

Supporting information

Atomically Embedded Ag via Electro-diffusion Boosts Oxygen Evolution of CoOOH Nanosheet Arrays

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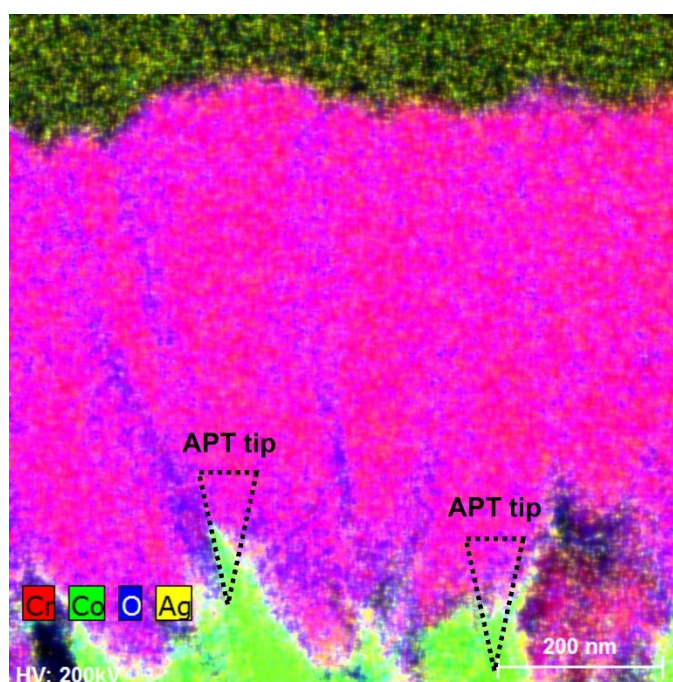


Figure S1. EDS map of cross-section of the Cr-coated Ag-doped CoOOH electrocatalysts: lift-off of APT tips are described as the dashed lines.

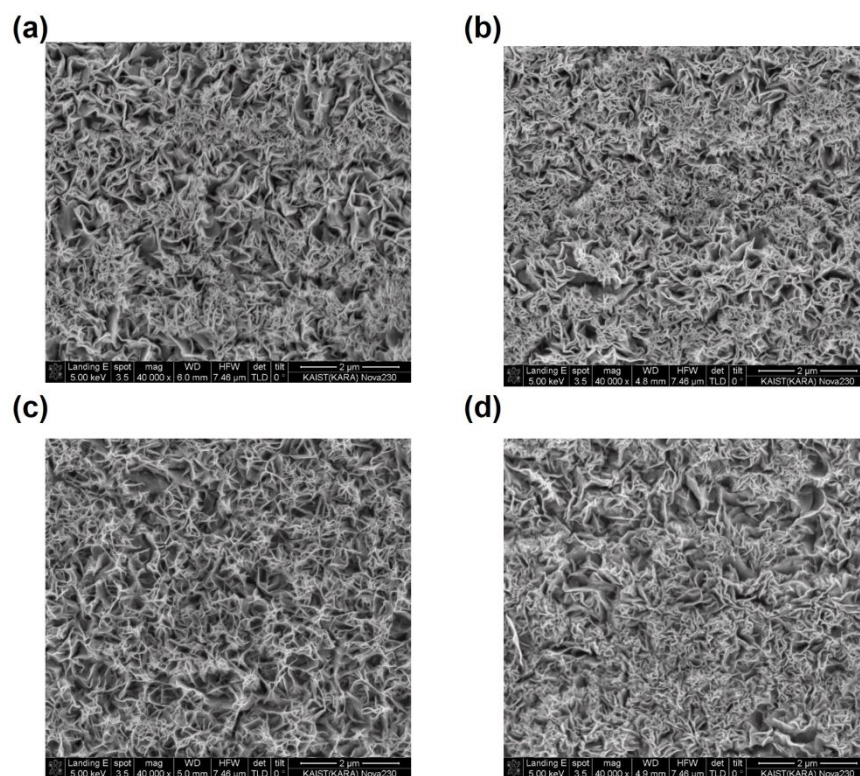


Figure S2. Surface morphologies of CoOOH on each metallic substrate: (a) Ag, (b) Au, (c) Cu, and (d) Ni.

