

Supporting Information for

**Hollow Waxberry-Like Cobalt-Nickel Oxide/S, N-Codoped Carbon
Nanospheres as Trifunctional Electrocatalyst for OER, ORR, and HER**

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Figure Captions:

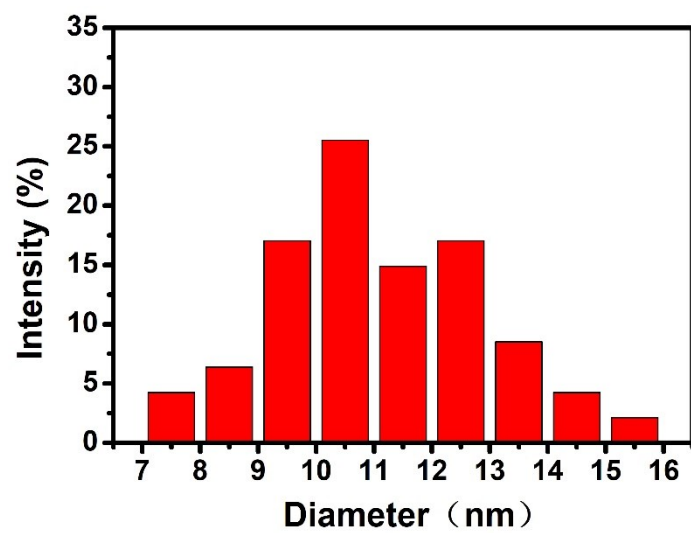


Figure S1. particle size distribution image of the Co-Ni glycerate surface nanoparticles.

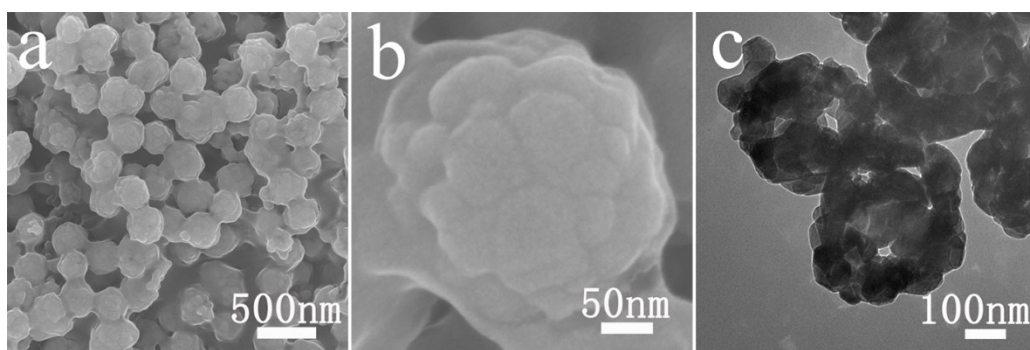


Figure S2. SEM (a,b) and TEM (c) image of the CoNiO_x/NC nanocomposites.

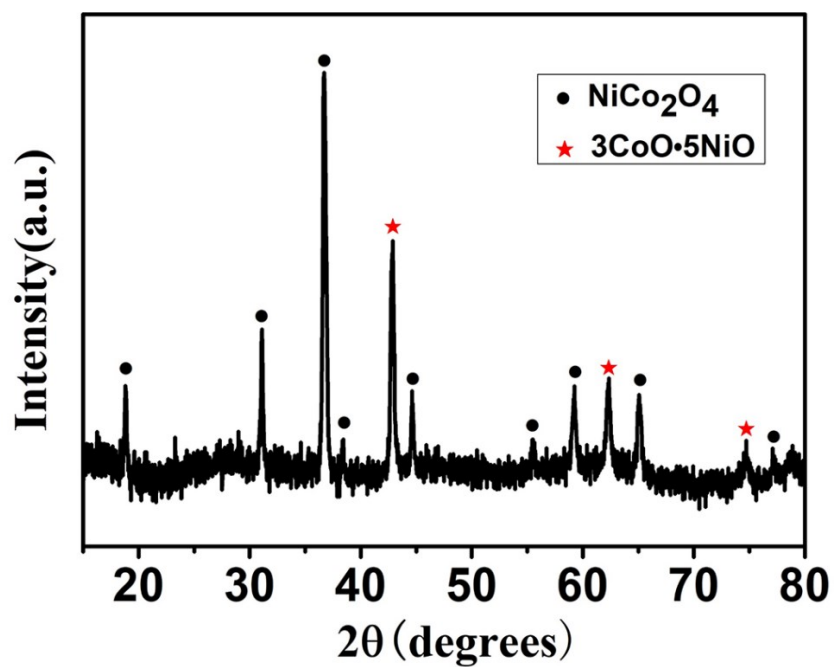


Figure S3. XRD image of the CoNiO_x/NC nanocomposites.

