Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Electronic Supplementary Information

Zeolitic Imidazole Framework Derived Composites of Nitrogen-Doped Porous Carbon and Reduced Graphene Oxide as High-efficiency Cathode Catalysts for Li-O_2 Batteries

Ming Zhong,[a†] *Xin Zhang,*[a†] *Dong-Hui Yang,*[a] *Bei Zhao,*[a] *Zhaojun Xie,*[a] *Zhen Zhou,*[a*] *Xian-He Bu*[a,b*]

[a] *School of Materials Science and Engineering, National Institute for Advanced Materials, Tianjin Key Laboratory of Metal and Molecule Based Material Chemistry, Institute of New Energy Material Chemistry, Collaborative Innovation Center of Chemical Science and Engineering (Tianjin), Nankai University, Tianjin 300350, China*

[b] *State Key Laboratory of Elemento-Organic Chemistry, College of Chemistry, Nankai University, Tianjin 300071, China*

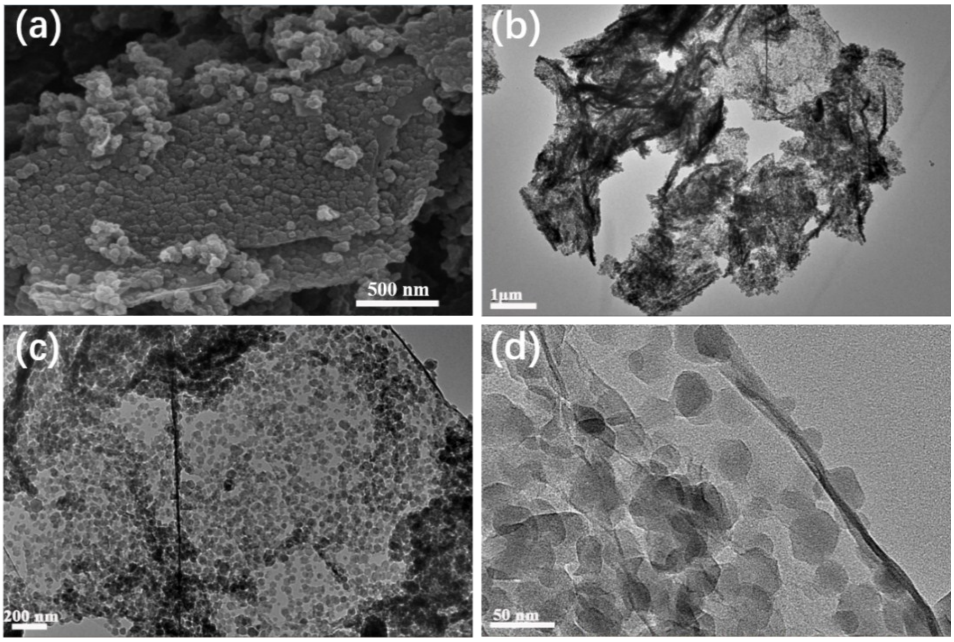

Figure S1 SEM (a) and TEM(b-d) images of ZIF-8/GO precursor.

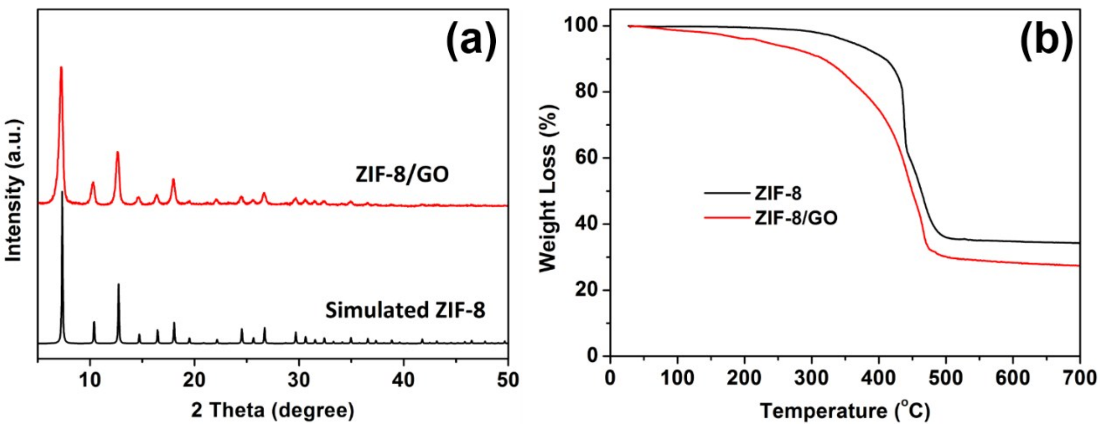

Figure S2 (a) XRD patterns of ZIF-8/GO precursors; (b) TG curves of ZIF-8 and ZIF-8/GO precursors.

