Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting information

A self-supporting anode with high activity and long-term stability for efficient water-splitting

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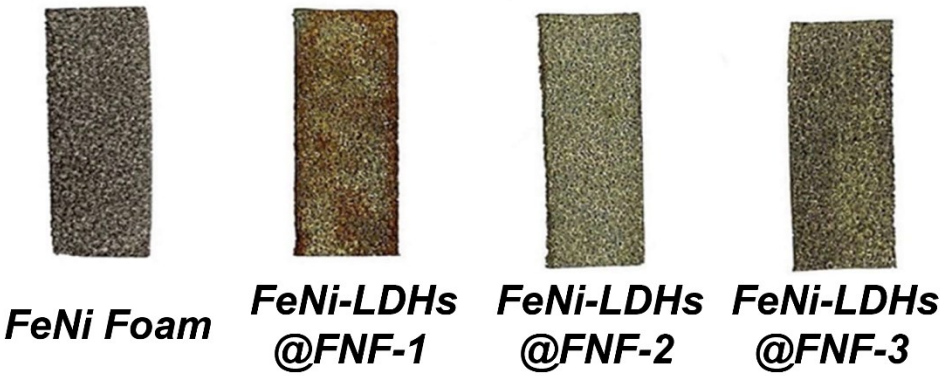

Fig. S1 Appearance of FeNi-LDHs prepared in $NiSO_4$ solution with varying Ni^{2+} concentration.

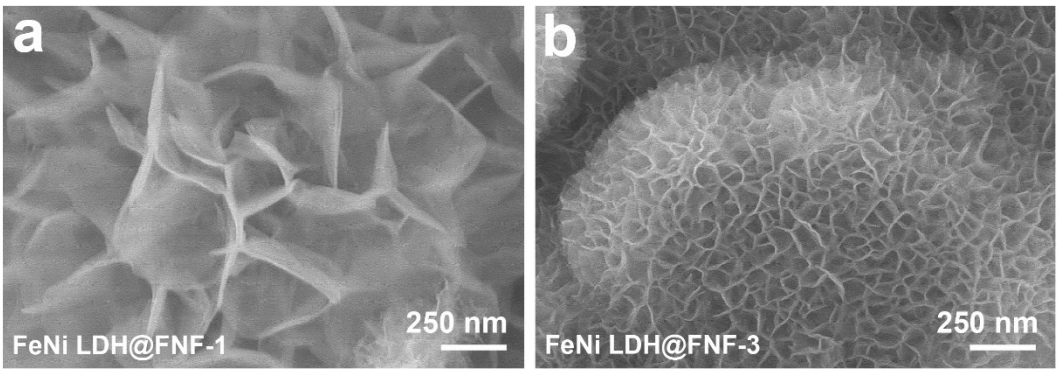

Fig. S2 (a) SEM images of FeNi-LDH@sFNF-1. (b) SEM image of FeNi-LDHs@FNF-3.

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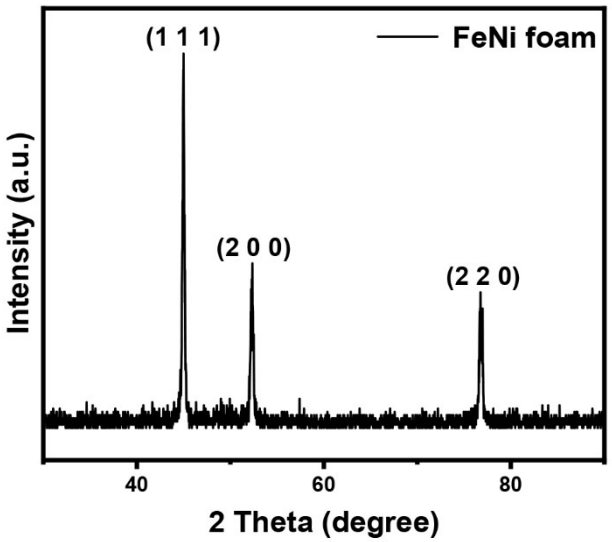

Fig. S3 XRD spectra of FeNi foam.

