Enhanced Nitrate Reduction Performance of Cu-Doped Nanoporous Co_2P Electrocatalyst

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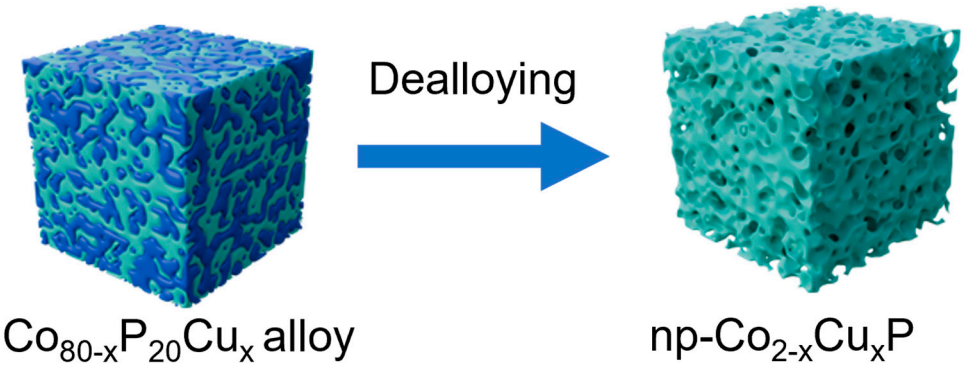


Figure. S1. Sample preparation diagram

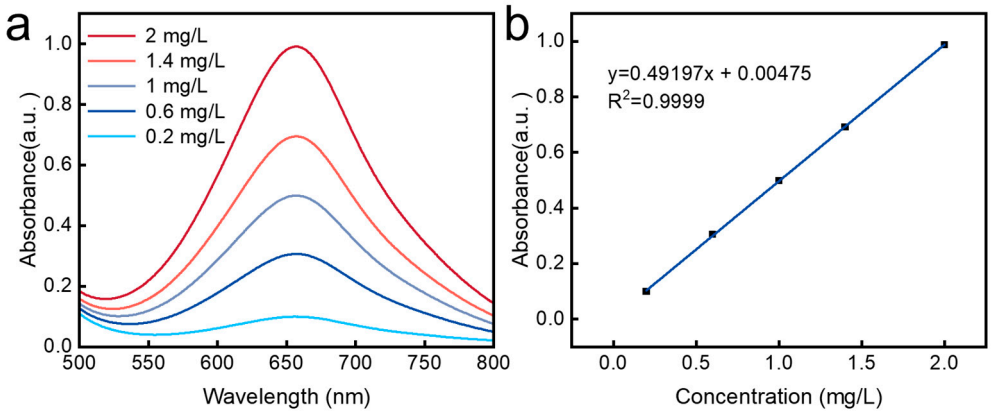


Figure. S2. (a) UV-Vis absorption curves of standard samples and (b) corresponding NH_4^+ calibration curve.