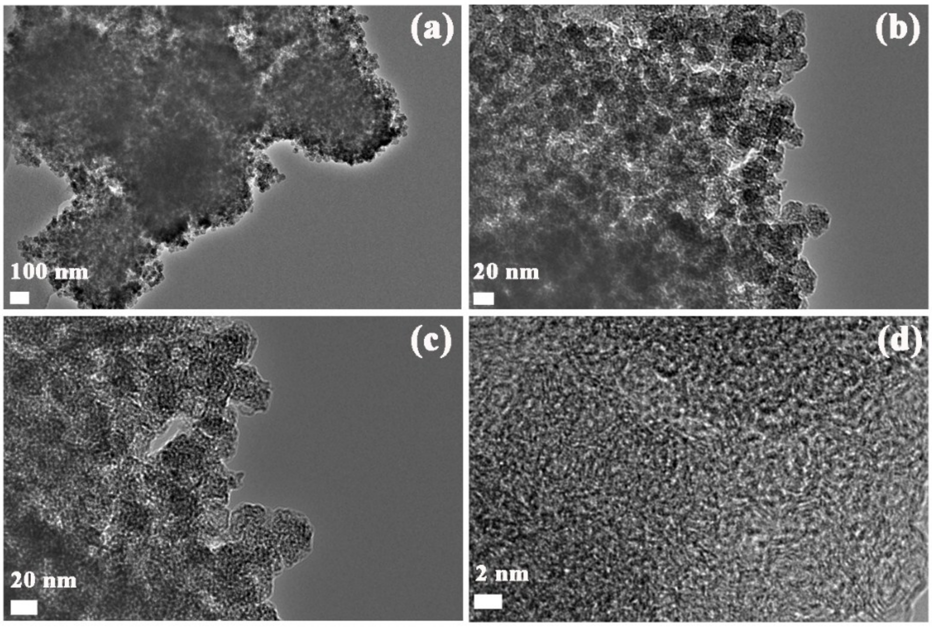

Figure S3 TEM and HRTEM images of NPC obtained by pyrolysis of ZIF-8 at 1000 ^{o}C.

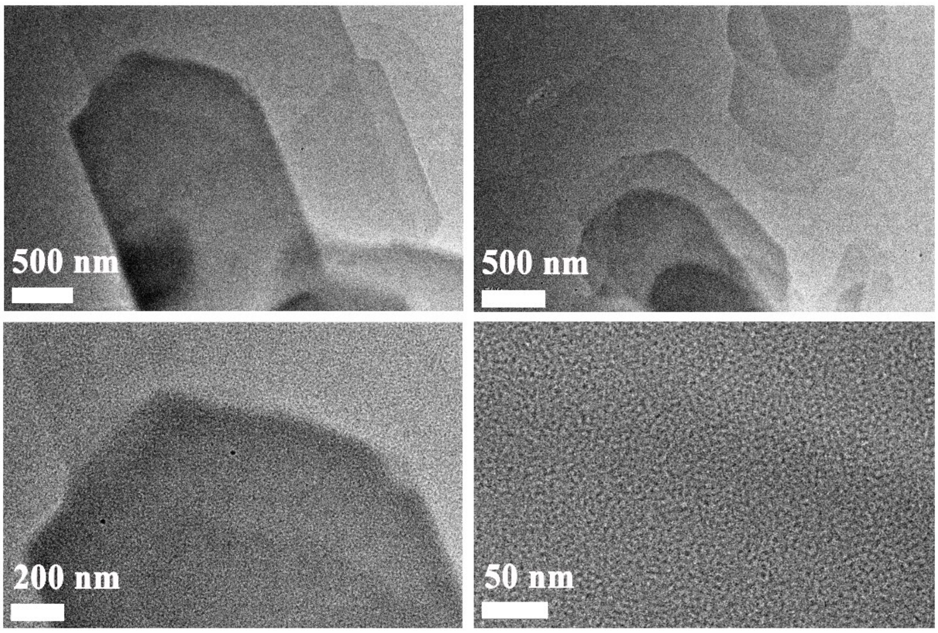

Figure S4 SEM images of rGO obtained by pyrolysis of graphene oxide at 1000 ^{o}C.

