

Supporting Information

Promoted oxygen reduction performance enabled by Co/Cu nanoparticles encapsulated in carbon nanotubes for long-term flexible and rechargeable Zn-air batteries

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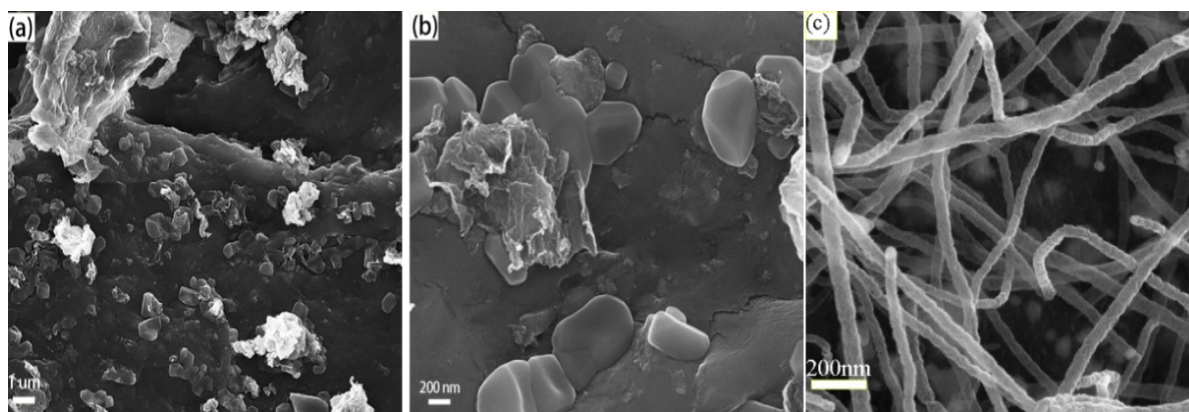


Figure S1. (a,b) SEM images of Cu/NC, (c) SEM images of Co@NC

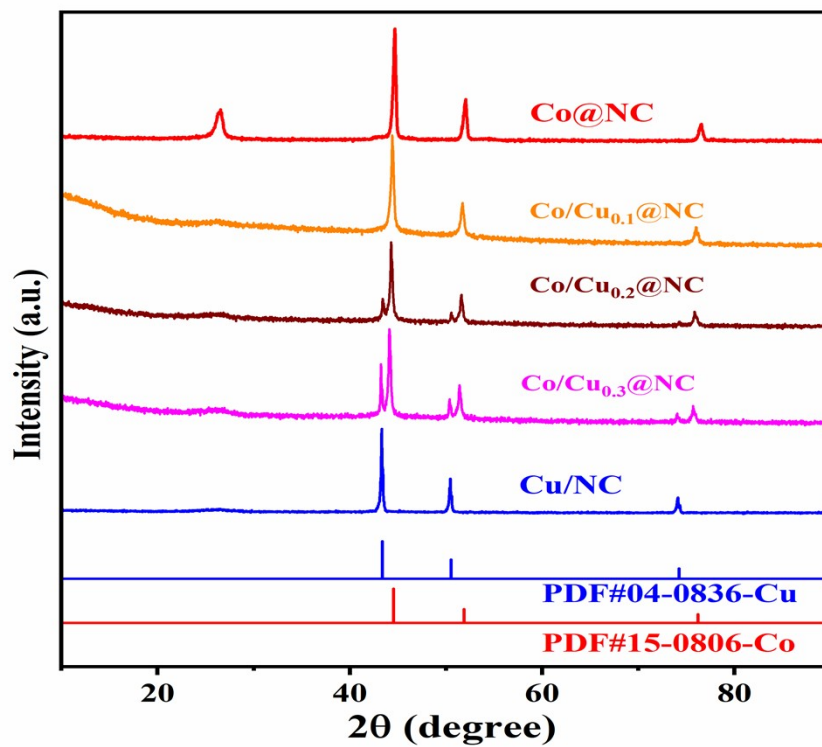


Figure S2. XRD patterns of the Co@NC, Co/Cu_{0.1}@NC, Co/Cu_{0.2}@NC, Co/Cu_{0.3}@NC and Cu/NC catalysts.

