Supporting information

A MOF-derived self-template strategy toward cobalt phosphides electrodes with ultralong cycle life and high capacity

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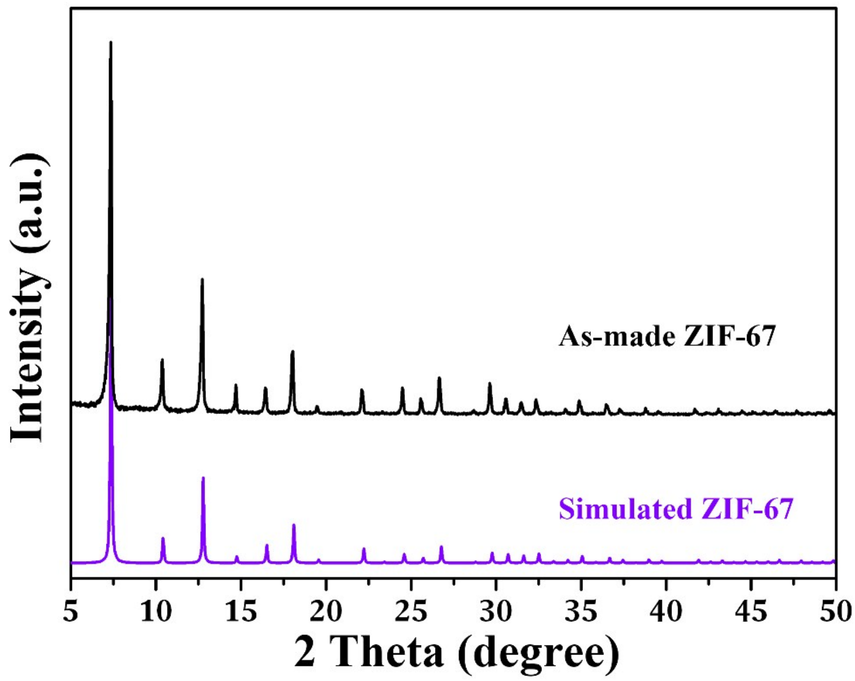

Figure S1. XRD patterns of the precursor ZIF-67 and simulated ZIF-67.

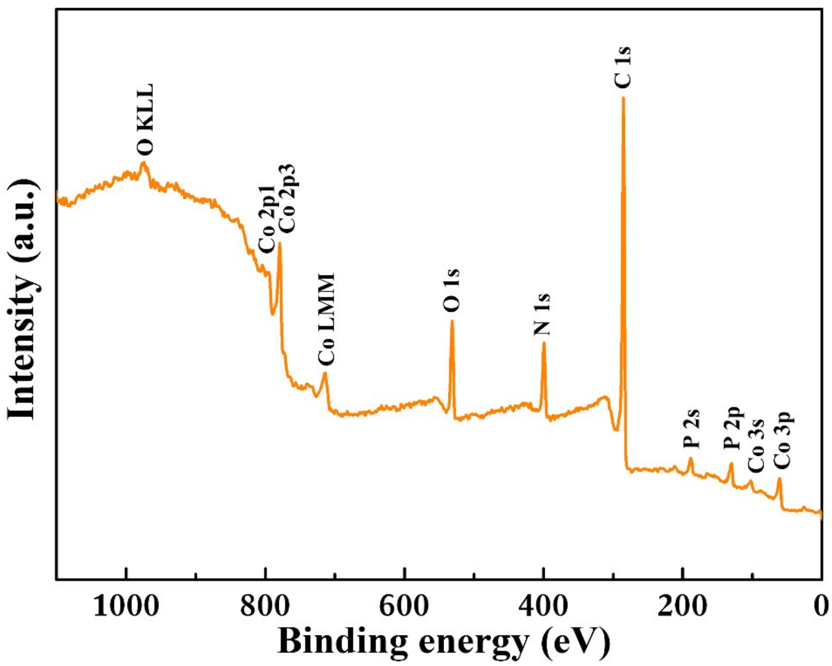

Figure S2. XPS wide scan spectral plot of Co_xP-NC-800.