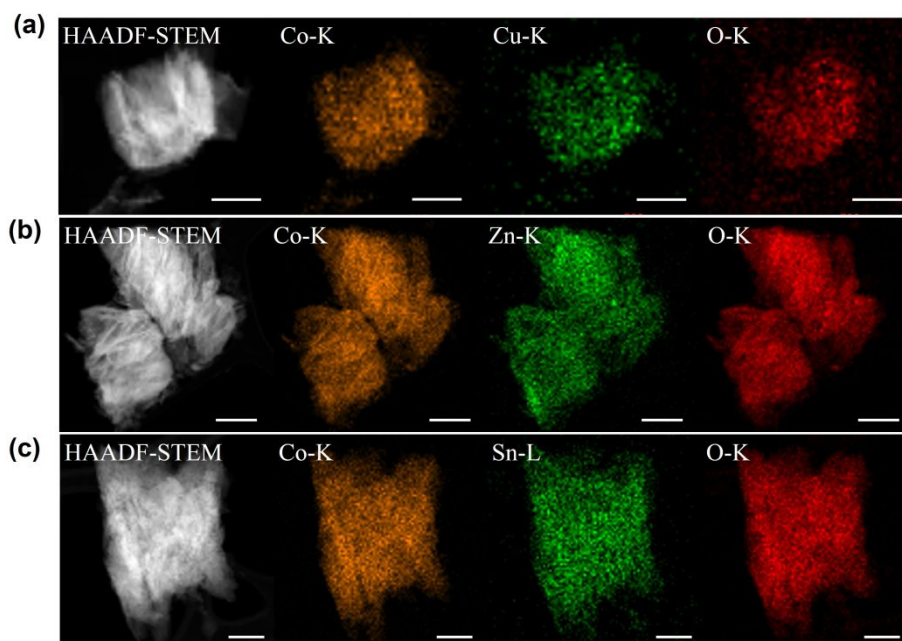


Figure S3. EDS elemental maps of exfoliated CoOOH on (a) Cu, (b) Zn, and (c) Sn substrates. Scale bars: (a) 300 nm, (b) 500 nm, and (c) 100 nm.

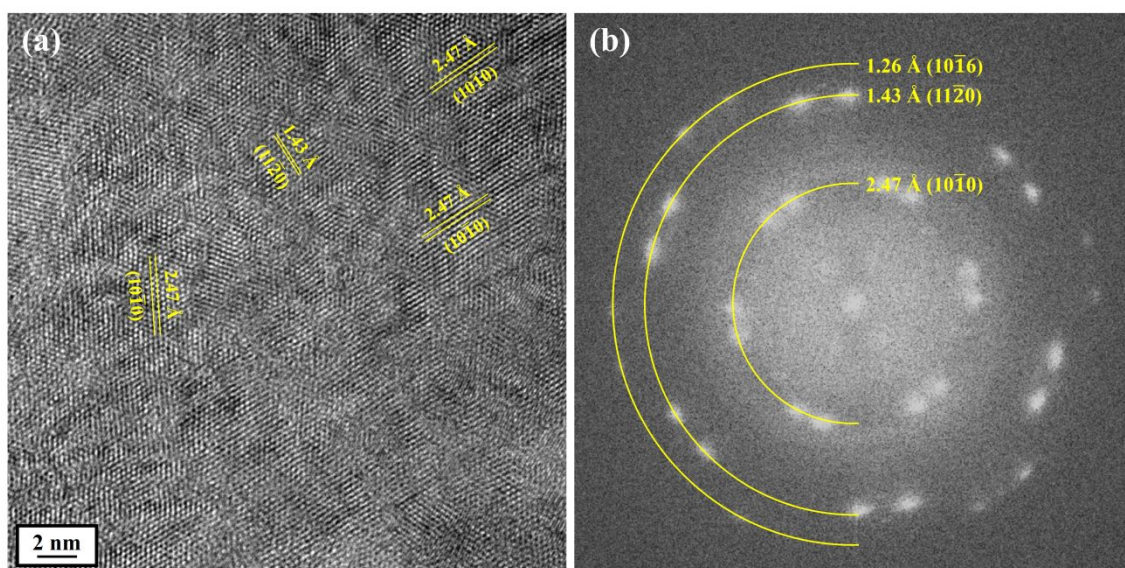


Figure S4. (a) HRTEM of Ag-doped CoOOH, and (b) its fast-Fourier transformed selected area electron diffraction pattern (FFT-SAED).

