

Supporting Information

Layer-structured FeCo bihydroxide as ultra-stable bifunctional electrocatalyst for water splitting at high current densities

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Physical characterizations

The X-ray diffraction (XRD) was done on Shimadzu XD-3A Instrument, which was fitted with filtered Cu-K α radiation ($\lambda = 0.15418$ nm) and operated at 30 mA and 40 kV. The 2θ scan rate for XRD analysis was set at 5° min^{-1} . JEOL (JEM-2000 FX) microscope operated at 200 kV was used for transmission electron microscopy (TEM), high angle annular dark field scanning transmission electron microscopy (STEM) images and selected area electron diffraction (SAED) analysis. X-ray photoelectron spectra (XPS) were carried out on VG Escalab210 Spectrometer with Mg 300 W X-ray source.

Electrochemical measurements

A three-electrode electrochemical cell linked with a potentiostat/galvanostat (CHI 760, CH Instruments) was applied to evaluate the HER and OER electrocatalytic properties. In this three-electrode cell, Hg/HgO and graphite rod were used as reference electrode (RE) and counter electrode (CE) respectively. 1.0 M KOH aqueous solution was used as electrolyte for all electrocatalytic testing. Electrochemical impedance spectroscopy (EIS) spectra were measured at corresponding OER and HER electrode potentials from 0.01 to 1,000,000 Hz with an amplitude of 5 mV. Linear sweep voltammetry (LSV) was done with a scan rate of 5 mV s^{-1} . All potentials stated in this work were normalized to the reversible hydrogen electrode (RHE). iR compensation was applied for all electrochemical experiments.

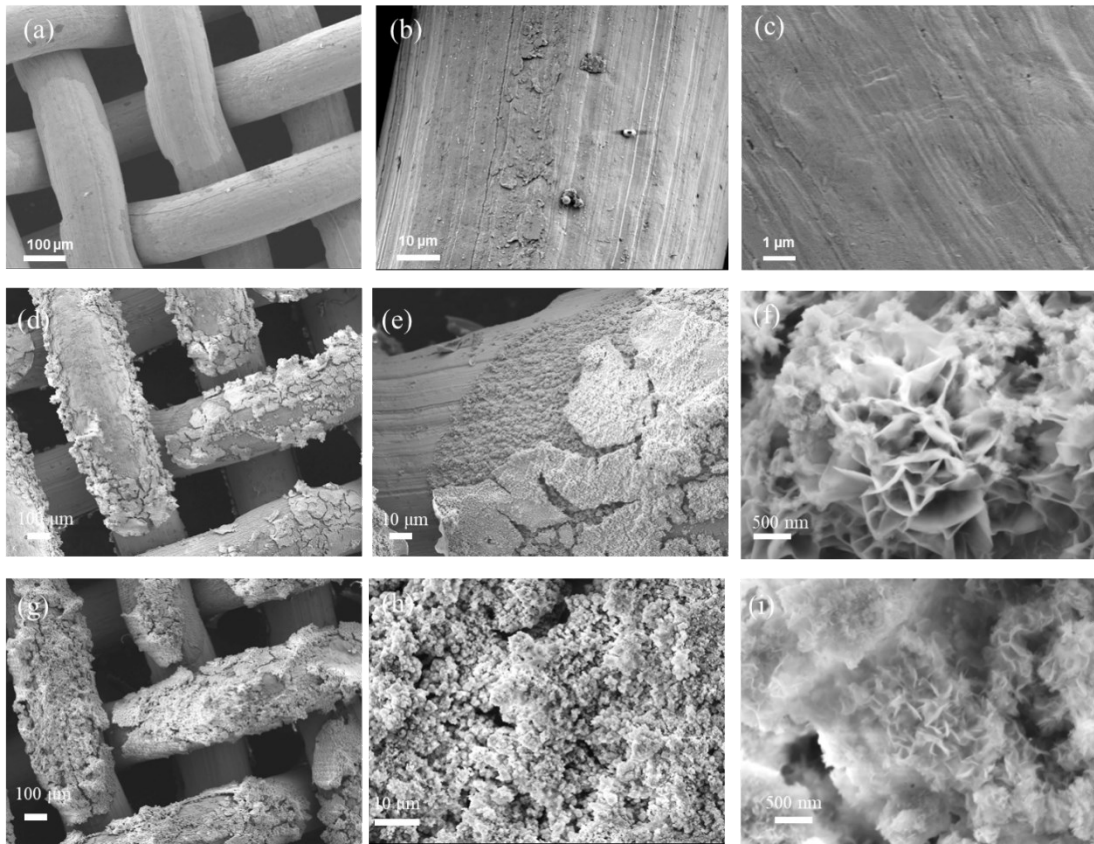


Figure S1. SEM images of NM(a,b,c); SEM pictures of different time of (d,e,f) 10 s, and (g,h,i) 60 s.