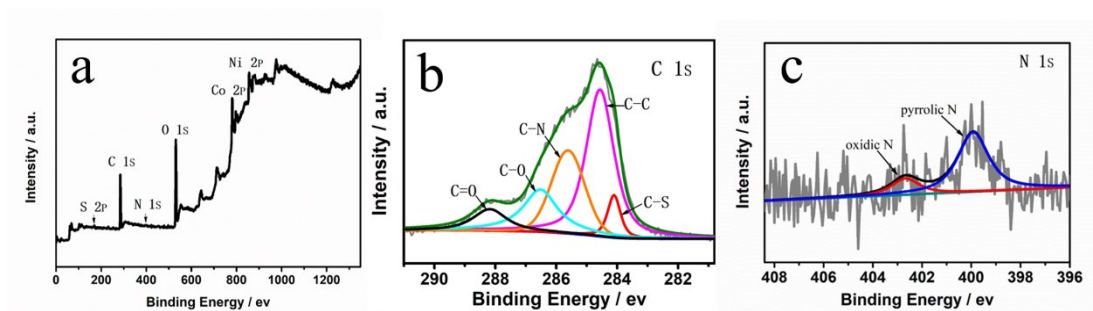


Figure S4. XPS survey-level scan(a) and High resolution XPS spectras of element C (b), N (c) of CoNiO₂/SNC nanocomposites.

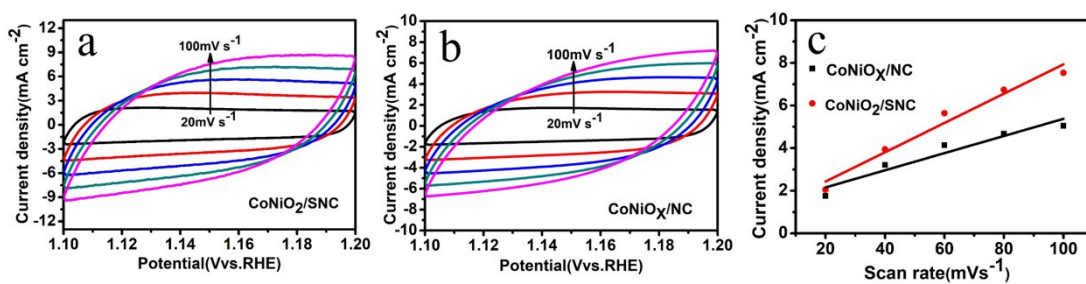


Figure S5. CV curves and plots of the current density of the CoNiO₂/SNC and CoNiO_x/NC. CV curves of (a) the CoNiO₂/SNC and (b) CoNiO_x/NC in N₂-saturated 1 M KOH electrolyte at different scan rates. (c) Plots of current density as a function of scan rates for the CoNiO₂/SNC and CoNiO_x/NC.

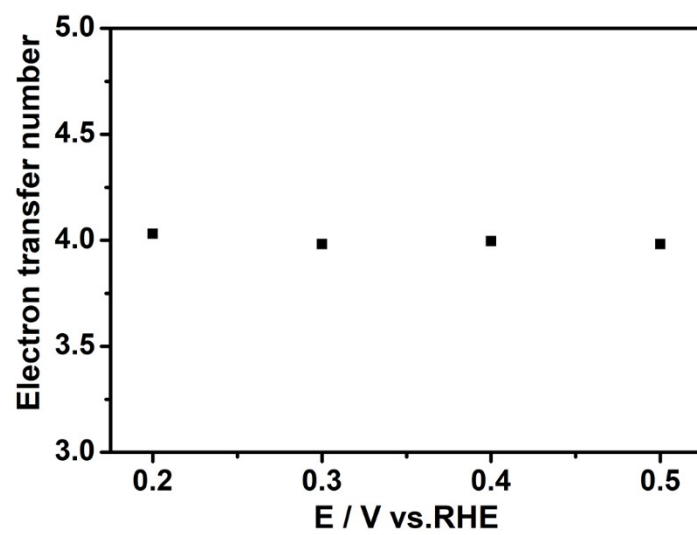


Figure S6. Electron transfer number at different potentials of CoNiO₂/SNC nanocomposites.

