

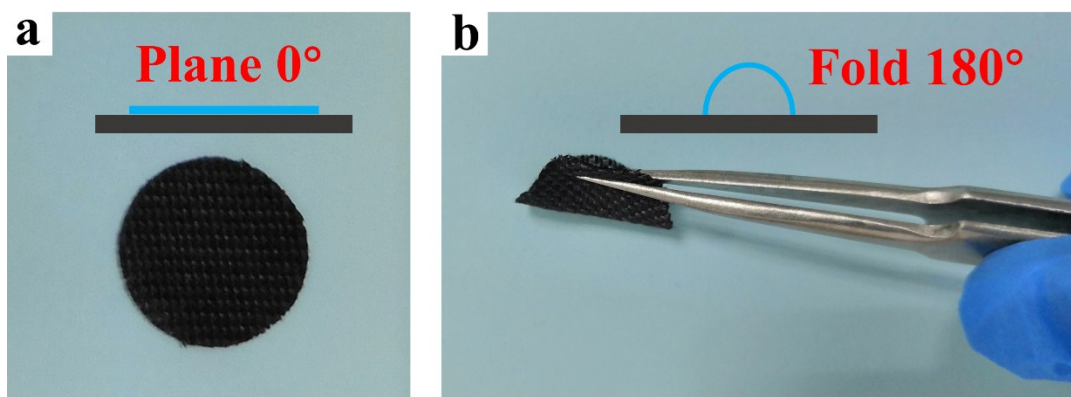
## Supporting Information

### **3D Free-Standing Co doped Ni<sub>2</sub>P Nanowires Oxygen Electrode for Stable and Long-Life Lithium-Oxygen Battery**

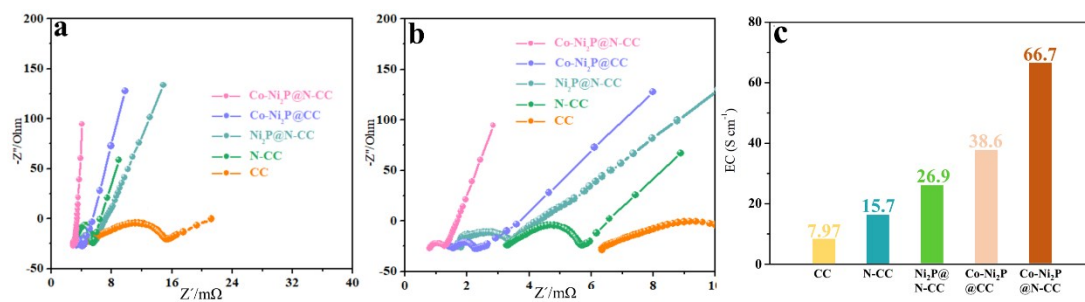
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*Zhiqun Ran, Jianping Long\**