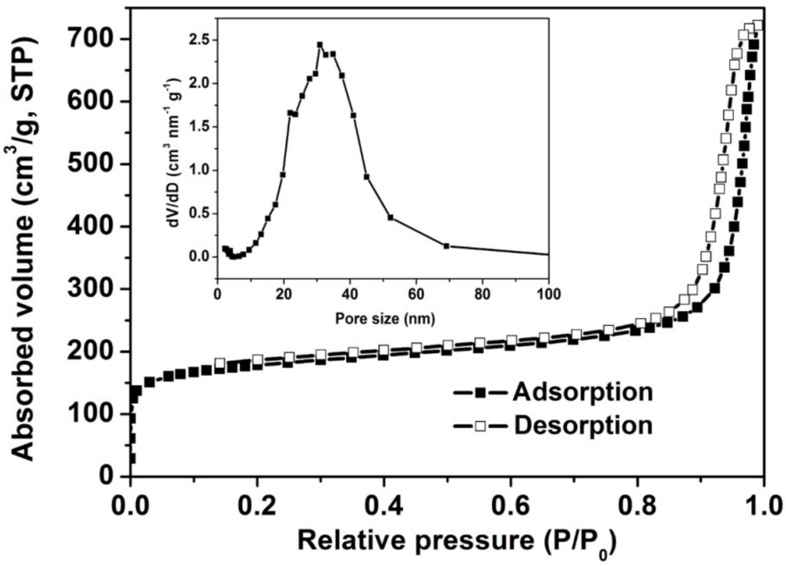

Figure S5 N_2 sorption/desorption isotherms of the as-prepared NPC sample. Inset is the corresponding pore size distribution.

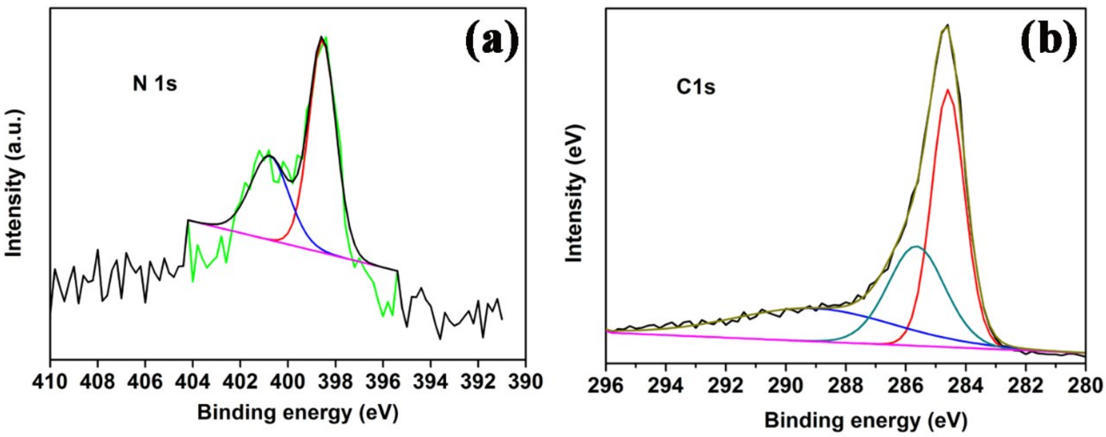

Figure S6. (a) High-resolution C1s spectrum, and (b) N1s spectrum of the as-synthesized NPC.