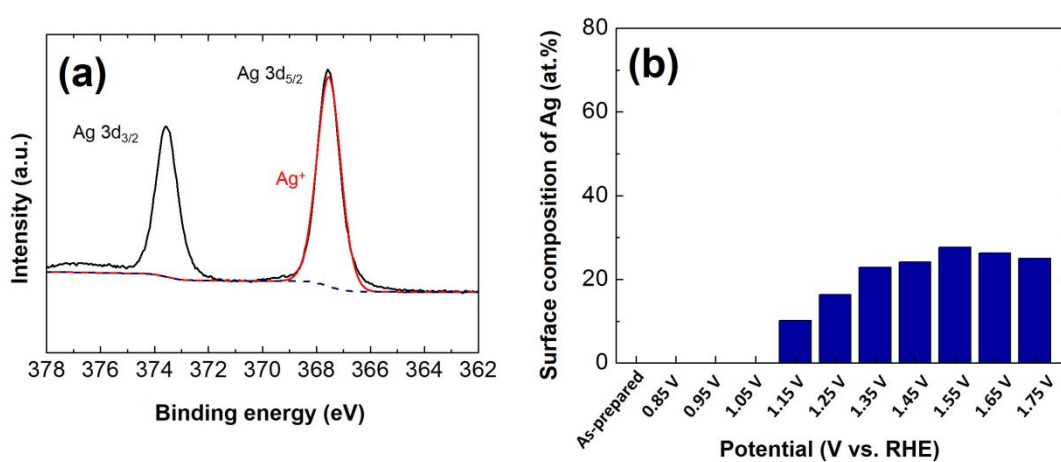


Figure S5. (a) XPS Ag 3d peak, and (b) Quantitative XPS analysis of Ag-doped CoOOH with applied voltages ranging from 0.85 V to 1.75 V (vs. RHE), indicating the surface composition at each voltage.

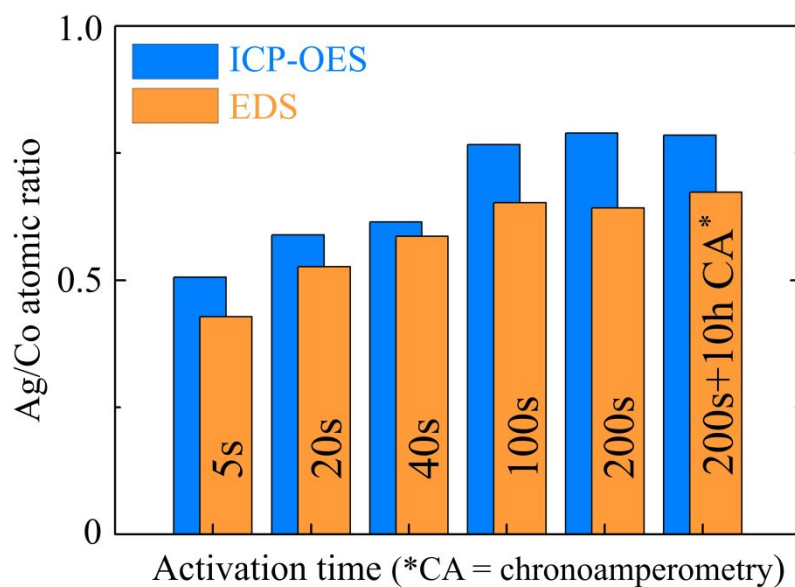


Figure S6. Compositional investigation of Ag diffusions at 1.4 V (vs. RHE) with EDS and ICP-OES compositional measurements; 10 h CA was conducted at the overpotential of 300 mV; the compositions were measured with exfoliated electrocatalysts using ultra-sonication for 30 min.