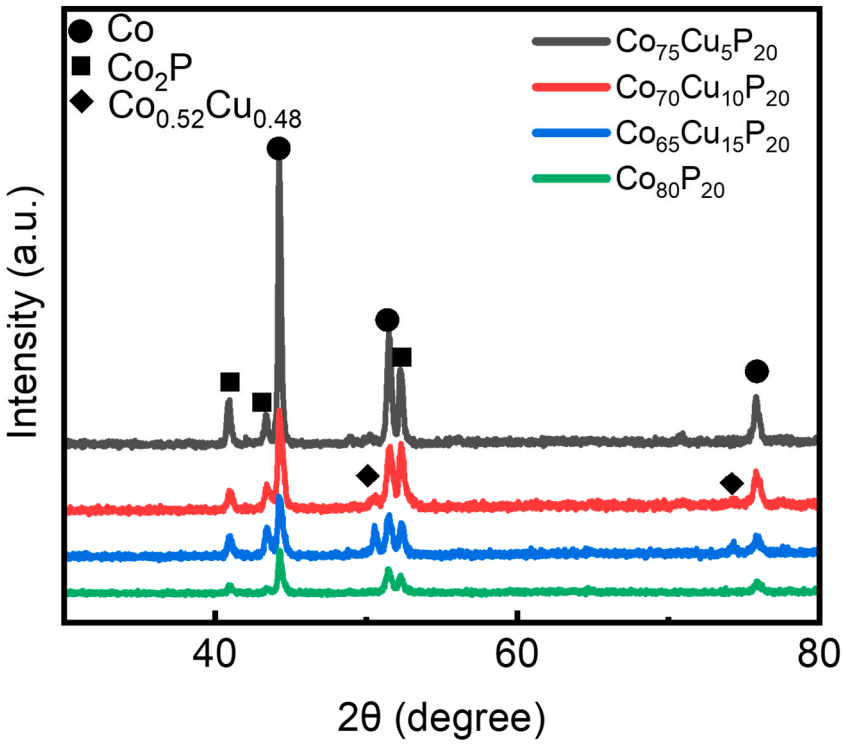


Figure. S3. XRD patterns of alloys with different Cu contents

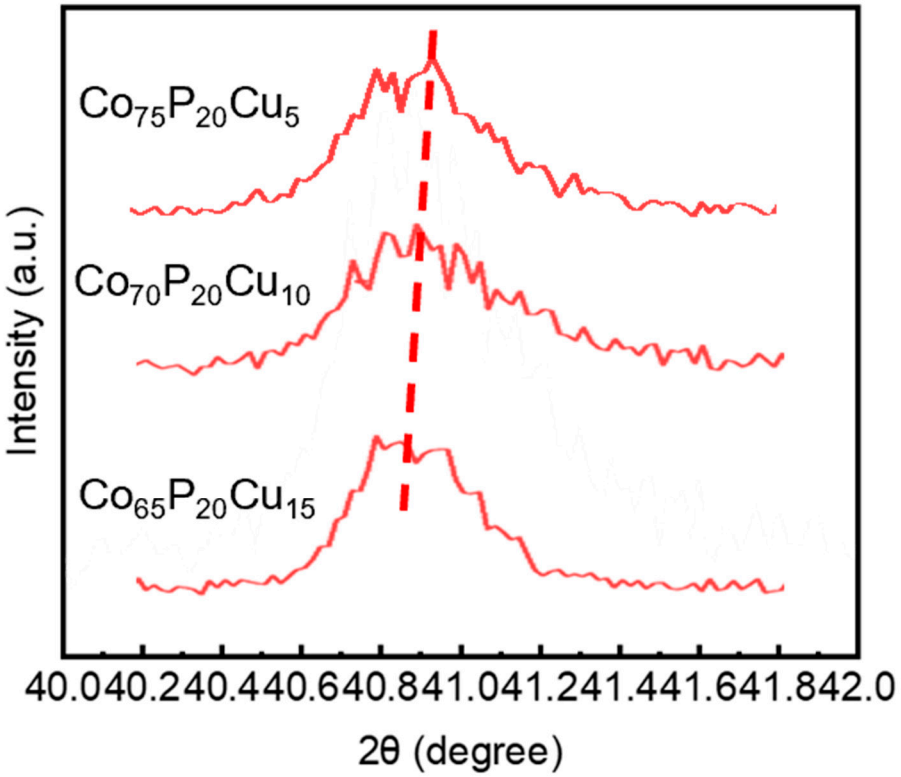


Figure. S4. XRD patterns focusing on the (201) plane of Co_2P

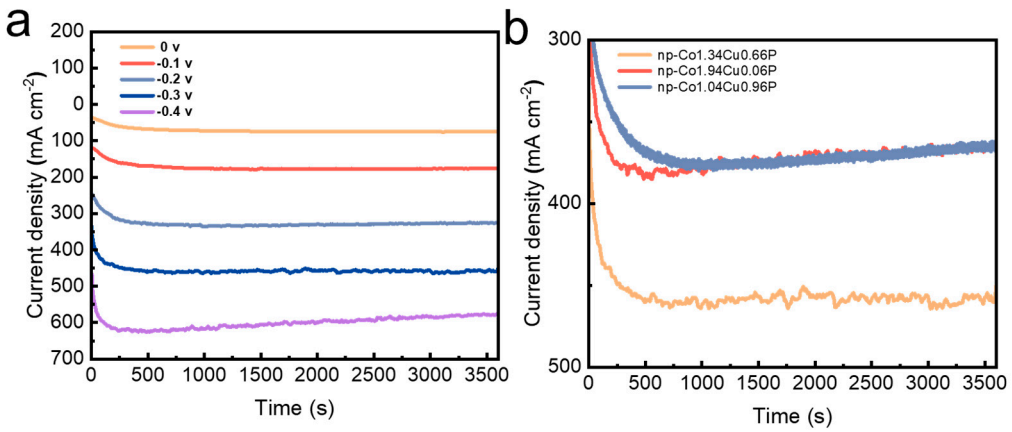


Figure. S5. (a) Time-current curve of np-$Co_{1.34}Cu_{0.66}P$ at different potentials during electrochemical nitrate reduction. (b) Time-current curve of np-$Co_{2-x}Cu_xP$ at -0.3 V