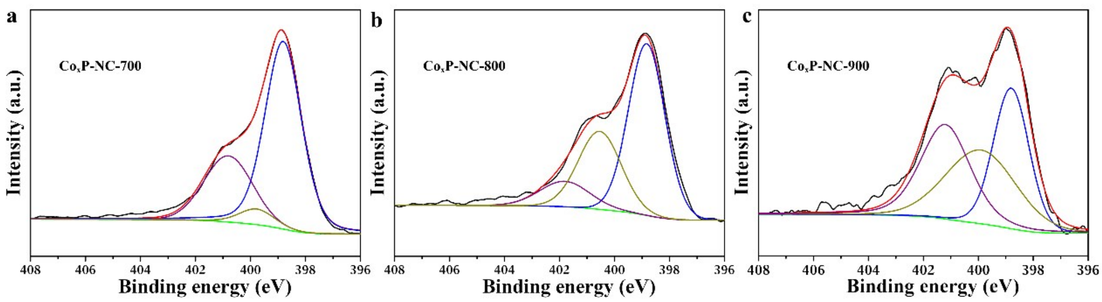

Figure S3. a-c) N1s spectra of Co_xP-NC-700, Co_xP-NC-800 and Co_xP-NC-900 electrodes.

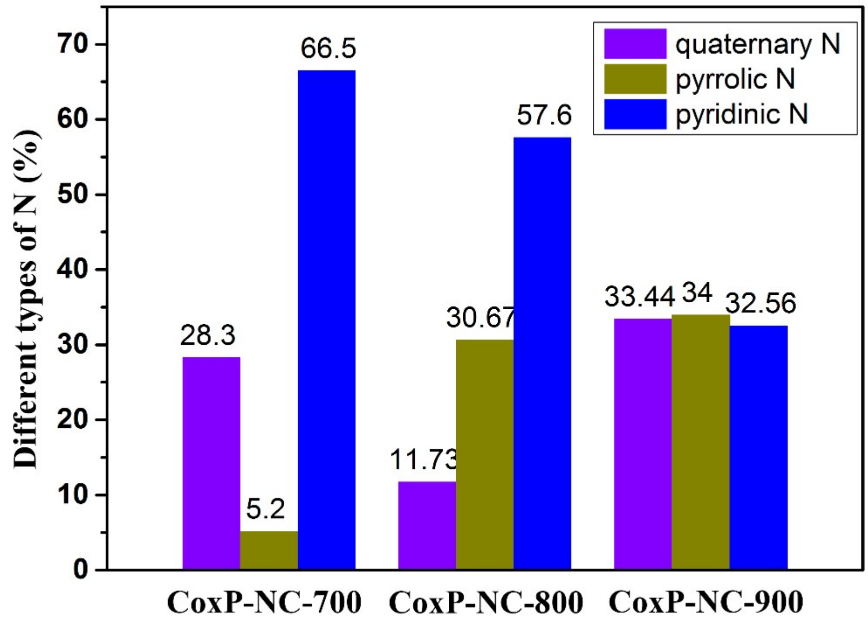

Figure S4. Ratio of different types of nitrogen in Co_xP-NC-700, Co_xP-NC-800 and Co_xP-NC-900 electrodes.

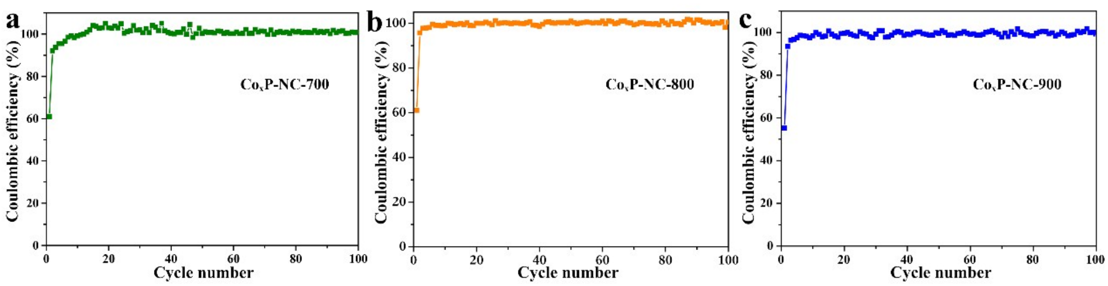

Figure S5. a-c) Coulombic efficiency of Co_xP-NC-700, Co_xP-NC-800, and Co_xP-NC-900 electrodes when cycled at current density of 0.1 A g^{-1}.

