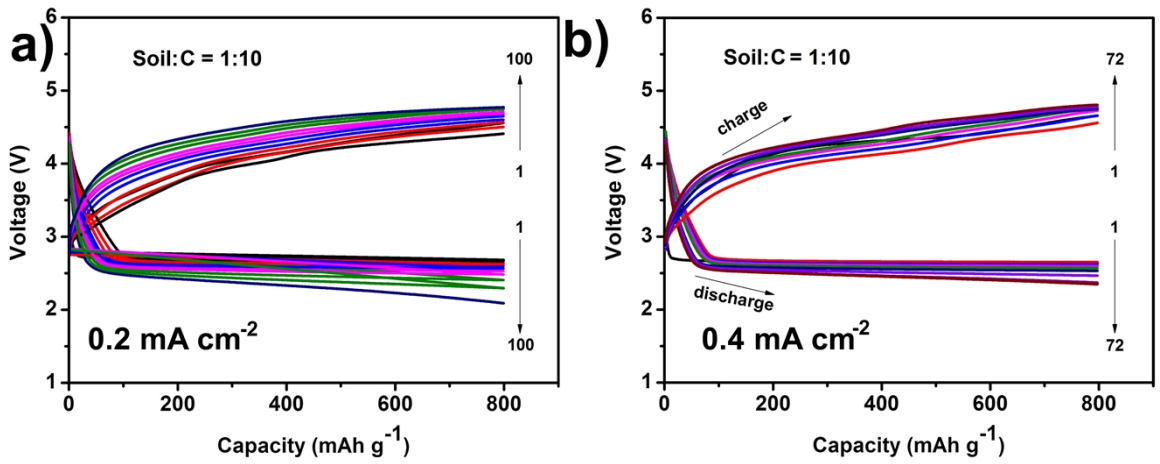

Fig. S3 Charge/discharge curves of Li–O_2 batteries with capacity cut-off 800 mAh g^{-1} (0.4 mAh cm^{-2}) at (a) 0.2 mA cm^{-2} and (b) 0.4 mA cm^{-2} in pure O_2.The cathode catalyst is hybrid of soil/C (soil:C = 1:10, mass ratio).

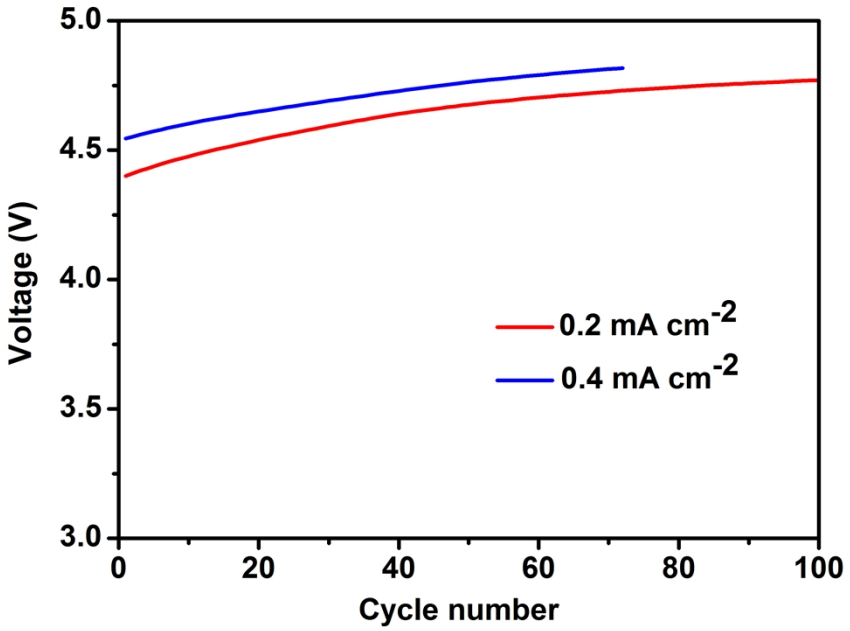

Fig. S4 OER terminal voltage curves of Li–O_2 batteries at different current densities.

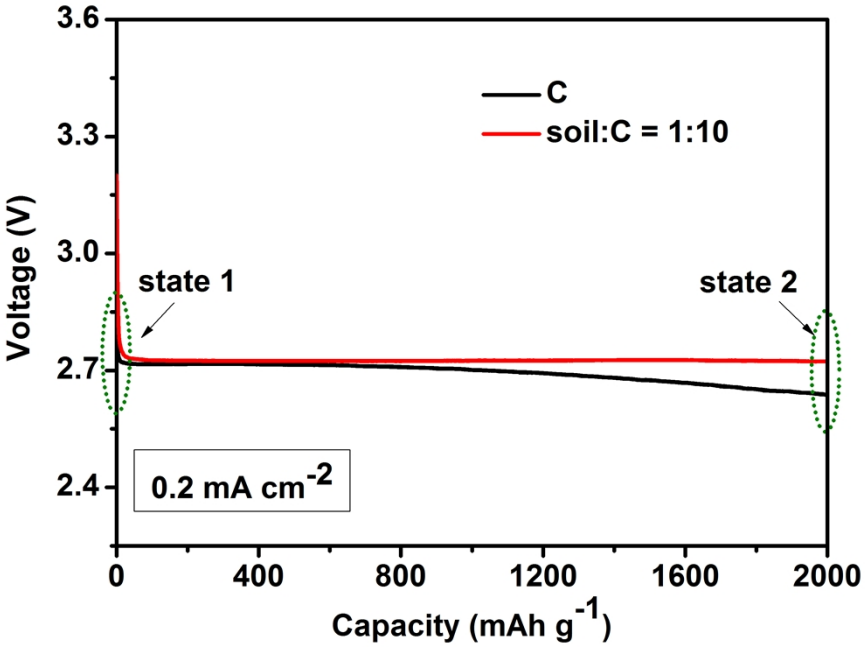

Fig. S5 Discharge curves of Li–O_2 batteries at 0.2 mA cm^{-2}. Two states are selected to observe the cathode morphology by SEM. State 1: prior to discharge. State 2: after discharge to 2000 mAh g^{-1}.