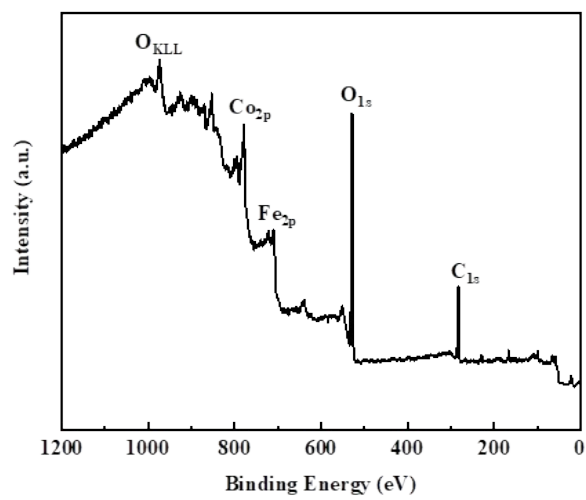


Figure S2. Survey XPS spectrum of FeCo-LDH/NM

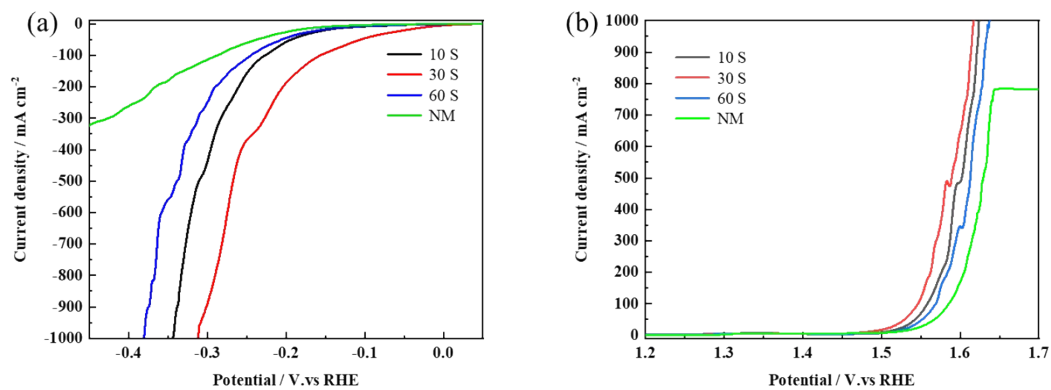


Figure S3. (a) HER LSV curves of the FeCo-LDH/NM samples prepared with different time, (b) OER LSV curves of the FeCo-LDH / NM samples prepared with different time.