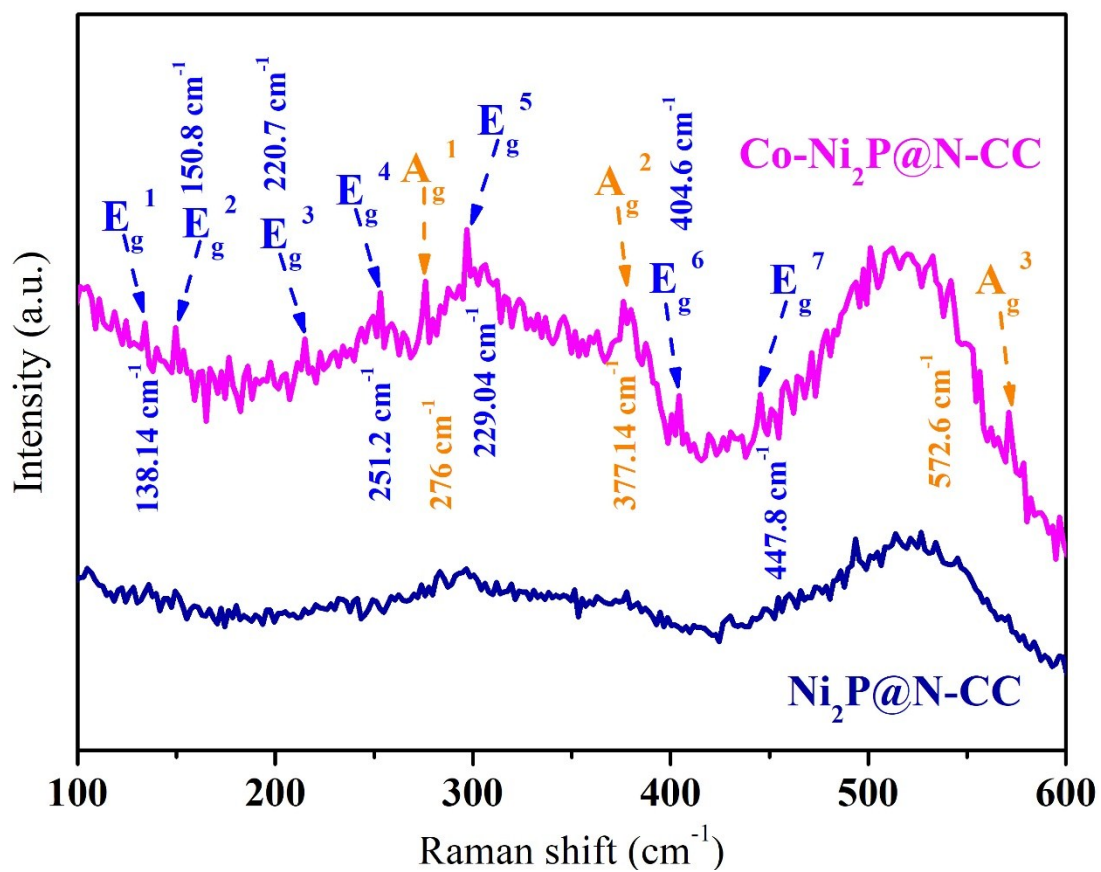
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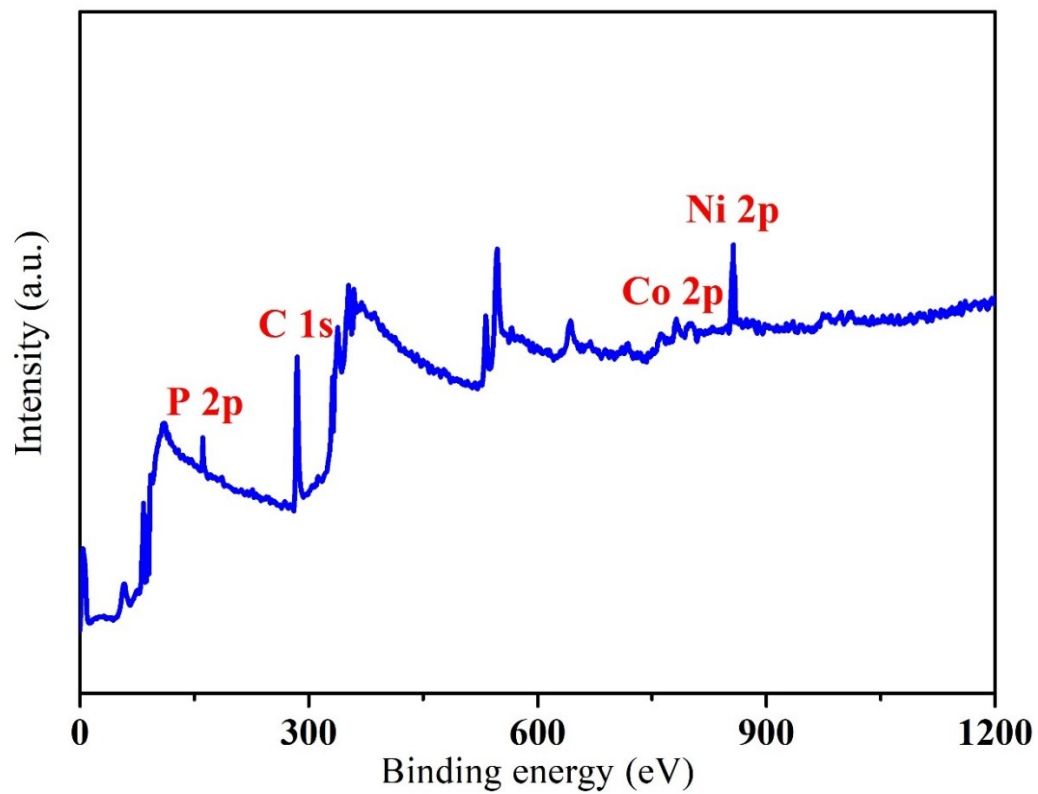
**Figure S1.** Digital photos of the Co-Ni<sub>2</sub>P@N-CC cathode without bend (a) and (b) twisting the electrode to 180°.