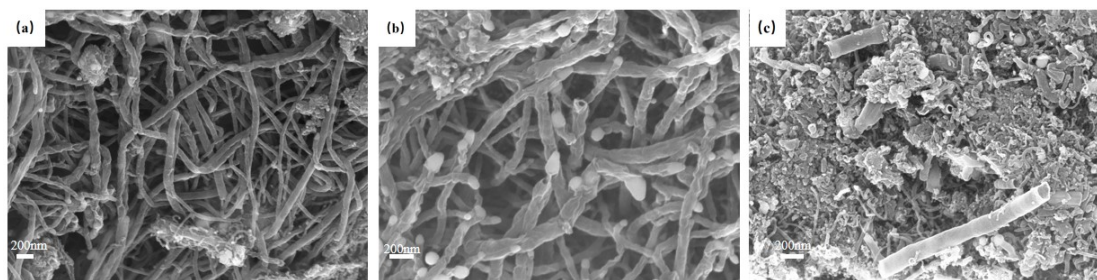


Figure S3.(a) SEM images of Co/Cu_{0.1}@NC (b) SEM images of Co/Cu_{0.2}@NC (c) SEM images of Co/Cu_{0.3}@NC.

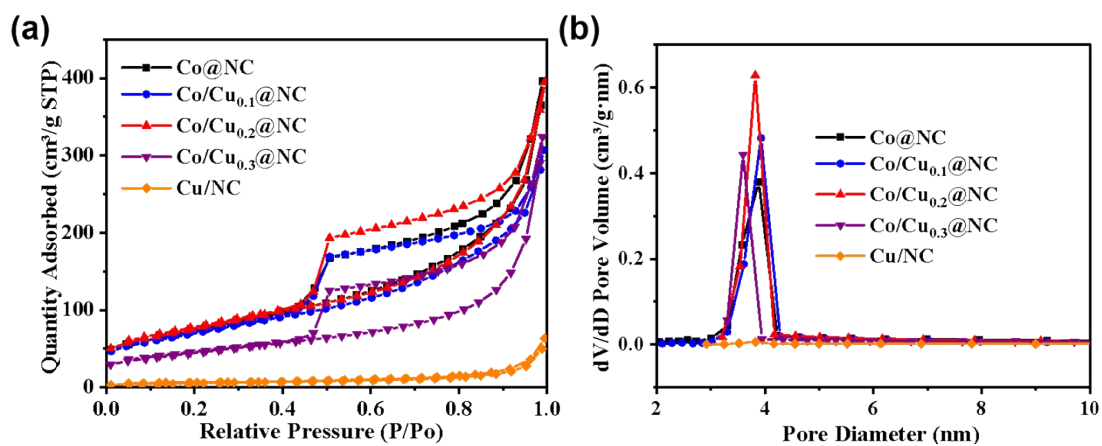


Figure S4.(a) N_2 absorption–desorption isotherms and (b) pore size distribution curves of Co@NC, Co/Cu_{0.1}@NC, Co/Cu_{0.2}@NC, Co/Cu_{0.3}@NC, and Cu/NC.

