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Support Information

Co_3O_4 functionalized Porous Carbon nanotube Oxygen-Cathode to Promote Li_2O_2 Surface Growth for Improved Cycling Stability in Li-O_2 Batteries

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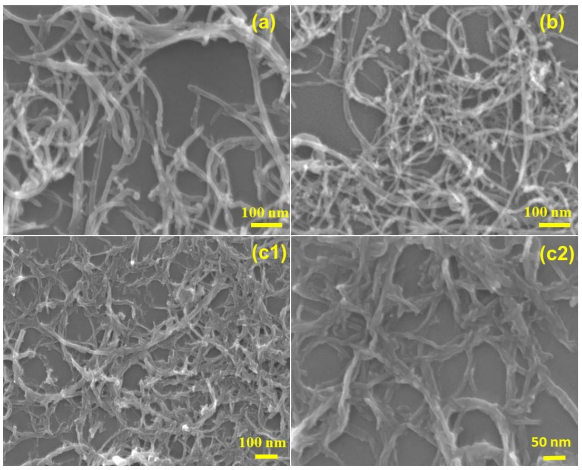

Figure S1. SEM images of (a): o-CNT; (b): p-CNT; (c1) and (c2): p-CNT/Co_3O_4[M].

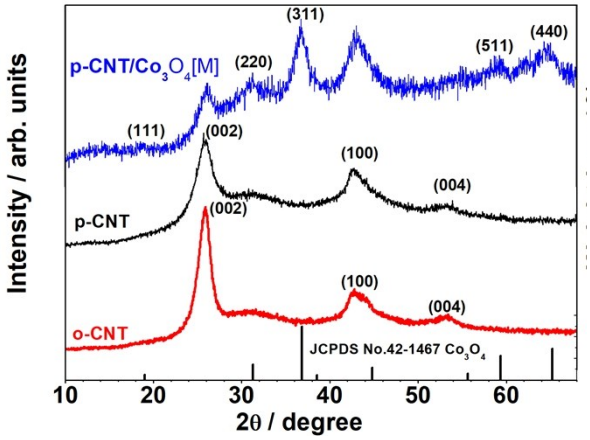

Figure S2. XRD patterns of (e): o-CNT; (f): p-CNT; (g): p-CNT/Co_3O_4[M].

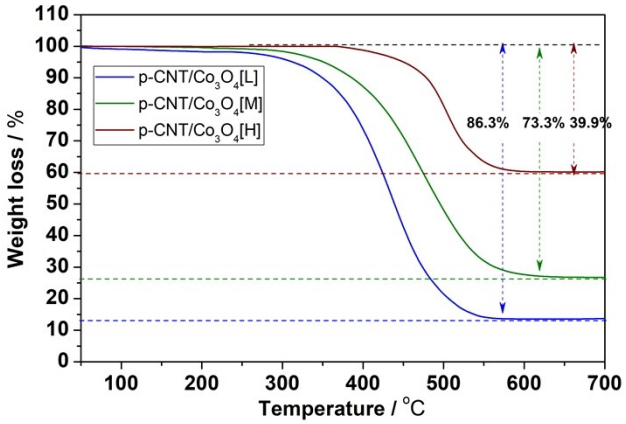

Figure S3. TG curve of p-CNT/Co_3O_4[L], p-CNT/Co_3O_4[M] and p-CNT/Co_3O_4[H].

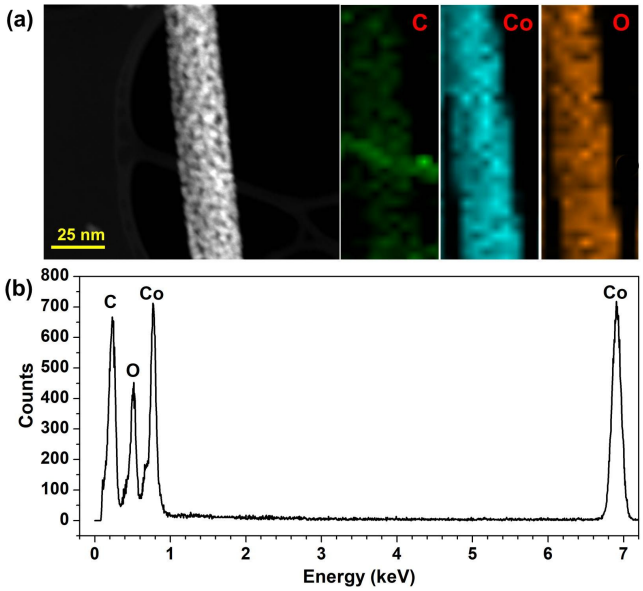

Figure S4 (a): HAADF-STEM image and EDX maps (of the C, Co, and O elements and of all three elements in the composite) of the p-CNT@Co_3O_4[M] sample; (b) EDX analysis of the p-CNT/Co_3O_4[M].

