Double Perovskite LaFe₁₋ₓNiₓO₃ Coated with Sea Urchin-like Gold Nanoparticles Using Electrophoresis as the Photoelectrochemical Electrode to Enhance H₂ Production via Surface Plasmon Resonance Effect

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Table S1. Particle sizes of the raw LFNO samples with different Ni concentrations.

Sample	Size (μm)
0.00 mole	4.72 ± 0.34
0.01 mole	7.25 ± 0.80
0.03 mole	7.35 ± 0.85
0.05 mole	7.63 ± 0.81
0.07 mole	7.82 ± 0.80

Table S2. UV-vis properties of the raw and Au-coated LFNO samples with different Ni concentrations.

Sample	LFNO		Au-coated LFNO	
	E_g (eV)	Wavelength (μm)	PE (eV)	Wavelength (μm)
0.00 mol	2.21	561.1	2.08	596.2
0.01 mol	2.20	563.6	2.05	604.9
0.03 mol	2.12	584.9	2.04	607.8
0.05 mol	2.09	593.3	2.02	613.9
0.07 mol	2.05	604.9	1.99	623.1

Table S3. Electrochemical properties of the raw LFNO samples with different Ni concentrations in 0.1 M KOH solution.

Sample	E_p^a (V)	E_p^c (V)	HER (V)
0.00 mol	0.003	−0.002	0.83
0.01 mol	0.368	−0.286	0.67
0.03 mol	0.194	−0.239	0.66
0.05 mol	0.272	−0.318	0.71
0.07 mol	0.156	−0.475	0.82

Table S4. Hydrogen efficiency and real production of the Au-coated LFNO samples with different Ni concentrations in ethanol under AM 1.5 G at different temperatures.

Sample	V_{op} (V)	0 °C		
		I_{op} (×10⁻⁴ mA)	η (×10⁻³ %)	Real production (μmol g⁻¹h⁻¹)
0.00 mol	0.002	1.12	1.37	4478.0

Sample	V_{op} (V)	I_{op} ($\times 10^{-4}$ mA)	η ($\times 10^{-2}$ %)	Real production (μmol g^{-1}h^{-1})
0.01 mol	0.004	1.08	1.32	4314.6
0.03 mol	0.009	1.05	1.29	4216.5
0.05 mol	0.005	1.05	1.28	4183.8
0.07 mol	0.002	1.09	1.34	4380.0
10 °C				
Sample	**V_{op} (V)**	**I_{op} ($\times 10^{-4}$ mA)**	**η ($\times 10^{-2}$ %)**	**Real production (μmol g^{-1}h^{-1})**
0.00 mol	0.012	1.05	1.28	41838.4
0.01 mol	0.014	1.10	1.34	43800.0
0.03 mol	0.003	0.99	1.22	39877.2
0.05 mol	0.005	1.06	1.30	42492.1
0.07 mol	0.004	1.04	1.28	41838.4
20 °C				
Sample	**V_{op} (V)**	**I_{op} ($\times 10^{-4}$ mA)**	**η ($\times 10^{-2}$ %)**	**Real production (μmol g^{-1}h^{-1})**
0.00 mol	0.005	1.02	1.25	40857.8
0.01 mol	0.004	1.01	1.24	40530.9
0.03 mol	0.002	1.00	1.22	39877.2
0.05 mol	0.002	0.97	1.19	38896.6
0.07 mol	0.004	1.02	1.25	40857.8
30 °C				
Sample	**V_{op} (V)**	**I_{op} ($\times 10^{-4}$ mA)**	**η ($\times 10^{-2}$ %)**	**Real production (μmol g^{-1}h^{-1})**
0.00 mol	0.002	1.00	1.22	39877.2
0.01 mol	0.001	0.97	1.20	39223.5
0.03 mol	0.008	0.97	1.20	39223.5
0.05 mol	0.002	0.96	1.18	38569.7
0.07 mol	0.012	0.98	1.20	39223.5

Table S5. Hydrogen efficiency and real production of the Au-coated LFNO samples with different Ni concentrations in 1-butanol under AM 1.5G at different temperatures.

		0 °C		
Sample	**V_{op} (V)**	**I_{op} ($\times 10^{-4}$ mA)**	**η ($\times 10^{-3}$ %)**	**Real production (μmol g^{-1}h^{-1})**
0.00 mol	0.001	9.21	1.13	3693.5
0.01 mol	0.002	9.17	1.13	3693.5
0.03 mol	0.001	9.36	1.15	3759.9
0.05 mol	0.002	9.15	1.12	3660.9
0.07 mol	0.010	9.53	1.16	3791.6
		10 °C		
Sample	**V_{op} (V)**	**I_{op} ($\times 10^{-4}$ mA)**	**η ($\times 10^{-3}$ %)**	**Real production (μmol g^{-1}h^{-1})**
0.00 mol	0.004	9.15	1.12	3660.9
0.01 mol	0.007	9.51	1.16	3791.6
0.03 mol	0.003	9.14	1.12	3660.9
0.05 mol	0.004	9.33	1.14	3726.2
0.07 mol	0.011	9.14	1.11	3628.2
		20 °C		
Sample	**V_{op} (V)**	**I_{op}**	**η**	**Real production**

Sample	V_{op} (V)	I_{op} ($\times 10^{-4}$ mA)	η ($\times 10^{-3}$ %)	Real production (μmol g^{-1}h^{-1})
0.00 mol	0.005	9.24	1.13	3693.5
0.01 mol	0.020	9.20	1.11	3628.2
0.03 mol	0.010	9.27	1.13	3693.5
0.05 mol	0.005	9.16	1.13	3693.5
0.07 mol	0.002	9.06	1.11	3628.2
		30 °C		
Sample	V_{op} (V)	I_{op} ($\times 10^{-4}$ mA)	η ($\times 10^{-3}$ %)	Real production (μmol g^{-1}h^{-1})
0.00 mol	0.008	8.95	1.09	3562.8
0.01 mol	0.005	9.17	1.12	3660.9
0.03 mol	0.006	8.87	1.10	3595.5
0.05 mol	0.003	8.95	1.10	3595.5
0.07 mol	0.008	8.95	1.09	3562.8

Table S6. Activation energy, E_a, of the Au-coated LFNO samples with different Ni concentrations in ethanol and 1-butanol.

Sample	E_a (eV)	
	ethanol	1-butanol
0.00 mol	−0.080	−0.056
0.01 mol	−0.068	−0.055
0.03 mol	−0.063	−0.059
0.05 mol	−0.068	−0.057
0.07 mol	−0.065	−0.058

Table S7. Parameters of the energy-level diagram (vs. vacuum) of the raw LFNO samples with different Ni concentrations.

Sample	E_g (eV)	E_{VB} (eV)	E_{CB} (eV)	E_{FB} (eV)	Carrier density ($\times 10^{19}$ / cm^3)
0.00 mol	2.21	−6.18	−3.97	−4.50	4.33
0.01 mol	2.20	−6.32	−4.12	−4.31	3.70
0.03 mol	2.12	−5.96	−3.84	−4.39	3.30
0.05 mol	2.09	−5.97	−3.88	−4.58	4.03
0.07 mol	2.05	−6.08	−4.03	−4.69	4.76