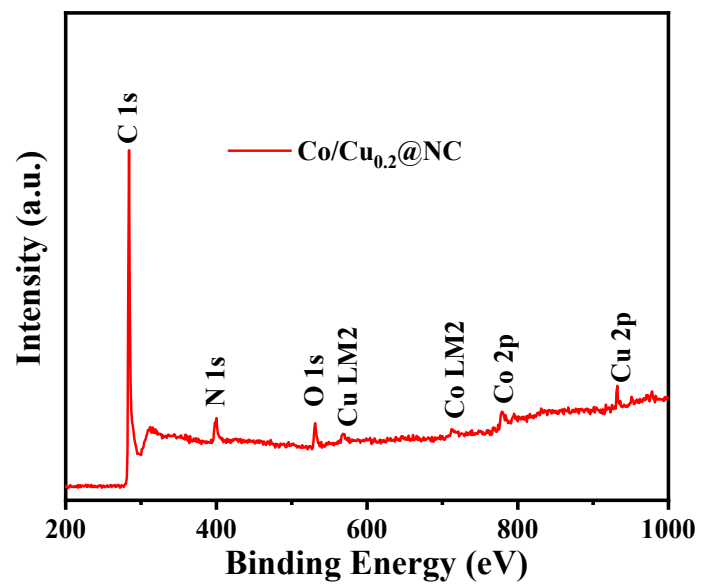


Figure S5. Full XPS survey for Co/Cu_{0.2}@NC

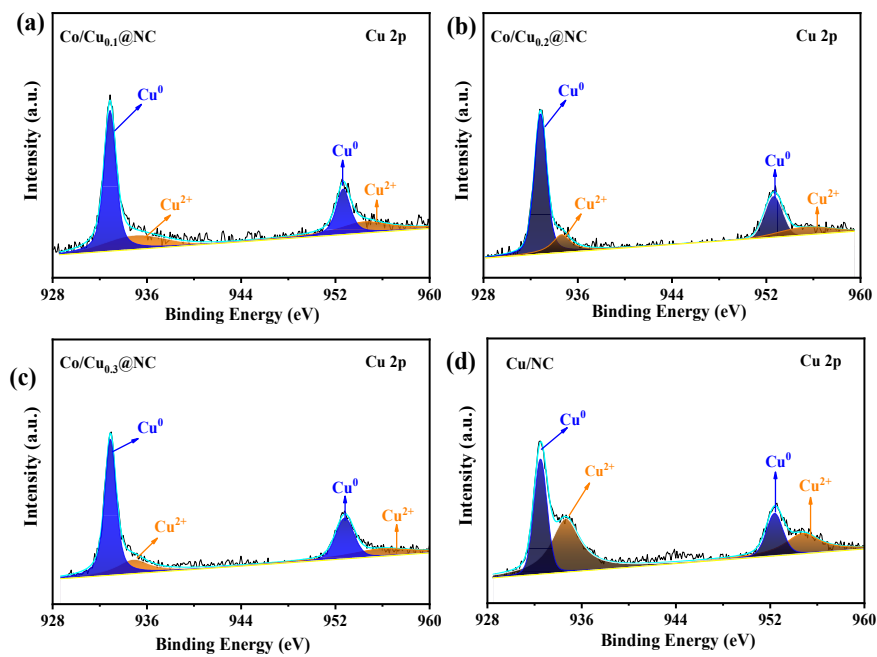


Figure S6. (a) XPS survey spectra of Co/Cu_{0.1}@NC catalysts High-resolution spectras of Cu 2p, (b) Co/Cu_{0.2}@NC, (c) Co/Cu_{0.3}@NC, (d)Cu/NC.

