Supplementary Information

Fabrication of three-dimensional ordered macroporous spinel CoFe$_2$O$_4$ as efficient bifunctional catalysts for a positive electrode of lithium-oxygen batteries

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**Fig. S1** Nitrogen adsorption isotherms of 3DOM CFO@60. Inset shows pore size distribution of 3DOM CFO@60.
**Fig. S2** SEM images (a and b) of CFO@60 and CFO@140. TEM images (c and d) of CFO@60 and CFO@140.
Fig. S3 EDX spectrum of the 3DOM CFO@140.
**Fig. S4** (a) Coulombic efficiency-cycle number curves for Li-O$_2$ cells with CFO NPs, 3DOM CFO@60, and CFO@140 catalysts for five cycles. (b) Plots of the differential capacity *versus* the voltage at a current density of 200 mA g$^{-1}$. 
**Fig. S5** The discharge-charge profiles of Li-O\(_2\) cells with KB, CFO NPs, 3DOM CFO@60, and CFO@140 at the first cycle. The capacities are normalized by the total mass of electrode (catalyst, carbon, and binder).
Fig. S6 Discharge-charge curves of Li-O$_2$ cells with KB, CFO NPs, 3DOM CFO@60, and CFO@140 catalysts at a current rate of 200 mA g$^{-1}$ with the limited capacity depth of (a) 500 and (b) 1000 mAh g$^{-1}$. KB in Fig. S6b was studied in our previous work [5].

The potential-capacity curves of Li-O$_2$ cells with KB, CFO NPs, 3DOM CFO@60, and CFO@140 catalysts at a current density of 200 mA g$^{-1}$ with the restricted capacity of 1000 mAh g$^{-1}$ were provided in Fig. S6b. When increasing the restricted capacity from 500 to 1000 mAh g$^{-1}$, the Li-O$_2$ cell with CFO@140 catalyst also showed the smallest overpotential of 1.31 V as compared to that with KB (1.72 V), CFO NPs (1.62 V), CFO@60 (1.37 V). This result emphasizes again that the CFO@140 catalyst can reduce the potential polarization efficiently at a relatively high restricted capacity of 1000 mAh g$^{-1}$. 
**Fig. S7** Magnified potential-capacity curves for (a) initial charging and (b) initial discharging of the Li-O$_2$ cells with KB, CFO NPs, CFO@60, and CFO@140 at a current density of 200 mA g$^{-1}$ with the limited capacity depth of 500 mAh g$^{-1}$.

For comparison of the potential polarizaison of O$_2$-electrode with KB, CFO NPs, CFO@60, and CFO@140 catalysts, the magnified potential-capacity profiles are provided in Fig. S7. The lowest charge potential of CFO@140 means reaction product of Li$_2$O$_2$ are decomposed more easily, while the highest discharge potential means reaction product of Li$_2$O$_2$ are formed more readily. Therefore, the CFO@140 could indicate high catalytic activity in both OER and ORR, as compared with KB, CFO NPs, and CFO@60. Consequently, the enhanced ORR/OER kinetics could lead to improvements in the energy output, the cycling stability, and the round-trip efficiency of the Li-O$_2$ cells.
Fig. S8 Potential-time curves of Li-O$_2$ cells with (a) KB, (b) CFO@60, and (c) CFO@140 catalysts. (d) Terminal voltage-cycle number curves with KB, CFO@60, and CFO@140.
Fig. S9 XRD patterns of the O₂-electrodes with (a) KB and (b) CFO@140 at different discharge/charge stages. Peaks marked with asterisks are originated from the carbon paper.