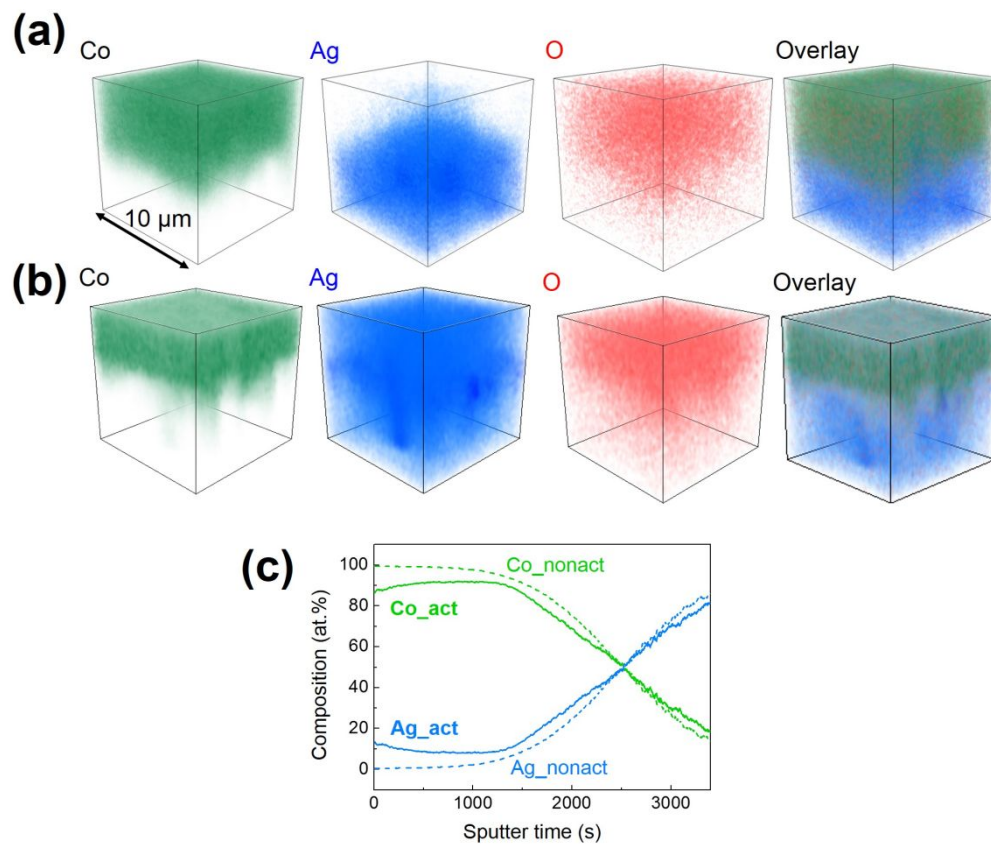


Figure S7. SIMS 3D rendering of each element and overlay for Ag-doped CoOOH: (a) before activation, and (b) after activation; (c) their depth profiling.

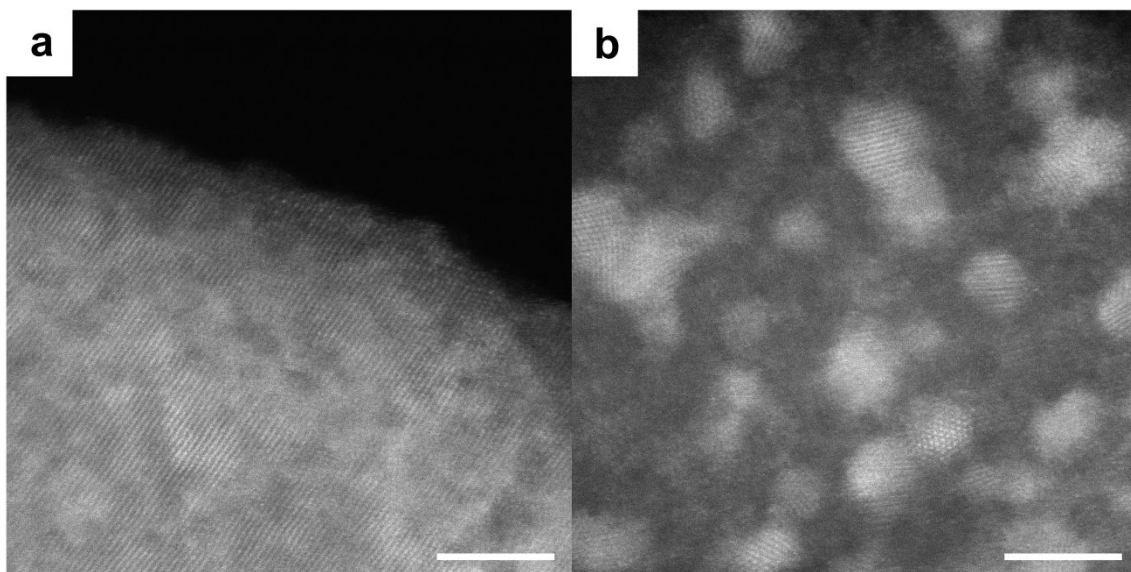


Figure S8. HADDF-STEM images of (a) Ag-doped CoOOH, and (b) Ag₂O/CoOOH after heat-treatment in 80°C for 10 h. Scale bars: (a) and (b) 5 nm.