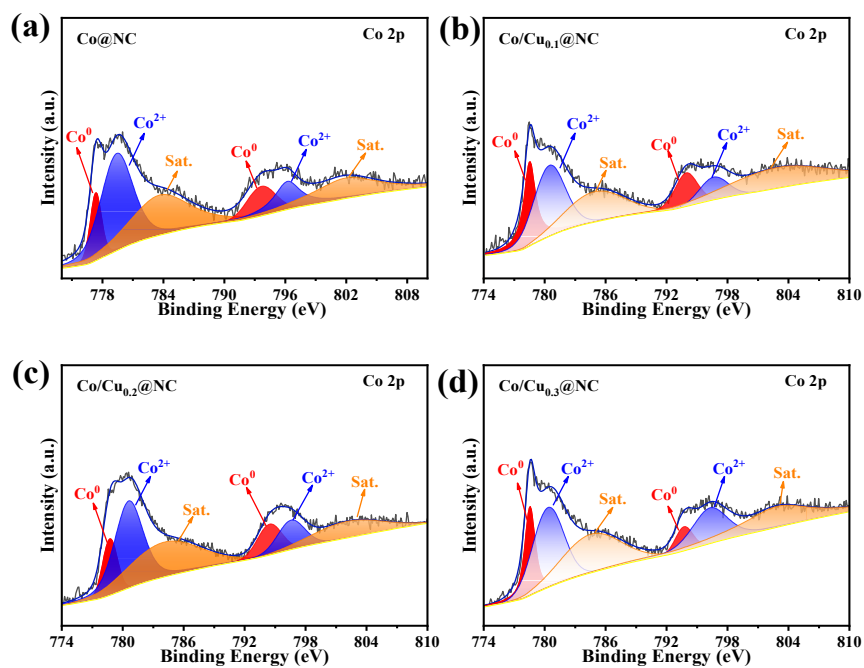


Figure S7. (a) XPS survey spectra of Co@NC catalysts High-resolution spectras of Co 2p, (b) $\text{Co/Cu}_{0.1}\text{@NC}$, (c) $\text{Co/Cu}_{0.2}\text{@NC}$, (d) $\text{Co/Cu}_{0.3}\text{@NC}$.

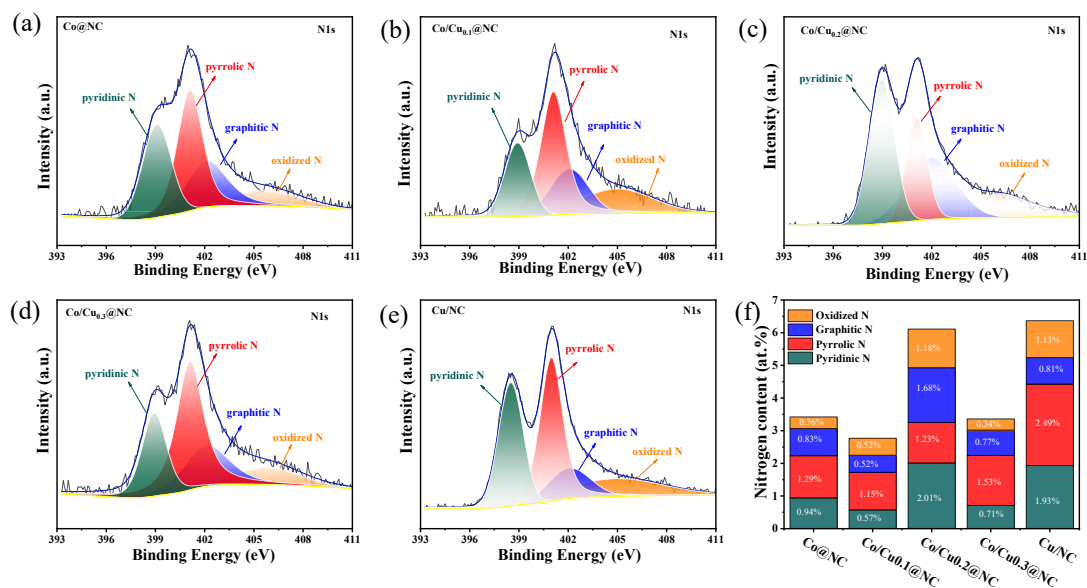


Figure S8. (a) XPS survey spectra of Co@NC catalysts high-resolution spectra of N 1s (b)Co/Cu_{0.1}@NC, (c) Co/Cu_{0.2}@NC, (d) Co/Cu_{0.3}@NC, (e)Cu/NC. (f) The contents of N species of Co@NC, Co/Cu_{0.1}@NC, Co/Cu_{0.2}@NC, Co/Cu_{0.3}@NC and Cu/NC.