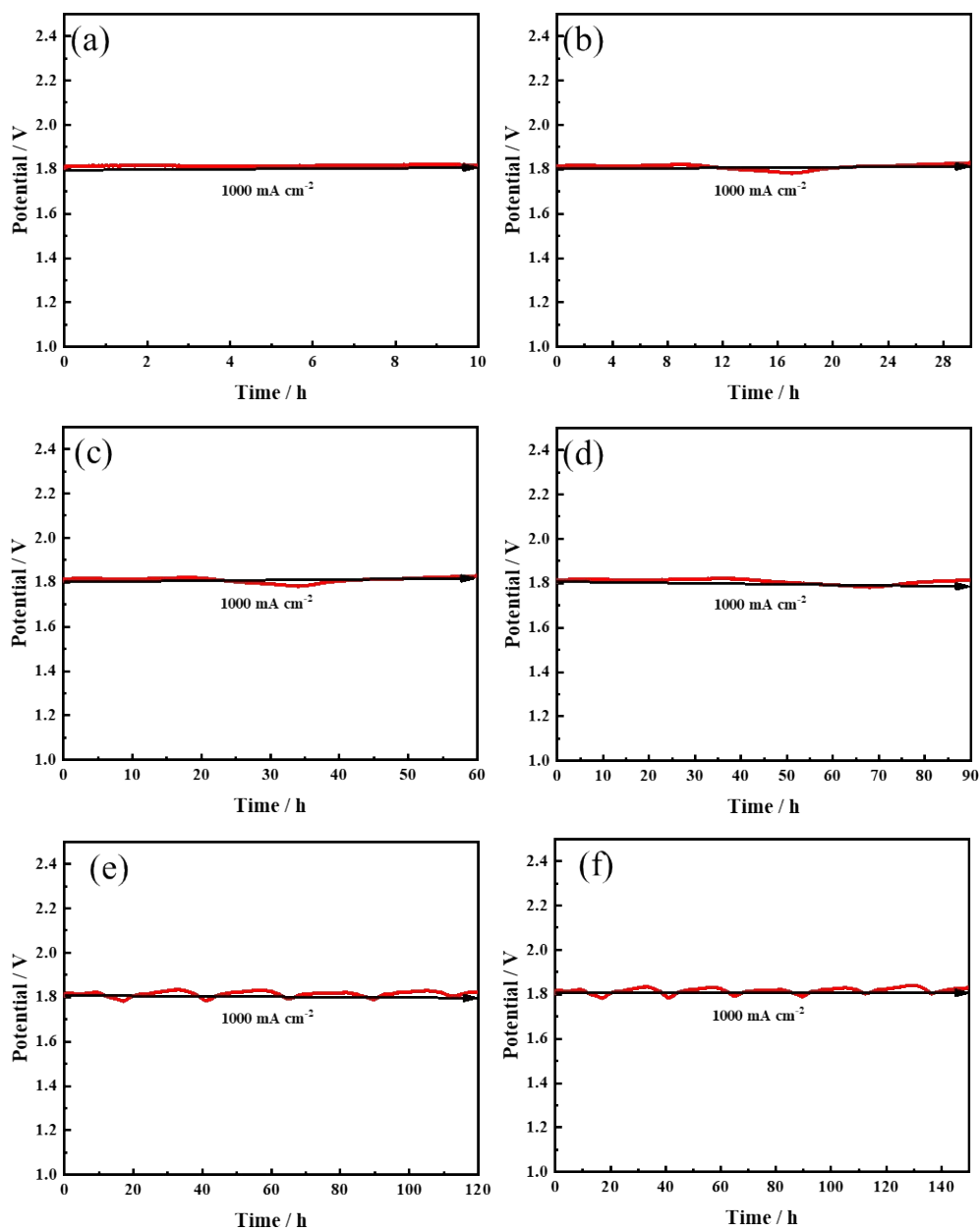


Figure S4. long-term overall water splitting chronopotentiometry of FeCo-LDH/NM at 1000 mA cm⁻² for (a) 10 h; (b) 30 h; (c) 60 h; (d) 90 h; (e) 120 h; (f) 150 h.