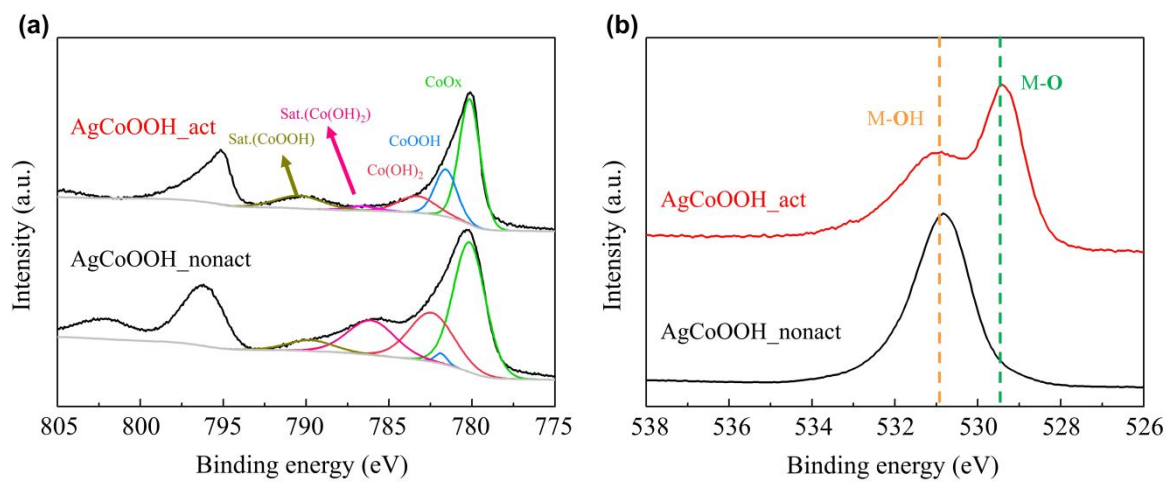


Figure S9. (a) XPS Co 2p peaks, and (b) O 1s peaks; for CoOOH on Ag before and after activation.