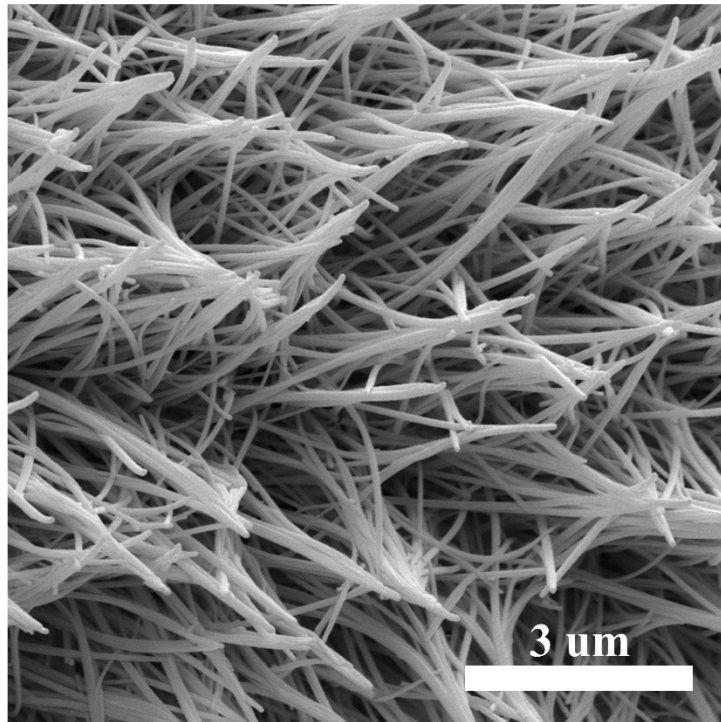
**Figure S2.** (a) Electrochemical impedance spectroscopy (EIS) of the Li-O<sub>2</sub> cells based on five electrodes; (b) is the magnified view of (a); (c) Electronic conductivity of five electrodes (CC, N-CC, Ni<sub>2</sub>P@N-CC, Co-Ni<sub>2</sub>P@CC, and Co-Ni<sub>2</sub>P@N-CC).



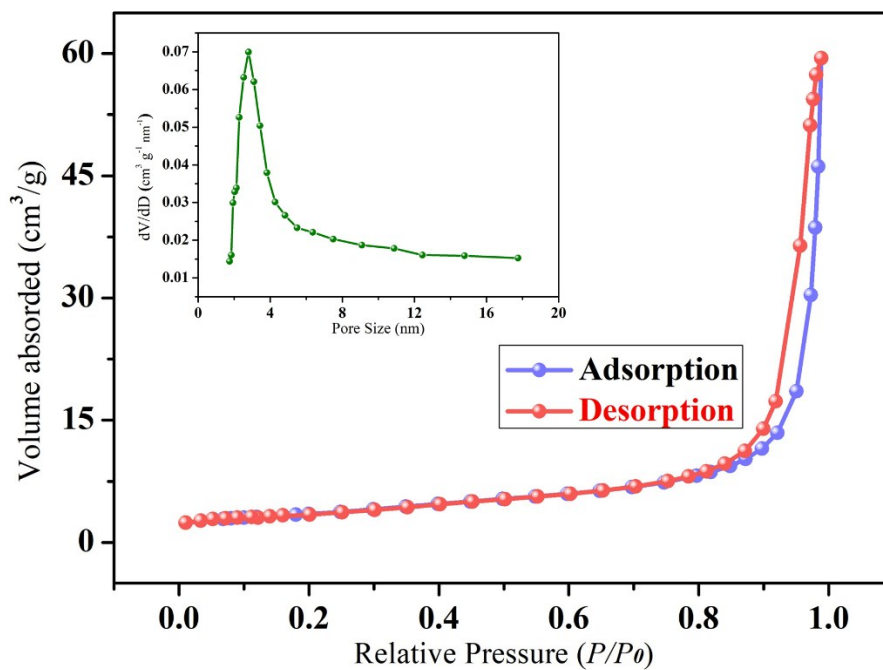
**Figure S3.** Raman spectrums of the as-prepared Co-Ni<sub>2</sub>P@N-CC and Ni<sub>2</sub>P@N-CC.