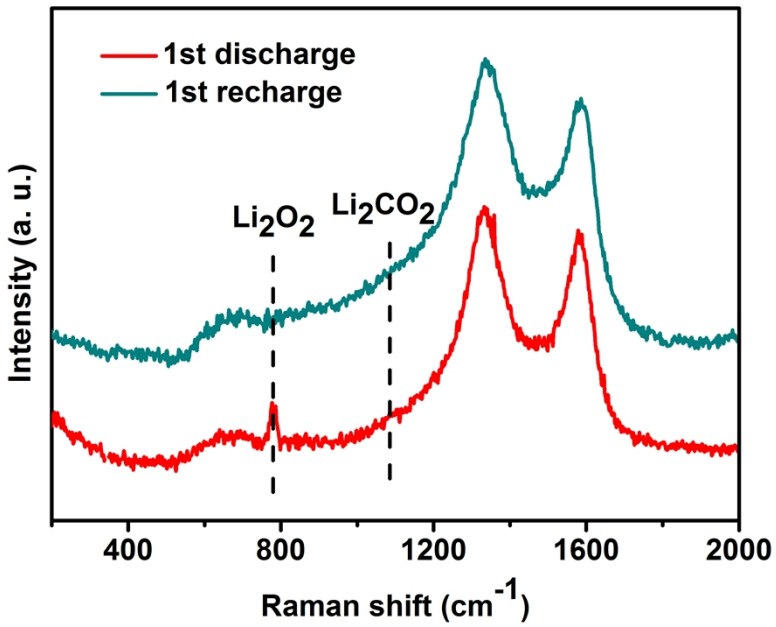

Fig. S6 Raman spectrum of cathodes at different discharge/charge states in Li-O_2 batteries. During test, cathodes were sealed by optical glass, which is used to prevent air from contaminating discharge product.

Table S1. Comparison of initial discharge capacity of soil/C hybrid and noble metal containing catalysts reported in literatures.

samples	citation	current density	Capacity /mAh cm^{-2}	Capacity /mAh g^{-2}
Porous gold	1	500 mA g^{-1}	0.45-5	~300
Pt-HSC/CP	2	1500 mA g^{-1}	-	6000
PdCu Nanocatalysts	3	200 mA g^{-1}	~3.24	~12000
Mn-Ru binary oxides	4	0.1 mA cm^{-2}	5.36	6500
Ru/ITO	5	0.15 mA cm^{-2}	1.81	905-1508
Soil/C hybrid	-	0.2 mA cm^{-2} or 400 mA g^{-1}	3.82	7640

Table S2. Comparison of electrochemical performance of carbon based cathode catalysts reported in literatures.

samples	citation	current density	cycle performance /cycles	Capacity /mAh g^{-1}
Hierarchical carbon	6	250 mA g^{-1}	50	1000
Pt-HSC/CP	2	300 mA g^{-1}	205	1000
Graphene/Graphene-Tube	7	400 mA g^{-1}	50	1200−1600
N-Doped Carbon Fiber	8	500 mA g^{-1}	200	500
our samples:	-	0.2 mA cm^{-2}	100	800
Soil/C hybrid		0.4 mA cm^{-2}	75	800

Supplementary References

1 Z. Q. Peng, S. A. Freunberger, Y. H. Chen and P. G. Bruce, *Science* 2012, **337**, 563–566.

2 J. J. Xu, Z. L. Wang, D. Xu, L. L. Zhang and X. B. Zhang, *Nat. Comm.*, 2013, **4**, 2438–2448.

3 R. Choi, J. Jung, G. Kim, K. Song, Y. I. Kim, S. C. Jung, Y. K. Han, H. Song and Y. M. Kang, *Energy Environ. Sci.* 2014, **7**, 1362–1368.

4 K. Guo, Y. Li, J. Yang, Z. Q. Zou, X. Z. Xue, X. M. Li and H. Yang, *J. Mater. Chem. A* 2014, **2**, 1509–1514.

5 F. J. Li, D. M. Tang, Y. Chen, D. Golberg, H. Kitaura, T. Zhang, A. Yamada and H. S. Zhou, *Nano Lett.* 2013, **13**, 4702−4707.

6 Z. Y. Guo, D. D. Zhou, X. L. Dong, Z. J. Qiu, Y. G. Wang and Y. Y. Xia, *Adv. Mater.*

2013, **25**, 5668–5672.

7 Q. Li, P. Xu, W. Gao, S. G. Ma, G. Q. Zhang, R. G. Cao, J. Cho, H. L. Wang and G. Wu, *Adv. Mater.* 2014, **26**, 1378–1386.

8 J. L. Shui, F. Du, C. M. Xue, Q. Li and L. M. Dai, *ACS Nano* 2014, **8**, 3015–3022.