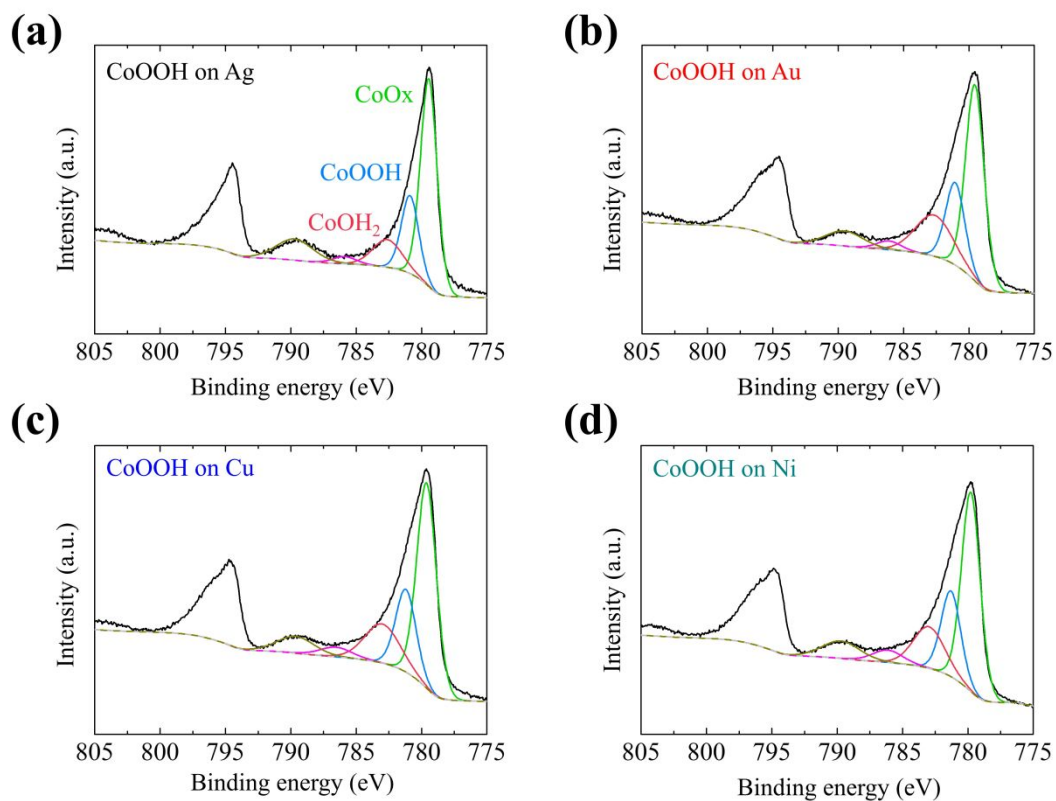


Figure S10. XPS Co 2p peaks for CoOOH on (a) Ag, (b) Au, (c) Cu, and (d) Ni, after the activation process.

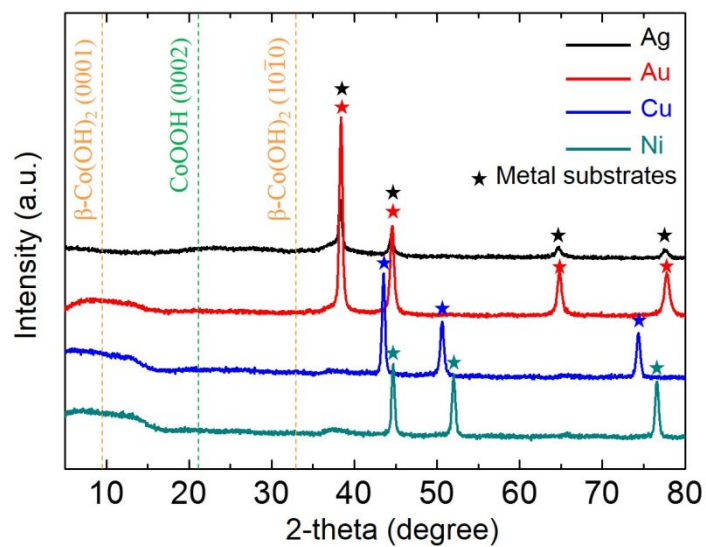


Figure S11. XRD analysis of CoOOH on Ag, Au, Cu, and Ni; ICDD No.00-051-1731 and No.01-072-2280 for $\text{Co}(\text{OH})_2$ and CoOOH, respectively.

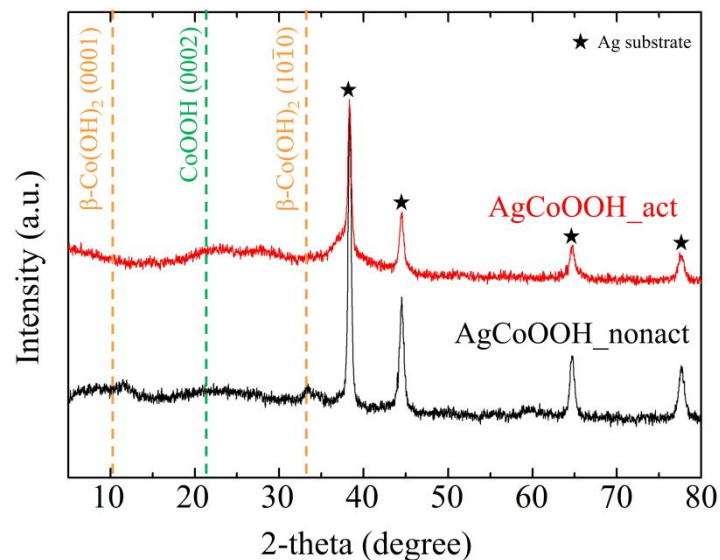


Figure S12. XRD analysis of Ag-doped CoOOH before and after activation; ICDD No.00-051-1731 and No.01-072-2280 for $\text{Co}(\text{OH})_2$ and CoOOH, respectively.