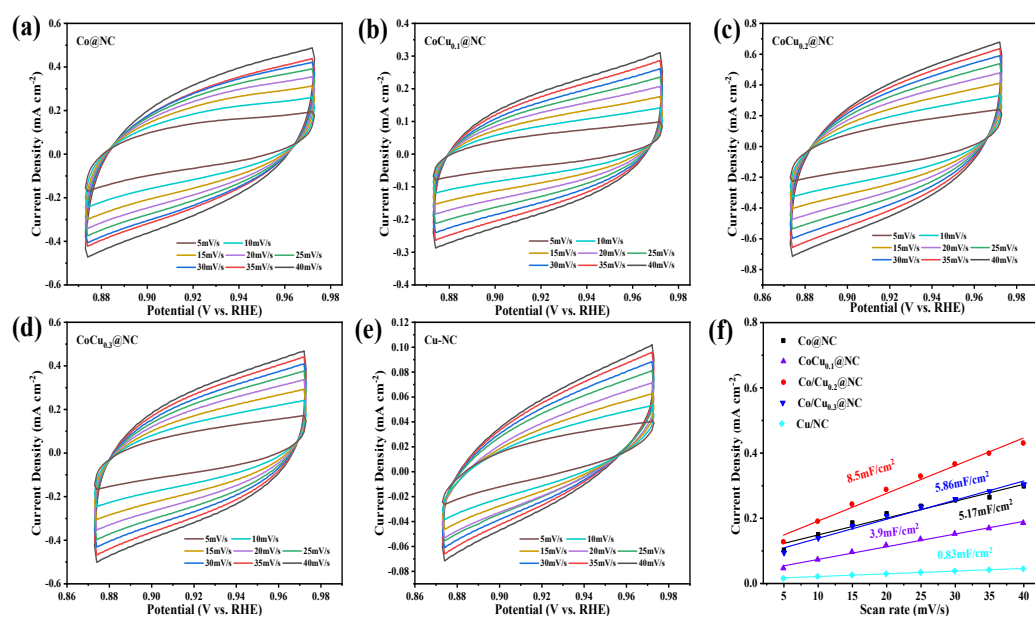


Figure S9. (a-e) Capacitive CV curves of Co@NC, Co/Cu_{0.1}@NC, Co/Cu_{0.2}@NC, Co/Cu_{0.3}@NC and Cu/NC, respectively, recorded with different scan rates in the non-Faradaic region.(f) Their Cdll values are given in the figure.

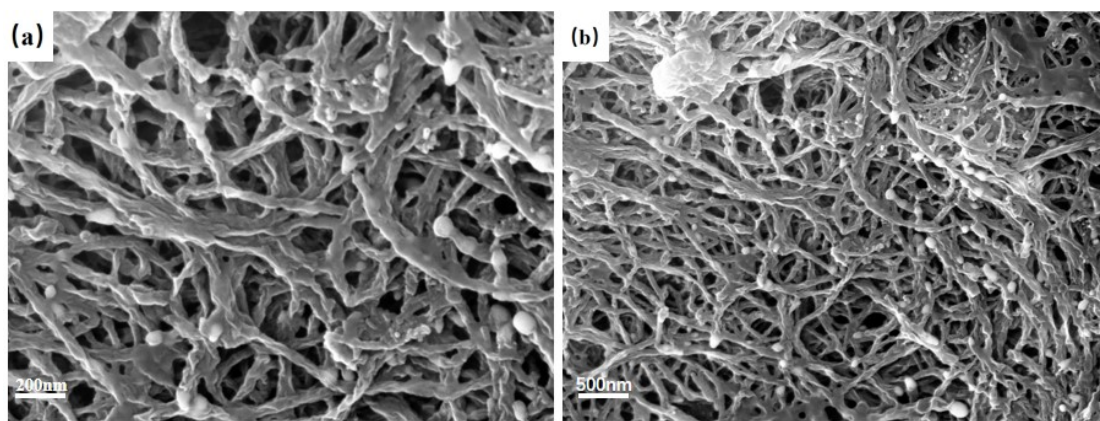


Figure S10. SEM image of Co/Cu_{0.2}@NC after OER stability testing.