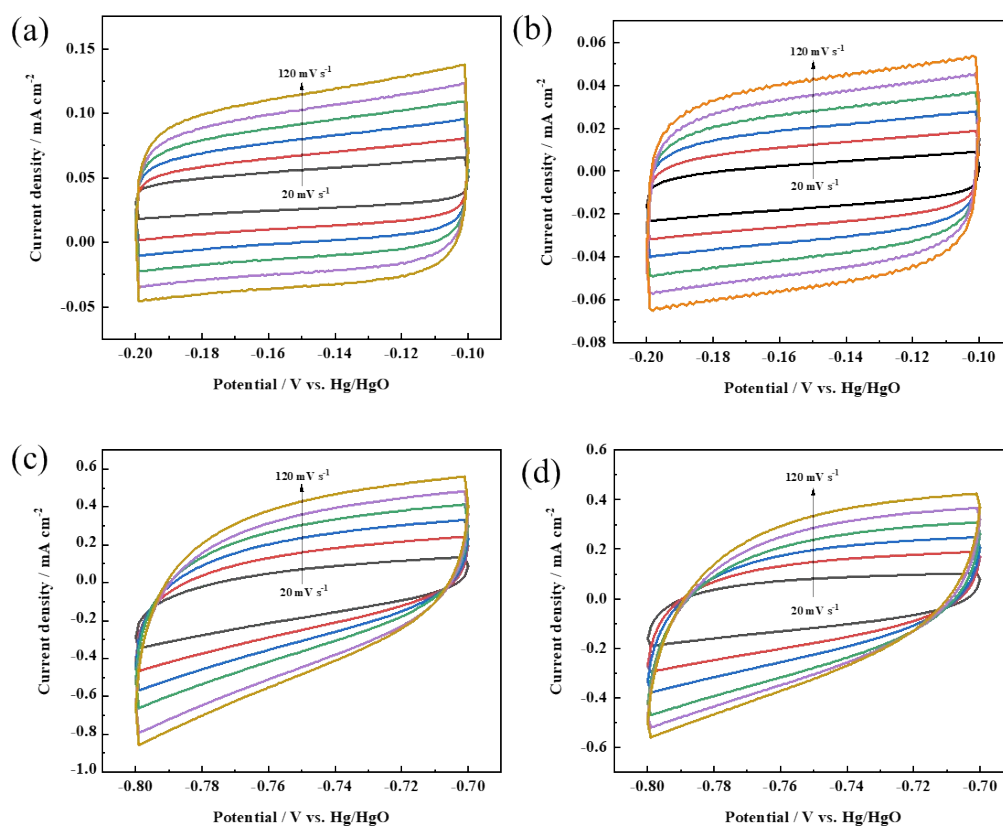


Figure S5. Cyclic voltammetry plots of (a) FeCo-LDH/NM; (b) NM for HER; (c) FeCo-LDH/NM; and (e) NM for OER.

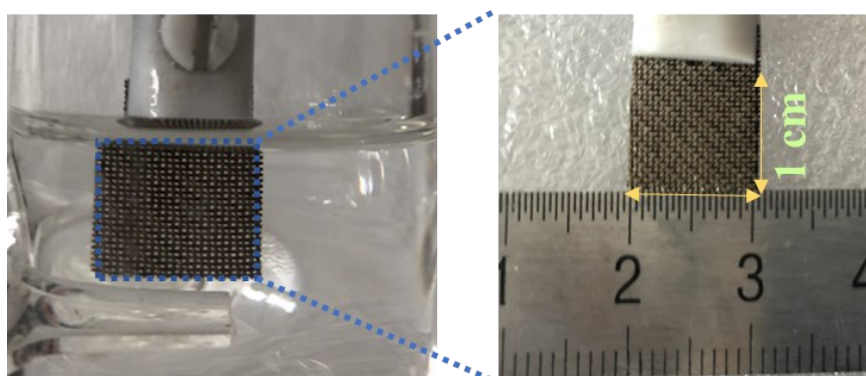


Figure S6. Picture of size measurement of electrode material used in electrochemical test

Table S1. Comparison of the stability of Fe-based electrocatalysts in overall water hydrolysis.

Catalysts	Morphology	$\eta_{50,overall}$ (V)	stability(h)	Ref.
FeCo-LDH/NM	Nanosheets	1.69	Over 150 h	This work
FeCoP/C NF	Nanosheet	1.68	3 h	1
FeCo/Co ₂ P	Nanoparticles	1.81	12 h	2
Fe ₂ P/CoP/Ni ₅ P ₄	Core-Shell	1.71	24 h	3
FeCoOOH	Nanosheets	1.72	15 h	4
Co-FeNiO _x	Nanosheets	1.70	20 h	5
Ni ₃ Se ₄ @NiFeLDH	Nanosheets	1.69	100 h	6
NiFeOH/CoS _x	Nanosheets	1.71	24 h	7
CoNi/CoFe ₂ O ₄	Nanosheets	1.65	48 h	8
Fe _{13.7%} -Ni ₃ S ₂	Nanowire	1.6	14 h	9
Ni ₂ P and FeP	nanoparticles	1.76	100 h	10

Table S2. Comparison of the stability of different substrates in water splitting.

Substrate material	Stability	Ref.
stainless steel wires (SSW)	24 h	11
Carbon substrate	6-30 h	12, 13
Nickel foam (NF)	24-120 h	14, 15
Cu mesh	70 h	16
Nickel mesh (NM)	Over 150 h	This work

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