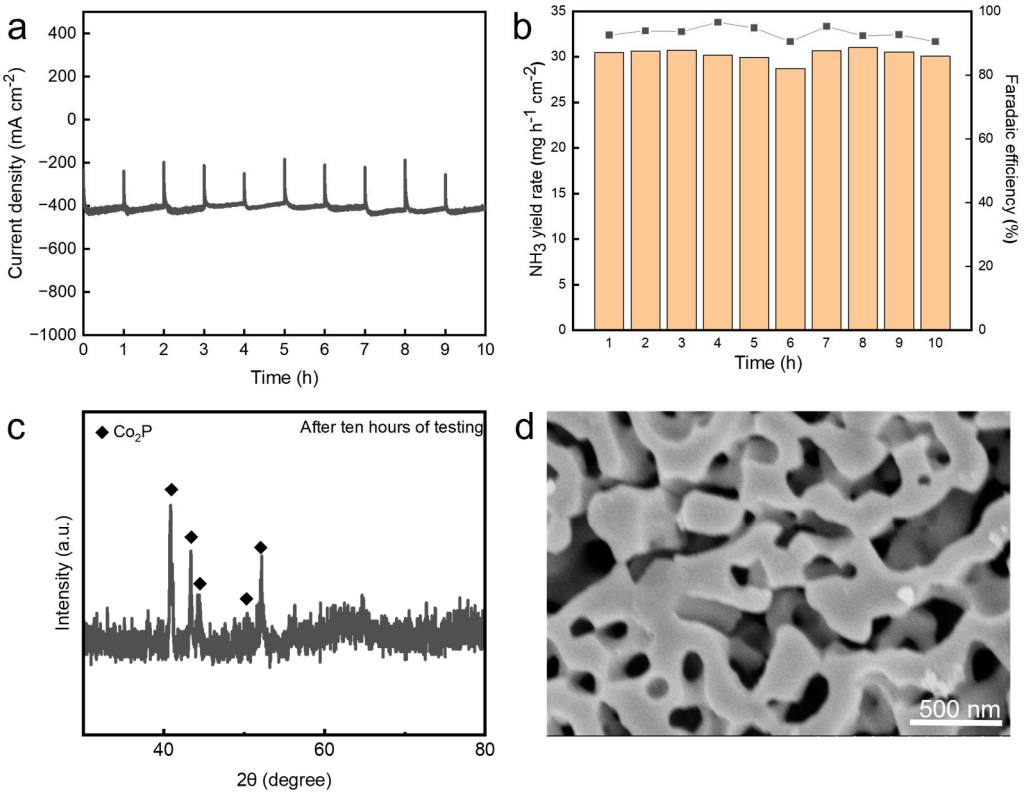


Figure. S6. (a) i-t curves of np-$Co_{1.34}Cu_{0.66}P$ for 10 h electrolysis; (b) Corresponding Faradaic efficiency and NH_3 yield of np-$Co_{1.34}Cu_{0.66}P$ over 10 h; (c) XRD pattern of np-$Co_{1.34}Cu_{0.66}P$ after stability test; (d) SEM image of np-$Co_{1.34}Cu_{0.66}P$ after 10 h electrolysis.

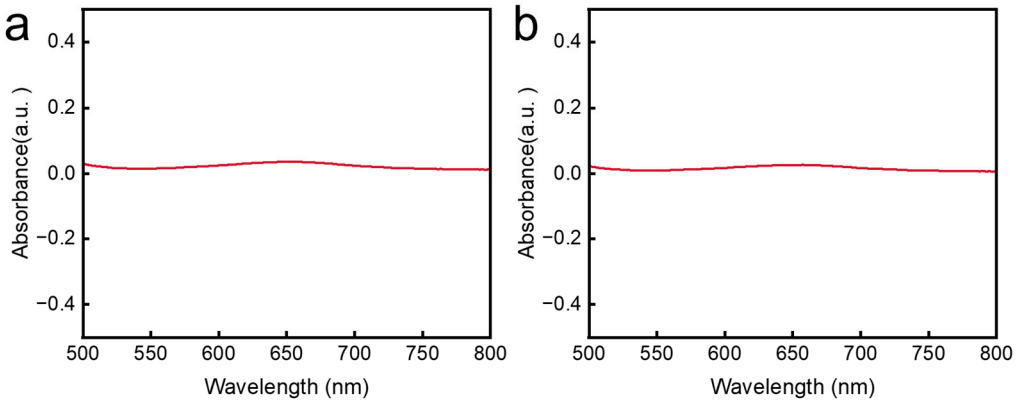


Figure. S7. (a) UV-Vis absorption curves without applied potential; (b) UV–Vis absorption curves without nitrate.