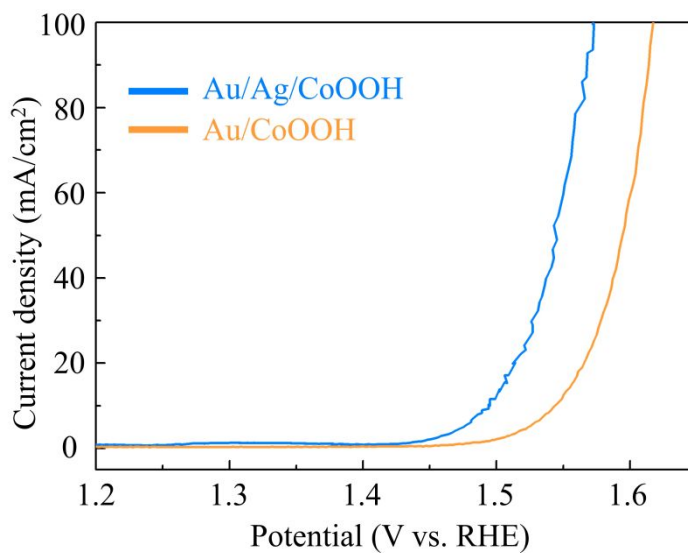


Figure S13. OER polarization curves of CoOOH on Au, and CoOOH on Ag electrodeposited Au substrate; Ag was deposited on Au substrate using a two-step chronoamperometry process (1 mA/cm^2 for 100 s and 10 mA/cm^2 for 60 s).

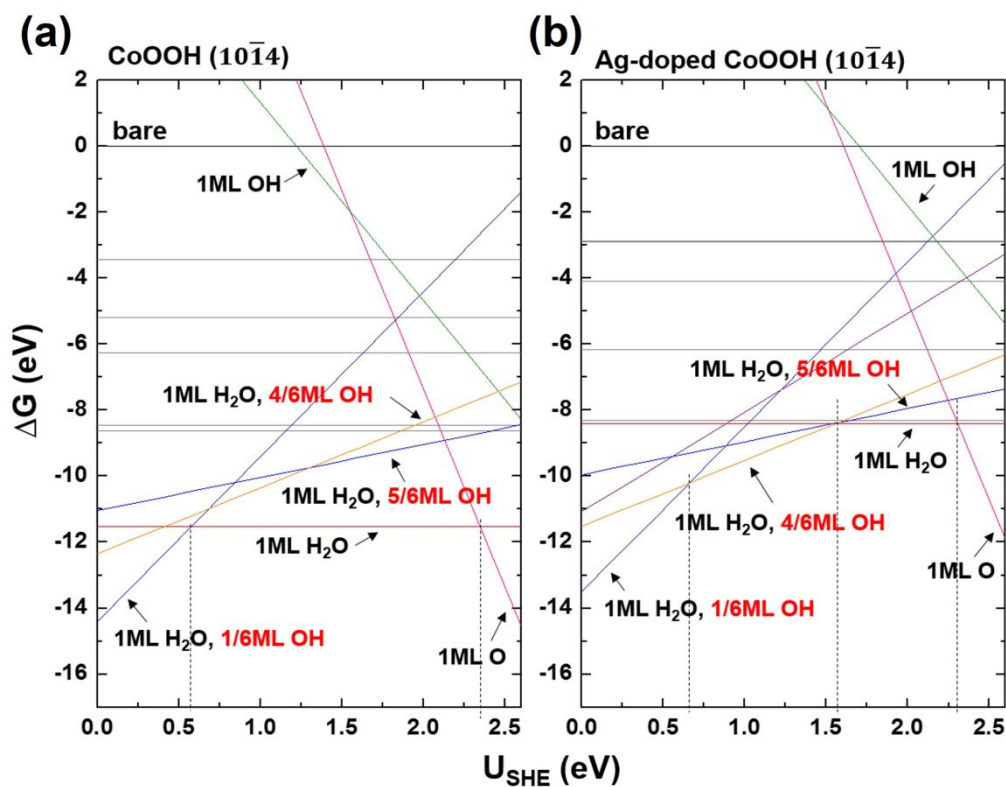


Figure S14. Surface free energy diagram of (a) CoOOH (1014), and (b) Ag-doped CoOOH (1014).