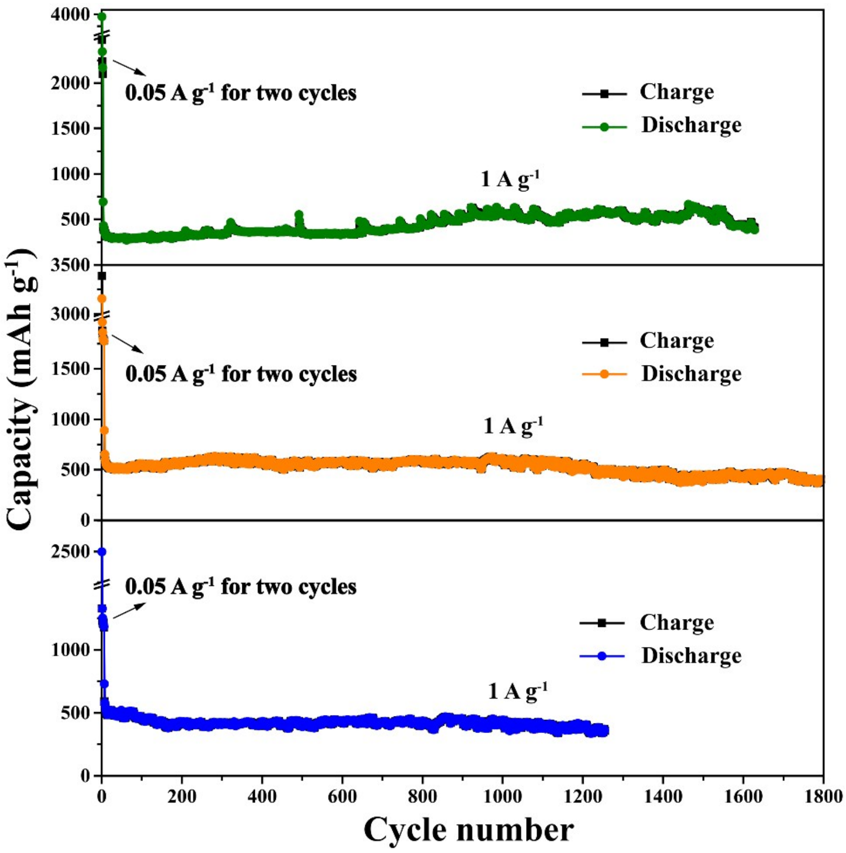

Figure S6. Cycling performance of Co_xP-NC-700, Co_xP-NC-800, and Co_xP-NC-900 electrodes at current density of 1 A g^{-1}.

Table S1. The comparison of Li-storage performance between Co_xP-NC-800 and other cobalt phosphides electrode materials.

Name	Current density (mA g^{-1})	Charge capacity (mA h g^{-1})	Cycle number	Reference
CoP hollow sphere	178	630	100	Ref 31
Co_2P/graphene	100	888	250	Ref 36
CoP@C nanorods	180/900	654/530	100/200	Ref 37
CoP/RGO	200	960	200	Ref 5
Co_xP-NC-800	100	1224	100	This work
	1000	550/400	1000/1800	This work

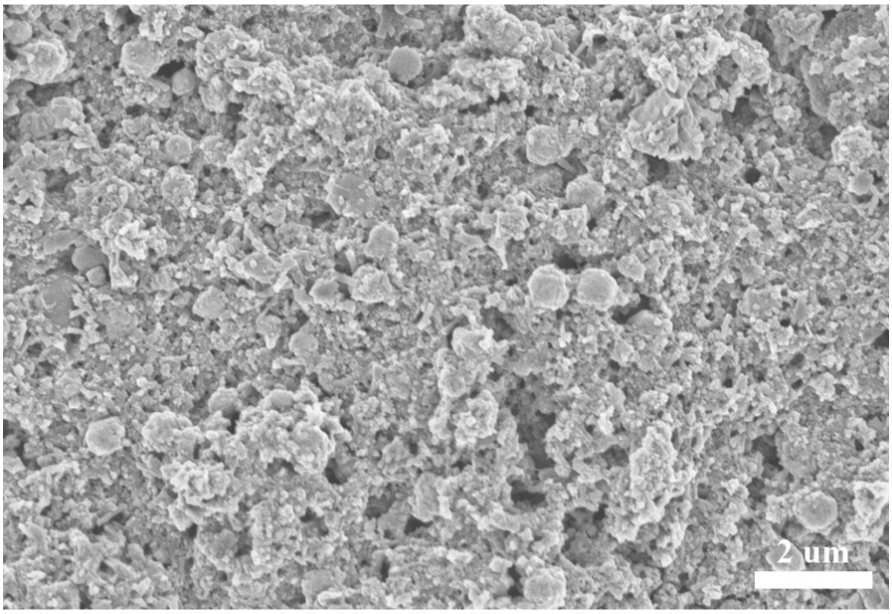

Figure S7. SEM images of Co_xP-NC-800 electrode after 1800 cycles at a current density of 1 A g^{-1}.