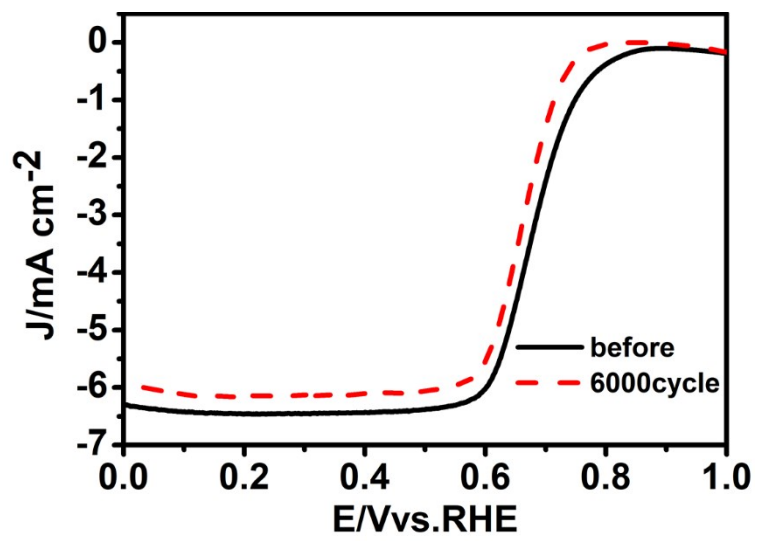


Figure S7. ORR stability test curves of the CoNiO₂/SNC nanocomposites catalyst at

1600 rpm.

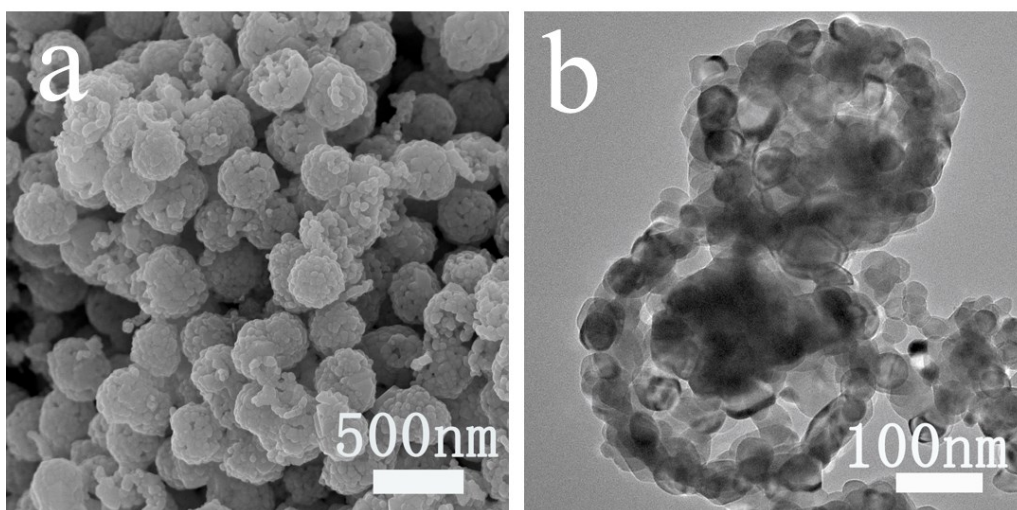


Figure S8. SEM(a) images, TEM(b) images of the $\text{CoNiO}_2/\text{SNC}$ nanocomposites catalyst after 1000 cycles.

Table S1.

OER performance comparisons of some non-precious metal electrodes.

Catalyst	Electrolyte	Loading (mg/cm ²)	Overpotential at 10 mA /cm ² (Vvs.RHE)	References
CoNiO ₂ /SNC nanocomposites	0.1M KOH	0.8	381	This work
Fe ₃ O ₄ @CoO Nanocrystals	0.1M KOH	0.31	390	1
PPy/FeTCPP/Co catalyst	0.1M KOH	0.3	380	2
Defect Graphene	0.1M KOH	0.08	370	3
Co ₃ O ₄ /mildly oxidized MCNT	0.1M KOH	—	390	4
CoNiO ₂ /SNC nanocomposites	1M KOH	0.8	280	This work
PPy/FeTCPP/Co catalyst	1M KOH	0.3	340	2
Defect Graphene	1M KOH	0.283	340	3
Ni-N-O porous interface nanoparticles	1M KOH	—	300	5
NiS ₂ /CoS ₂ -O Nanowires	1M KOH	0.2	235	6

REFERENCES

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