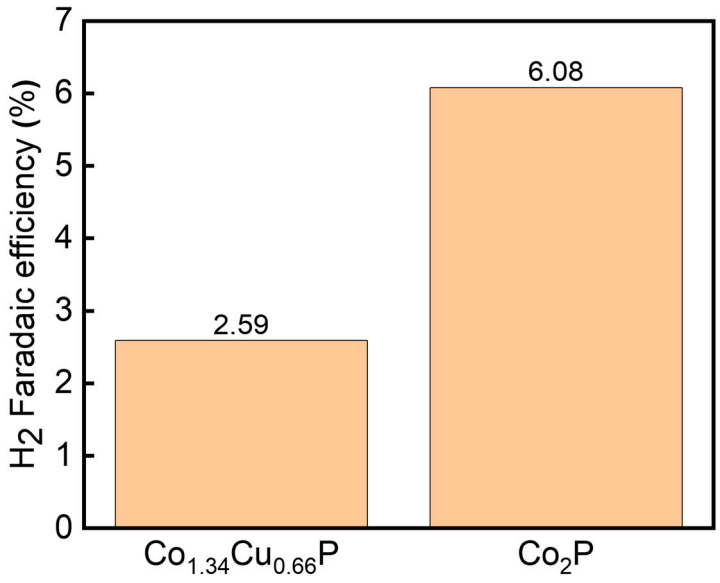


Figure. S8. Faradaic efficiency of H_2 evolution for np-$Co_{1.34}Cu_{0.66}P$ and Co_2P

Table S1 Mass of raw materials (Co, Co_2P, Cu) required to prepare 15 g of alloy with different Co:Cu:P atomic ratios.

Samples	Co (g)	Cu (g)	Co_2P (g)
$Co_{75}Cu_5P_{20}$ precursor alloy	5.79	0.89	8.31
$Co_{70}Cu_{10}P_{20}$ precursor alloy	4.95	1.81	8.24
$Co_{65}Cu_{15}P_{20}$ precursor alloy	4.10	2.73	8.17
$Co_{80}P_{20}$ precursor alloy	6.62	/	8.38

Table S2 Elemental composition of np-$Co_{2-x}Cu_xP$ measured by EDS.

Test Elements	Atomic percentage of np-$Co_{1.94}Cu_{0.06}P$	Atomic percentage of np-$Co_{1.34}Cu_{0.66}P$	Atomic percentage of np-$Co_{1.04}Cu_{0.96}P$
P	35.2 %	29.8 %	26.13 %
Cu	1.8 %	15.8 %	24.05 %
Co	63.0 %	54.4 %	49.82 %

Table S3 Elemental composition of Cu-Co-P samples measured by ICP.

Samples	Co (at %)	Cu (at %)	P (at %)
np-$Co_{1.94}Cu_{0.06}P$	66.0 %	1.6 %	32.4 %
np-$Co_{1.34}Cu_{0.66}P$	59.5 %	10.6 %	29.9 %
np-$Co_{1.04}Cu_{0.96}P$	54.3 %	19.0 %	26.7 %
np-Co_2P	66.9 %	/	33.1 %
$Co_{75}Cu_5P_{20}$ precursor alloy	75.8 %	5.2 %	19.1 %
$Co_{70}Cu_{10}P_{20}$ precursor alloy	71.8 %	10.5 %	17.7 %
$Co_{65}Cu_{15}P_{20}$ precursor alloy	67.7 %	14.5 %	17.8 %
$Co_{80}P_{20}$ precursor alloy	81.4 %	/	18.6 %

Table S4 Comparison table of Faradaic efficiency between np-$Co_{1.34}Cu_{0.66}P$ catalyst and reported catalysts.

Catalysts	NH_3 Faradaic efficiency (%)	Potential (V vs. RHE)	Ref.
np-$Co_{1.34}Cu_{0.66}P$	93.4	-0.3	This work
Cu/Cu_2O NWAs	81.2	-0.9	[1]
RuPdPtCu	79.8	-0.95	[2]
Co-CuOx	53.5	-1.13	[3]
Co/CoO NSAs	91.2	-1.1	[4]
Pd-NDs/Zr-MOF	58.1	-1.3	[5]
TiO_{2-x}	85	-1.3	[6]
Co-Fe/Fe_2O_3	85.2	-1.6	[7]
Cu-N-C SAC	84.7	-0.95	[8]
Fe_2Co-MOF	90.55	-1	[9]
Cu-Ni	88	-1.1	[10]
Cu@C	85.6	-0.9	[11]

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