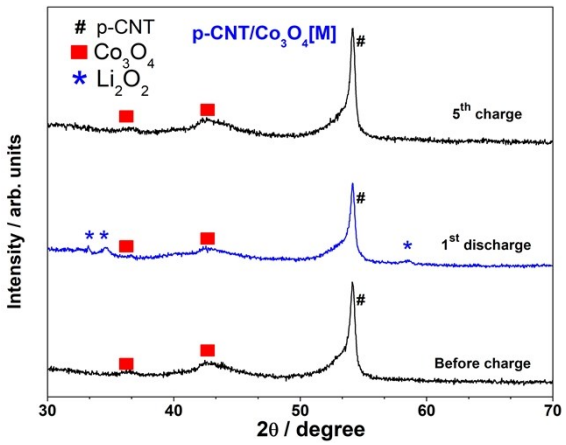

Figure S5. XRD patterns of the p-CNT/Co_3O_4[M] before discharge, after 1st discharge, and after 5th charge.

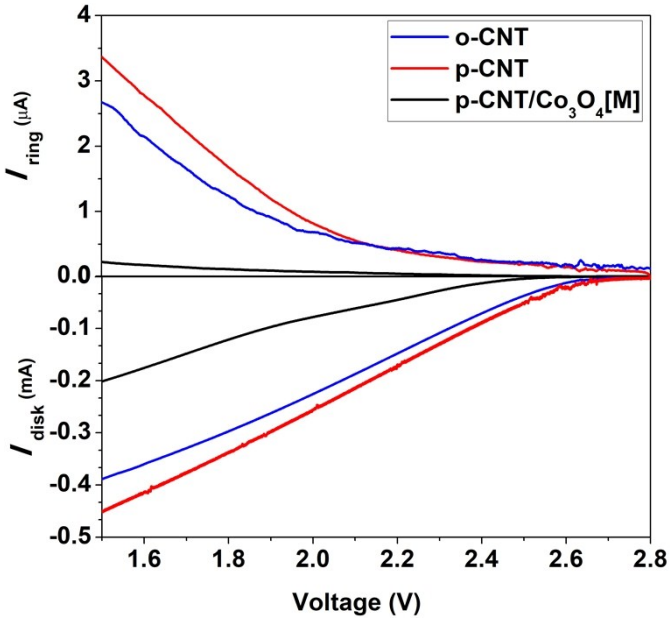

Figure S6. RRDE curves of the o-CNT, p-CNT and p-CNT/Co_3O_4[M] catalysts.

We do the rotating ring disk electrode (RRDE) to evaluate the role of Co_3O_4 on the formation of Li_2O_2, in particularly the oxygen adsorption strength on different cathode catalysts. The RRDE of o-CNT, p-CNT and p-CNT/Co_3O_4[M] were tested to determine the concentration of O_2^- adsorbed on the surface of disk or dissolved in solution. In the RRDE studies, O_2 is firstly reduced at the disk and then dissolved O_2^- in electrolyte is oxidized and detected at the ring. The low ring current of p-CNT/Co_3O_4[M] demonstrated a very small concentration of O_2^- in the electrolyte solution, suggesting that O_2^- is mainly adsorbed on the p-CNT/Co_3O_4[M], leading to surface thin film growth mode. In contrast, the higher ring current of o-CNT and p-CNT indicated that O_2^- is dissolved in solution, resulting in solution growth mode. The RRDE results show that the decorated Co_3O_4 surface layer possesses stronger oxygen adsorption strength, and hence lead to the transformation of the discharge product from the toroid-type Li_2O_2 via the solution growth mechanism to the thin film-type Li_2O_2 via the surface growth mechanism.

Table S1. BET surface area and pore volume of o-CNT, p-CNT, p-CNT/Co_3O_4[L], p-CNT/Co_3O_4[M] and p-CNT/Co_3O_4[H].

Sample	S_{BET} (m^2 g^{-1})	S_{pore} (cm^3 g^{-1})
o-CNT	131.8	0.26
p-CNT	551.7	0.90
p-CNT/Co_3O_4[L]	402.9	0.80
p-CNT/Co_3O_4[M]	355.7	0.64
p-CNT/Co_3O_4[H]	167.0	0.33

Table S2. Fitted values for equivalent circuit elements by simulation of EIS data in Figure 7.

Samples	R_o (Ω)		R_{ct} (Ω)	
	Initial	5th charge	Initial	5th charge
o-CNT	47.0	77.9	96.2	229.4
p-CNT	44.7	71.4	55.5	194.1
p-CNT/Co_3O_4[M]	41.7	56.1	74.3	100.5