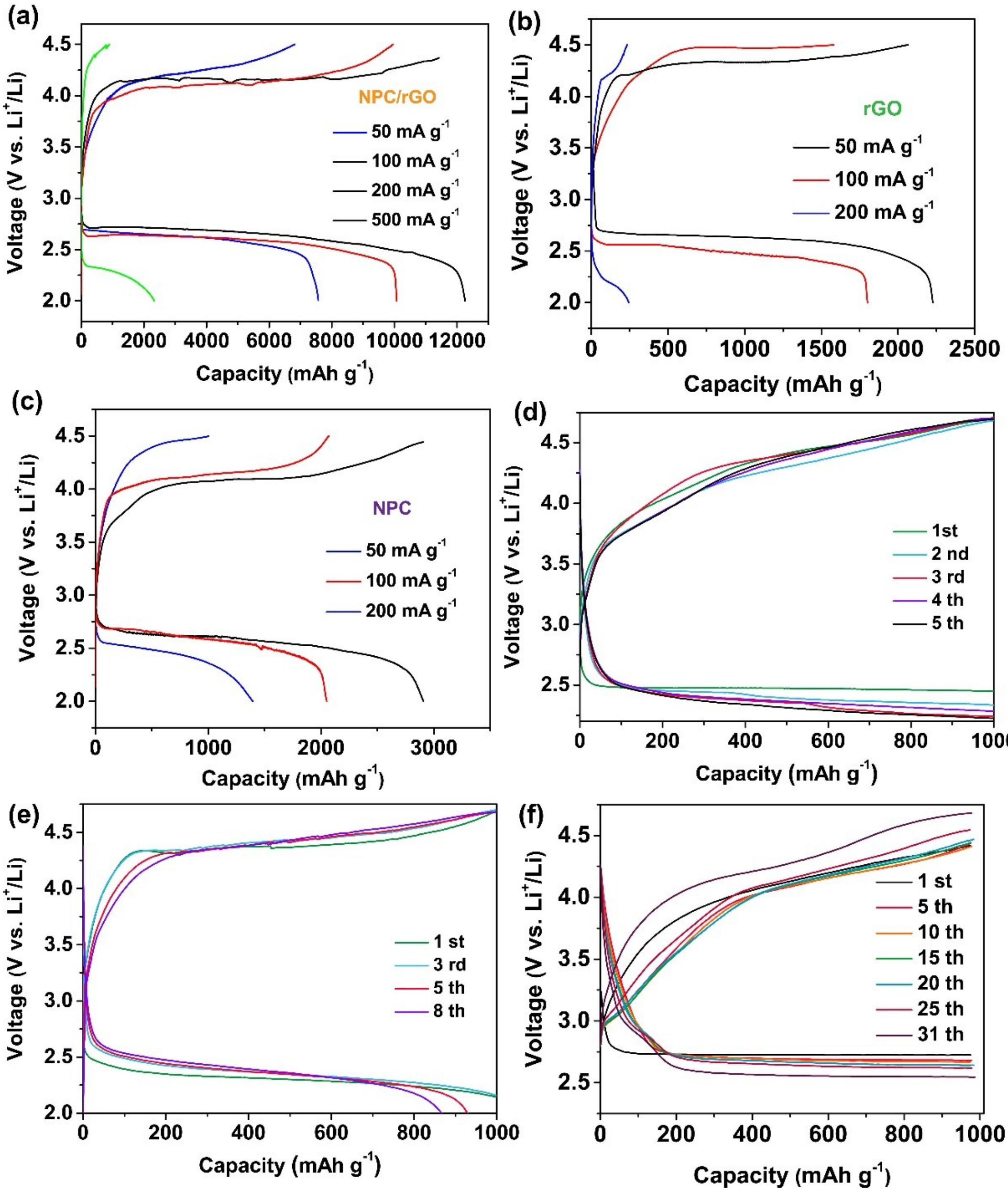

Figure S7 (a) The discharge-charge curves of Li-O_2 batteries with NPC/rGO at different current densities. (b) The discharge-charge curves of Li-O_2 batteries with rGO at different current densities. (c) The discharge-charge curves of Li-O_2 batteries with NPC at different current densities. (d) Cyclic performance of NPC cathode at 200 mA g^{-1} with a capacity limited at 1000 mAh g^{-1}. (e) Cyclic performance of rGO cathode at 200 mA g^{-1} with a capacity limited at 1000 mAh g^{-1}. (f) Cyclic performance of NPC/rGO cathode at 500 mA g^{-1} with a capacity limited at 1000 mAh g^{-1}.

Table S1 Comparison of the electrochemical performance of the present work with the reported nitrogen doped carbon or graphene cathode catalysts.

Materials	Maximum capacity/mAh g^{-1} (current density/mA g^{-1})	Cycle (current density/mA g^{-1}, upper-limit capacity/mAh g^{-1})	Initial overpotentials /V vs. Li/Li^+	Ref.
N-doped graphene	1200 (50)	50 (400, 50)	0.4/1.2	S1
N-doped 3D graphene	3900 (200)	22 (100, 500)	0.4/1.3	S2
Dual-doped graphene and mesoporous carbon	11000 (100)	44(100, 1000)	0.2/1.1	S3
N-doped CNT	200 (800)	10 (50, 500)	0.1/1.3	S4
Hierarhcerical N-doped Carbon sheets	3200 (100)	161 (200, 600)	0.2/1.2	S5

References

[S1] G. Wu, N. H. Mack, W. Gao, S. Ma, R. Zhong, J. Han, J. K. Baldwin, P. Zelenay, *ACS Nano*, 2012, **6**, 9764-9776.

[S2] M. He, P. Zhang, L. Liu, B. Liu, S. Xu, *Electrochim. Acta*, 2016, **191**, 90-97.

[S3] J.-H. Kim, A. G. Kannan, H.-S. Woo, D.-G. Jin, W. Kim, K. Ryu, D.-W. Kim, *J. Mater. Chem. A*, 2015, **3**, 18456-18465.

[S4] X. Lin, X. Lu, T. Huang, Z. Liu, A. Yu, *J. Power Sources*, 2013, **242**, 855-859.

[S5] Z. Zhang, J. Bao, C. He, Y. Chen, J. Wei, Z. Zhou, *Adv. Funct. Mater.*, 2014, **24**, 6826-6833.