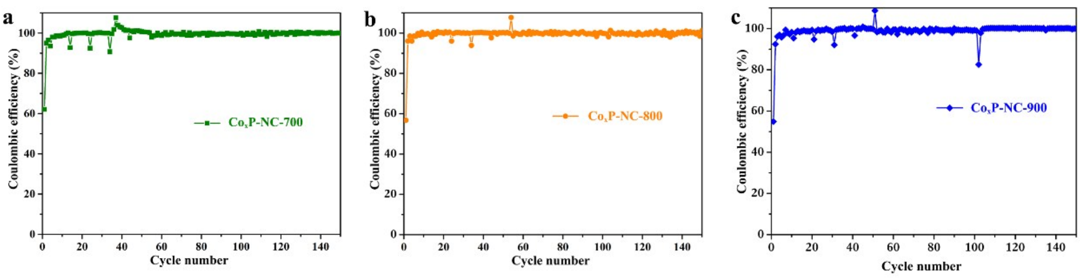

Figure S8. Coulombic efficiency of Co_xP-NC-700 (a), Co_xP-NC-800 (b) and Co_xP-NC-900 (c) corresponding to rate performance respectively.

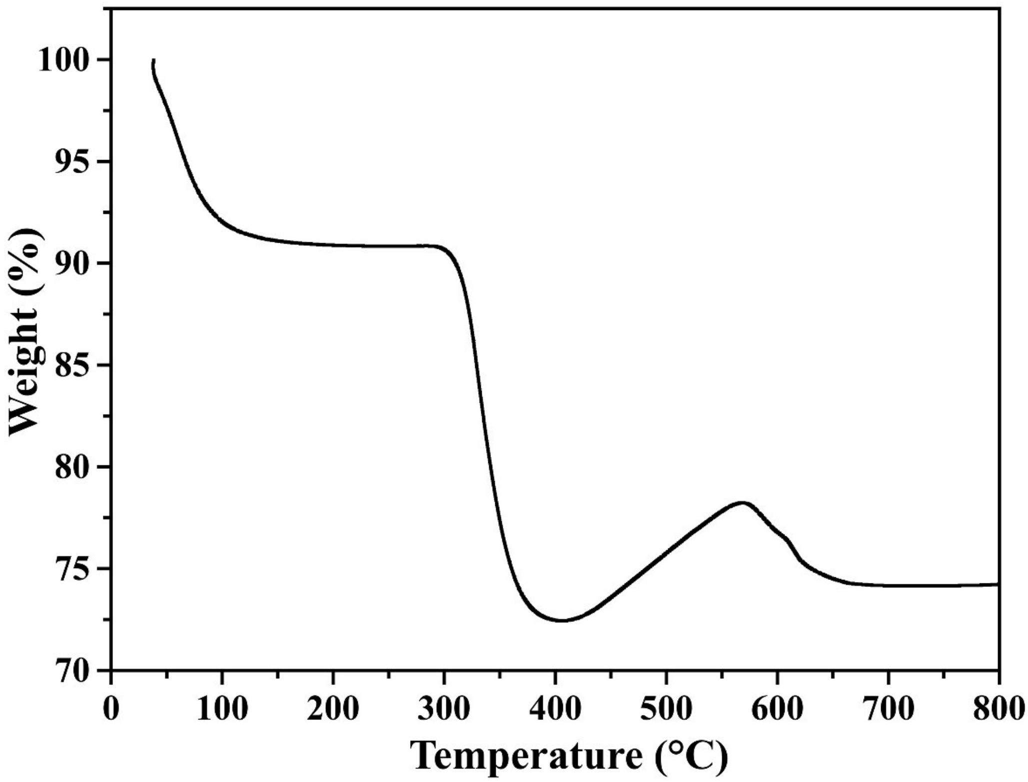

Figure S8. TGA curve of Co_xP-NC-800 in air.

The initial weight loss of 9 % could be the weight of water, which were absorbed from the air. Then followed by the combustion of carbon, and gradual oxidation of Co_xP to Co_3O_4, P_2O_5. Since the Co_xP nanoparticles are homogeneously distributed in carbon network, the combustion of carbon could be the majority between 300-400 °C , and a significant weight loss could happen. Then next gradual oxidation can happen. The final product is Co_3O_4 with remaining weight of 74 wt.%. The Co content estimated to be 59.7 wt.% in the Co_xP-NC-800 according to the following equation: 74 wt.% * M(Co)/ M(Co_3O_4)/ (1-9 wt.%) ≈ 59.7 wt.%.