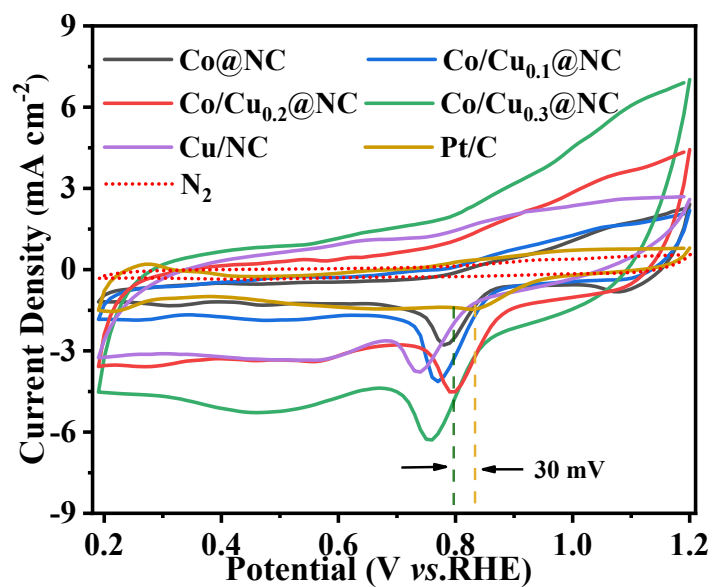


Figure S11. CV curves of Co@NC, Co/Cu_{0.1}@NC, Co/Cu_{0.2}@NC, Co/Cu_{0.3}@NC, Cu/NC and Pt/C in N₂- (the dashed curves) and O₂-saturated (the solid curves) 0.1 M KOH.

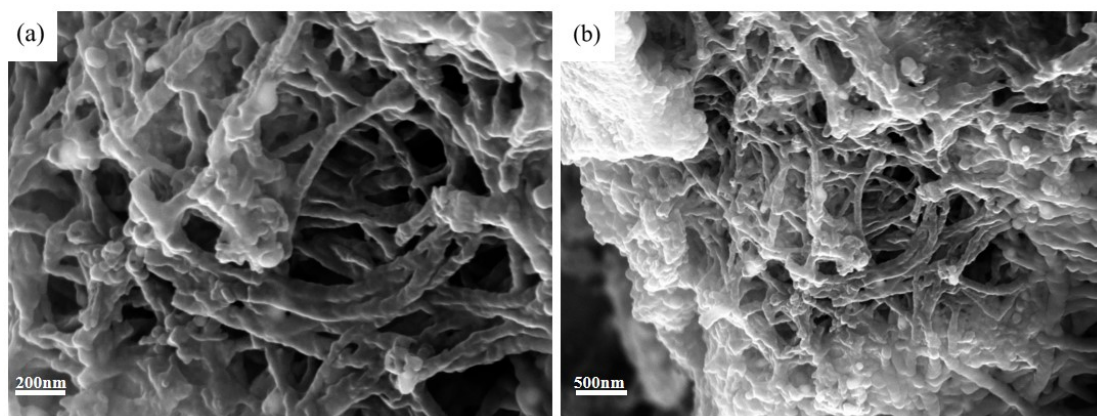


Figure S12. SEM image of Co/Cu_{0.2}@NC after ORR stability testing.

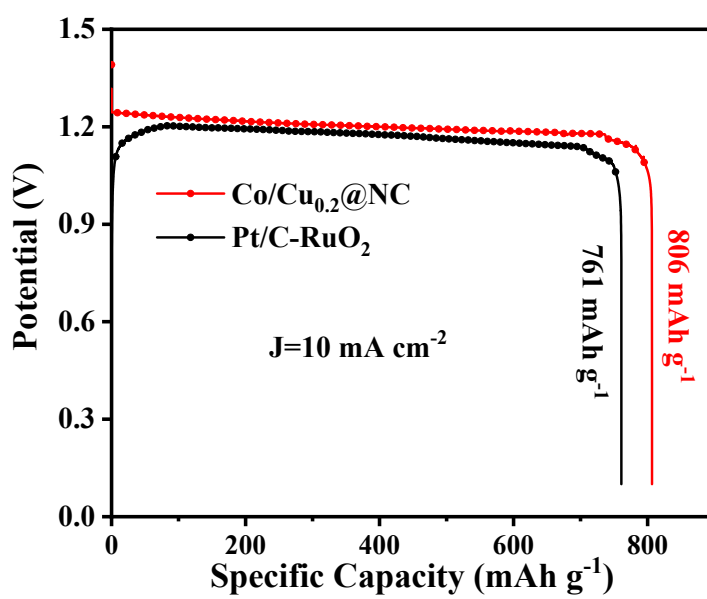


Figure S13. Constant current discharge curves at 10 mA cm⁻²