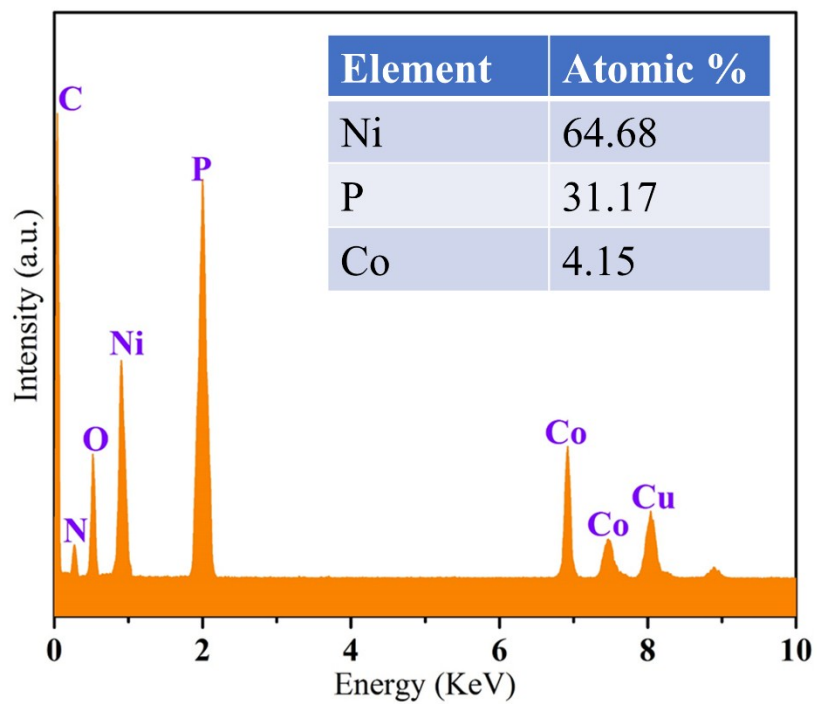
**Figure S4.** XPS survey spectrum of Co-Ni<sub>2</sub>P@N-CC.