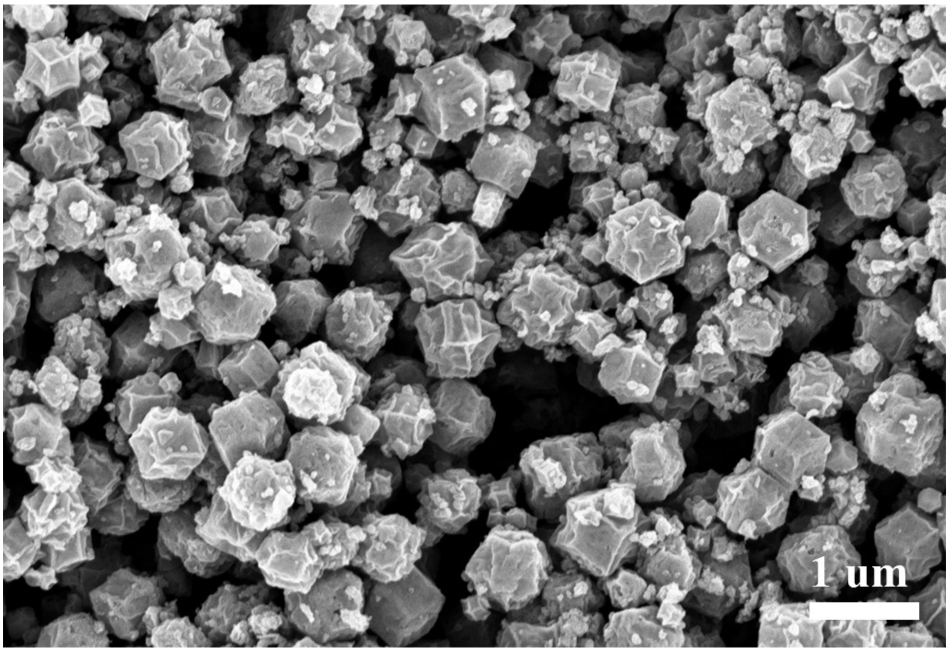

Figure S9. SEM image of Co_xP-NC-700 samples.

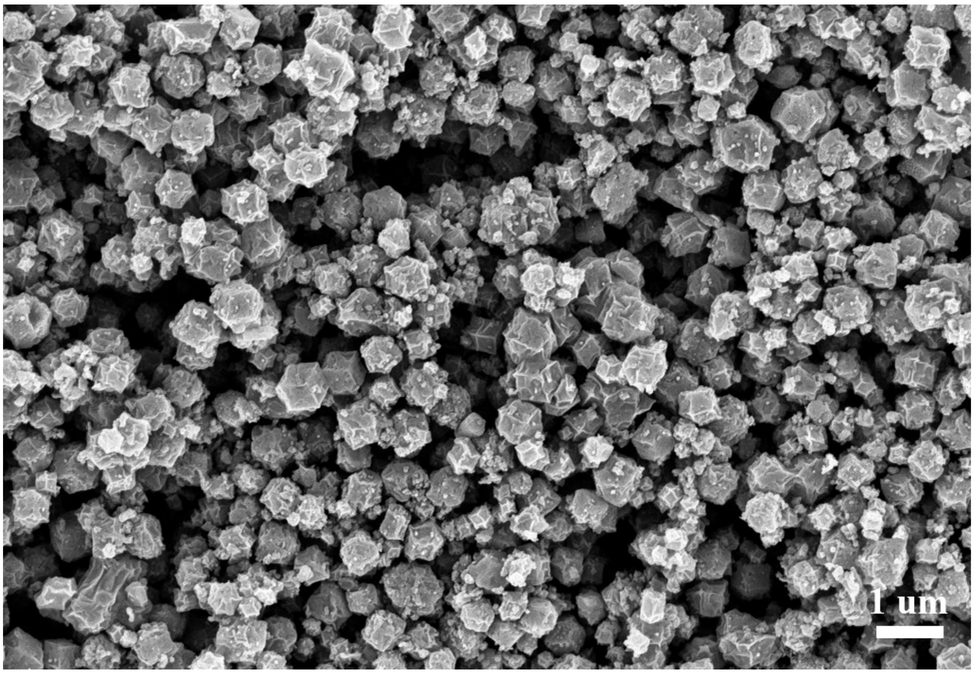

Figure S10. SEM graph of Co_xP-NC-900 samples.