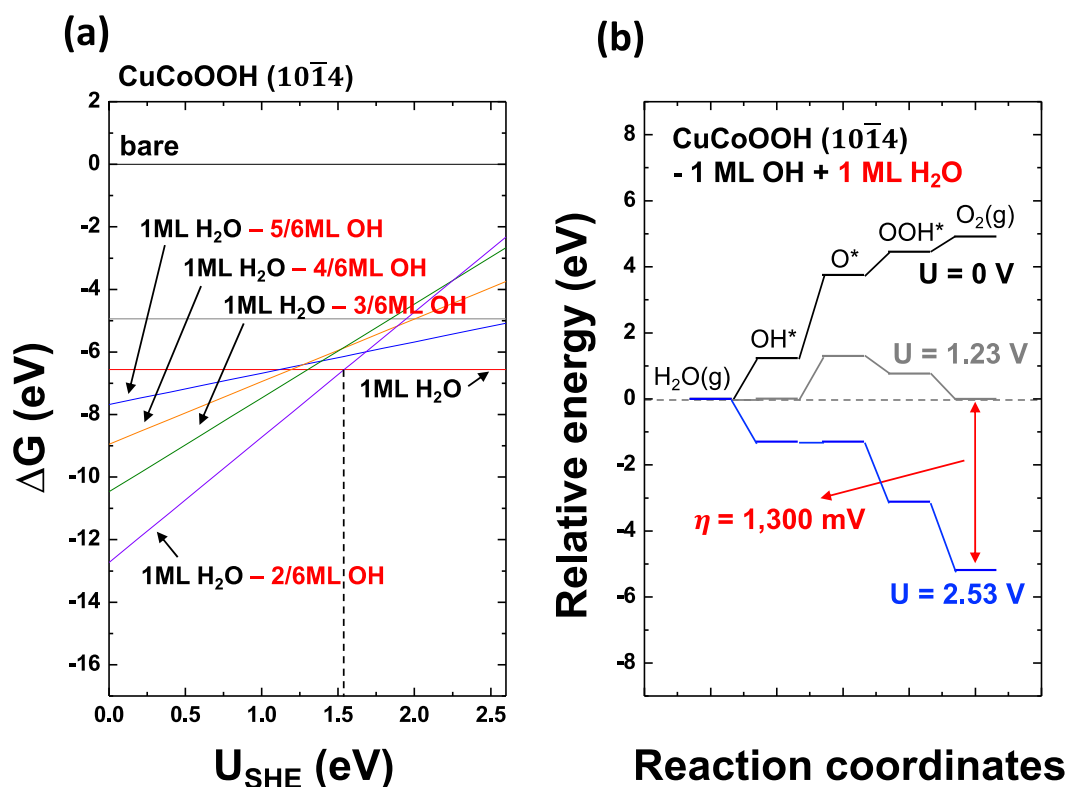


Figure S15. Surface free energy diagram of (a) Cu-doped CoOOH (10 $\bar{1}4$), and (b) Gibbs free energy diagram with OER overpotential for Cu-doped CoOOH (10 $\bar{1}4$).

Table S1. EDS compositions of exfoliated CoOOH on Ag, Au, Cu and Ni.

	Co (at.%)	X (at.%)	O (at.%)
CoOOH on Ag	20.33	13.22	66.44
CoOOH on Au	31.93	-	68.07
CoOOH on Cu	32.60	9.31	58.09
CoOOH on Ni	26.86	-	73.14

TEM EDS composition (10 points average)

Table S2. Recently reported Co-based electrocatalysts and their OER performances

Catalysts	Electrodes	Overpotentials (mV) @ 10 mA/cm ²	References
CeO _x /CoO _x	Ti	313	1
Co doped CuS	GC	270	2
Ag@Co _x P	GC	310	3
NiCo ₂ O ₄	Ni foam	290	4
CoNi(OH) _x	Cu foils	280	5
Co-defected Co _{3-x} O ₄	GC	268	6
(Co _{1-x} Fe _x) ₂ P	-	270	7
CoSn(OH) ₆	GC	274	8
NiCoP NWs	GC	221	9
Fe-CoP/CoO	GC	219	10
Co(OH) ₂ @g-C ₃ N ₄	GC	320	11

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