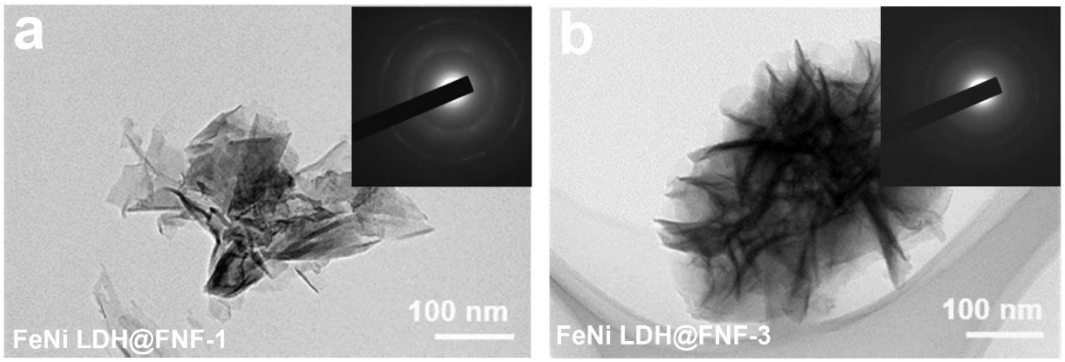

Fig. S4 (a) TEM image of FeNi-LDHs@FNF-1. (b) TEM image of FeNi-LDHs@FNF-3.

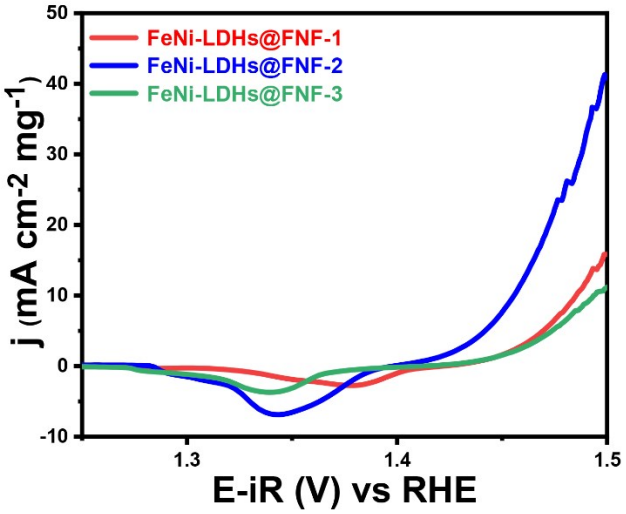

Fig. S5 Polarization curves of FeNi-LDHs normalized with catalyst mass.

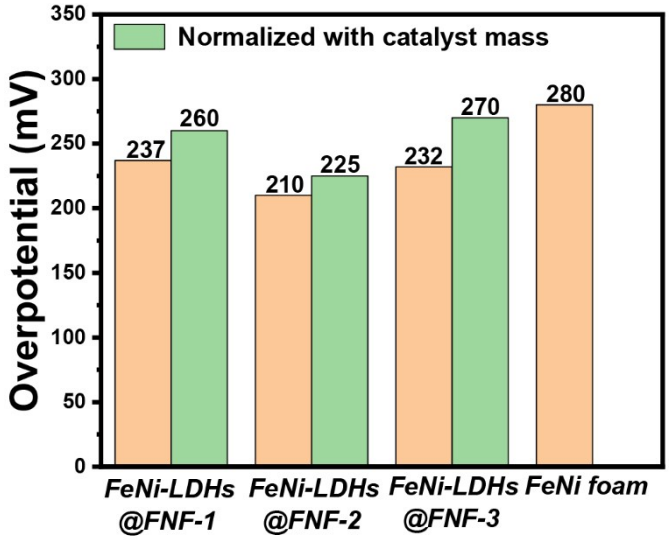

Fig. S6 Overpotential of FeNi-LDHs grown at different concentrations.