**Figure S5.** FESEM image of Co-Ni<sub>2</sub>P@N-CC.

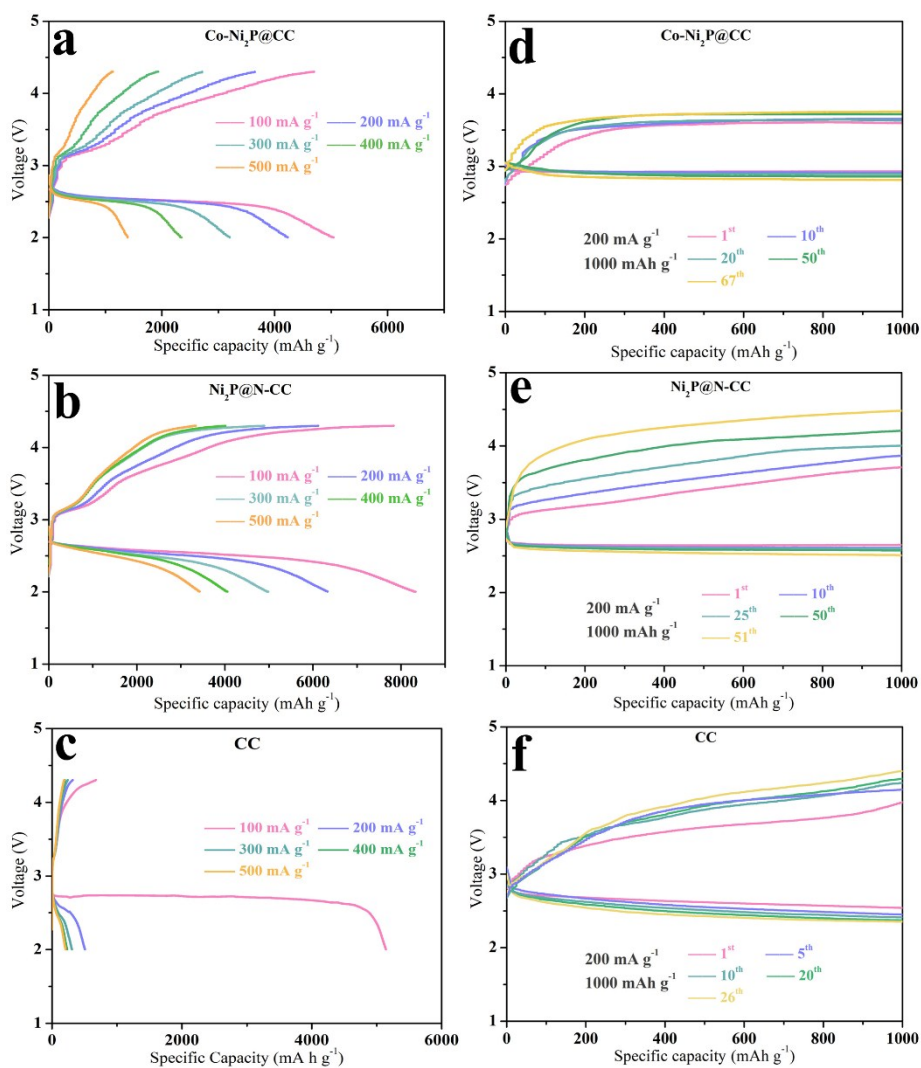


**Figure S6.** N<sub>2</sub> adsorption-desorption isotherms of the Co-Ni<sub>2</sub>P@N-CC and the corresponding pore size distribution (illustration).

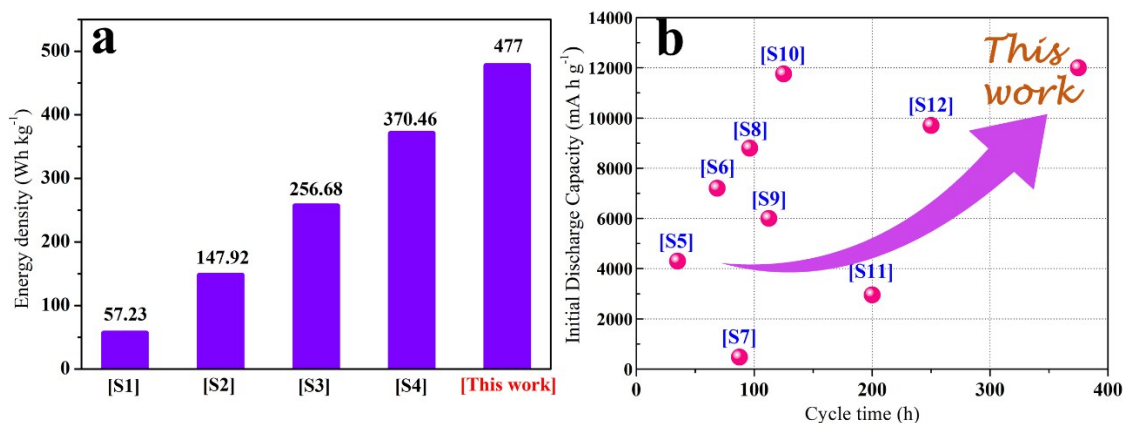


**Figure S7.** TEM-EDX of Co-Ni<sub>2</sub>P@N-CC.





**Figure S8.** the rate performance of Li-O<sub>2</sub> cells based on (a) Co-Ni<sub>2</sub>P@CC, (b) Ni<sub>2</sub>P@N-CC and (c) CC electrodes at various current density; the discharge/charge curves of Li-O<sub>2</sub> batteries with (d) Co-Ni<sub>2</sub>P@CC, (e) Ni<sub>2</sub>P@N-CC and (f) CC electrodes at a current density of 200 mA g<sup>-1</sup> with a restricted capacity of 1000 mA h g<sup>-1</sup>.



**Figure S9.** (a) comparing energy density of Co-Ni<sub>2</sub>P@N-CC electrode here with that of Li-ion battery, Zn-air battery, Li-S battery, as well as other Li-O<sub>2</sub> systems; (b) performance comparison of pouch-type Li-O<sub>2</sub> battery based on Co-Ni<sub>2</sub>P@N-CC electrode and other flexible batteries.

## Reference

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