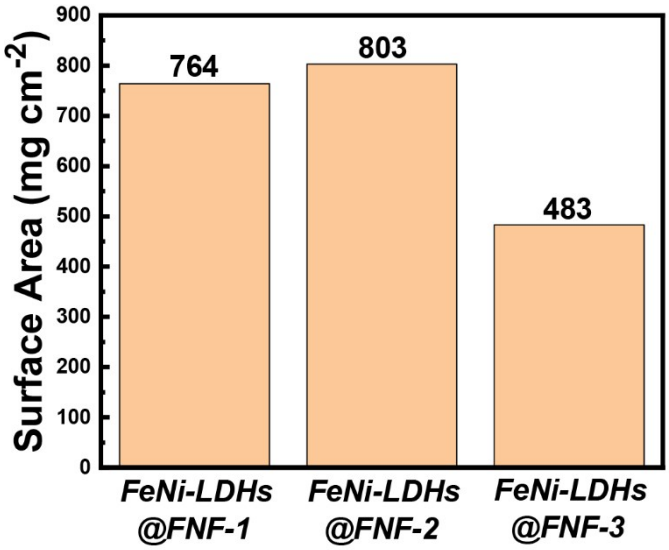

Fig. S7 BET surface area of FeNi-LDHs grown at different concentrations.

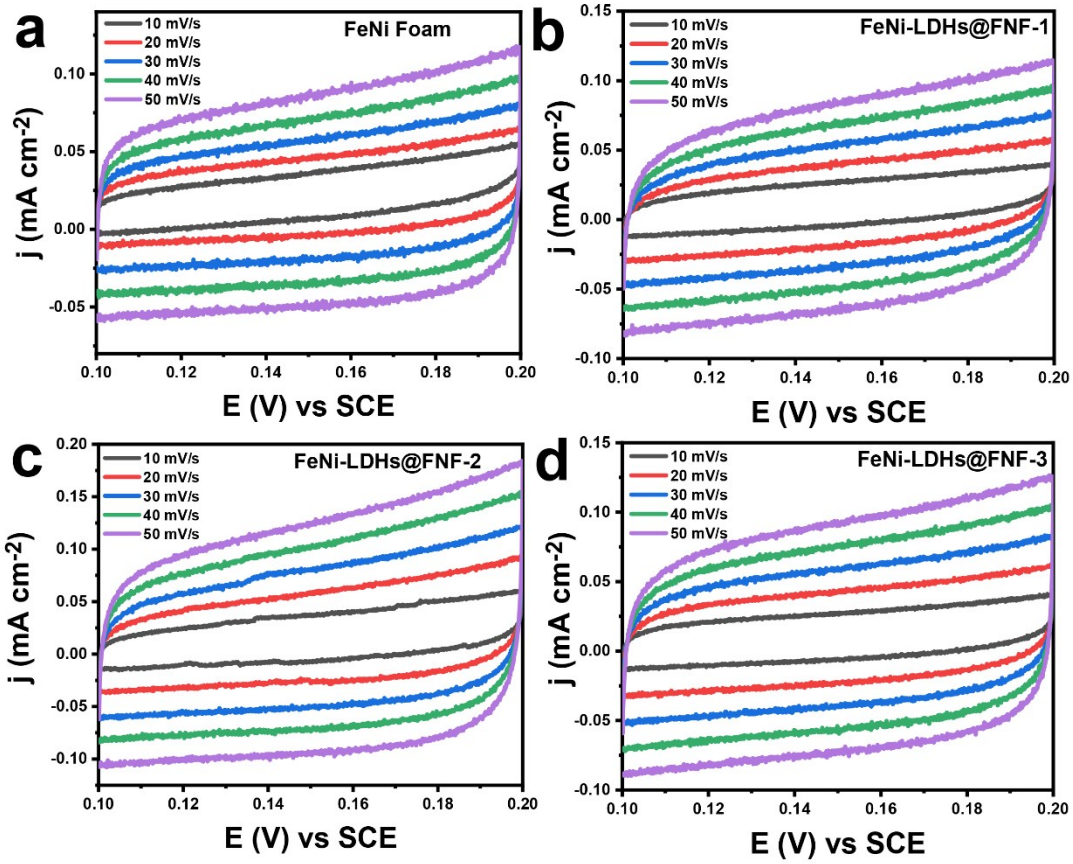

Fig. S8 (a, b, c, d) ECSA curves of FeNi-LDHS grown on FeNi foam under different $NiSO_4$ concentrations.

Table S1 Process comparison of different OER catalysts (* is the catalyst developed in this article)

Catalyst	Preparation	Chemicals
FeNi-LDHs-rGO	1. Synthesis of FeNi LDH by hydrothermal method. 2. Decarbonisation of FeNi LDH. 3. Synthesis of GO from natural graphite by a modified Hummers method. 4. Embedding graphene oxide into the FeNi LDH layer by anion exchange. 5. Reduction of FeNi-GO LDH to FeNi-rGO LDH.	ferrous chloride, nickel chloride, urea aqueous, trisodium trate, hydrochloric acid, sodium chloride, natural graphite, hydrazine hydrate, ammonium
NiFe-LDHs/CNT	1. Oxidization of carbon nanotubes. 2. Synthesis of NiFe LDH on multi-walled carbon nanotubes by solvothermal method.	carbon nanotubes sulfuric acid sodium nitrate potassium permanganate hydrogen peroxide N,N-dimethylformamide nickel acetate ferrous nitrate
N-NiFe-LDHs	Synthesis of N-NiFe LDH on nickel foam in the chemical bath.	nickel acetate hexamethylene tetramine

		iron nitrate ethanol
n-NiFe- LDHs/NGF	1. Preparation of magnesium oxide template by surfactant-assisted hydrothermal reaction. 2. Synthesis of NGF via CVD method with the as-obtained MgO as templates. 3. Synthesis of n-NiFe LDH/NGF via urea-assisted precipitation with NGF as the substrate.	magnesium oxide polyethylene glycol methane/ammonia hydrochloric acid N-methylpyrrolidone nickel nitrate ferric nitrate urea
NiCo-LDHs/Ni NiMn-LDHs/Ni NiCoMn-LDHs/Ni	Synthesis of NiCo LDH, NiMn LDH and NiCoMn LDH on nickel foam by hydrothermal method.	nickel acetate cobalt acetate manganese acetate sodium carbonate sodium hydroxide urea
***FeNi- LDHs/FeNi**	**Synthesis of FeNi-LDHs on FeNi foam at room temperature.**	**nickel sulfate**

Some calculation formulas involved in the article:

The overpotential is calculated by the following equation:

$$E\ (vs.\ RHE) = E\ (vs.\ SCE) + 1.0672\ V$$

$$\eta_{OER} = E\ (vs.\ RHE) - 1.23\ V$$

The ECSA is calculated by the following equation:

$$ECSA = Cdl/Cs(40\ \mu F\ cm^{-2})$$

The electric quantity of Ni reduction is calculated by the following equation:

$$Q = \frac{\int j \cdot t dt}{m(Ni)}$$

$\int j \cdot t dt$ is obtained by the integration of the j-t curve (Fig.S4). *m(Ni)* is obtained from the catalyst mass (By measuring the quality difference of samples before and after chemical corrosion. FeNi-LDHs@FNF-1: 2 mg, FeNi-LDHs@FNF-2: 2 mg, FeNi-LDHs@FNF-3: 3 mg) and XPS element content.