Supporting information for

Self-adaptive semiconductor-liquid junction for highly active and stable solar water splitting

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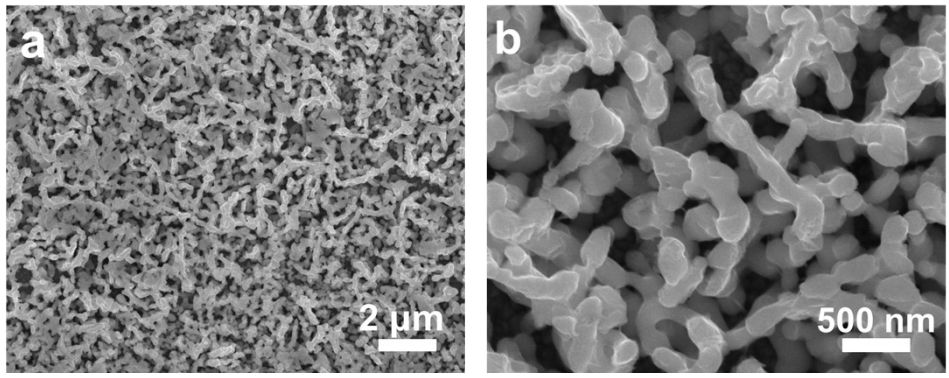

Fig. S1 SEM image of the $BiVO_4$ decorated by NiFe-TA complex.

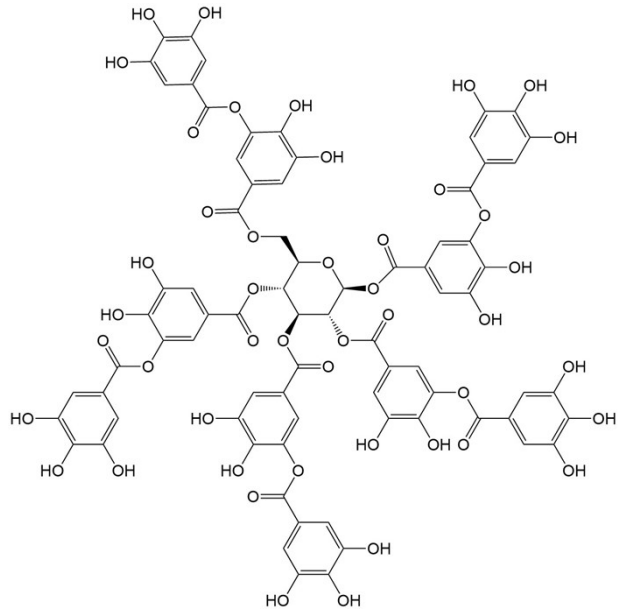

Fig. S2 The constitutional formula of TA molecule.

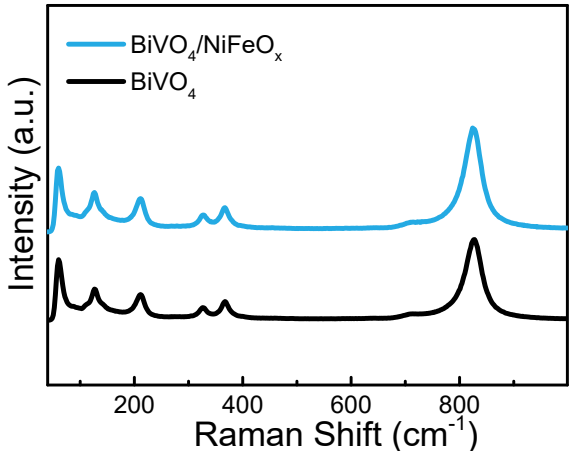

Fig. S3 Raman shift of bare $BiVO_4$ and $BiVO_4/NiFeO_x$ film.

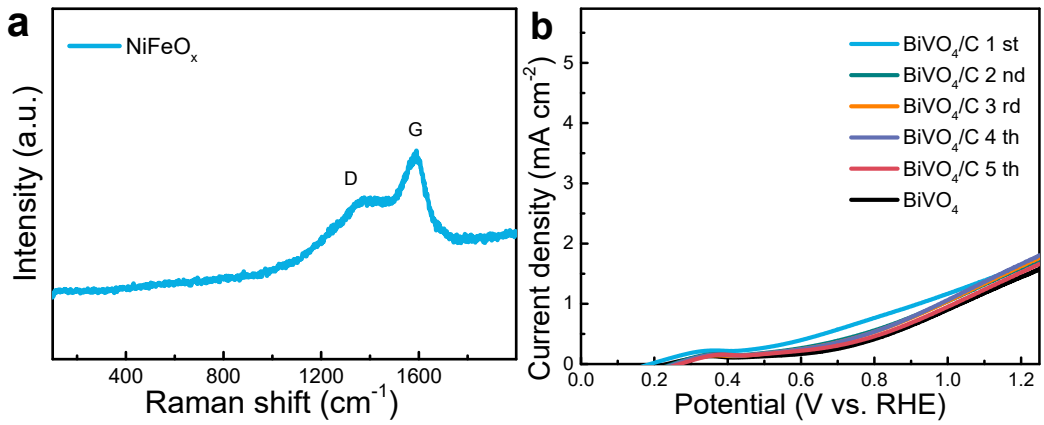

Fig. S4 (a) Raman shift of the $NiFeO_x$ powder. (b) LSV curves of $BiVO_4$/C photoanode.

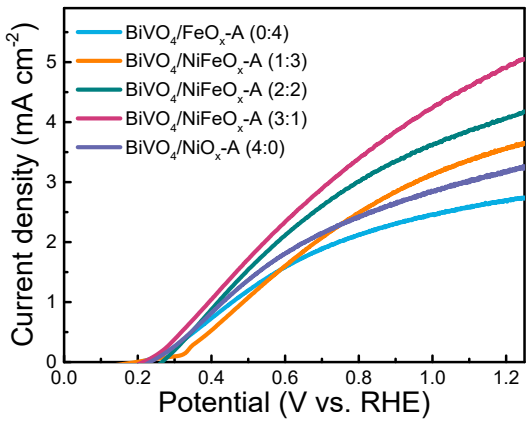

Fig. S5 LSV curves of $BiVO_4/NiFeO_x$ photoanode with different Ni/Fe ratio.

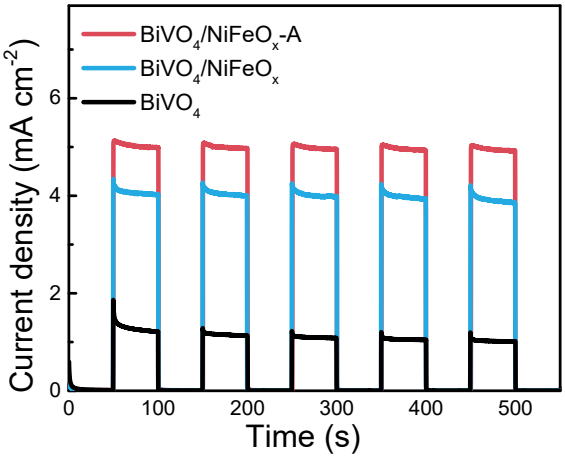

Fig. S6 Chopped light current-time curves of $BiVO_4$, $BiVO_4/NiFeO_x$, and $BiVO_4/NiFeO_x$-A at 1.23 V vs.RHE.

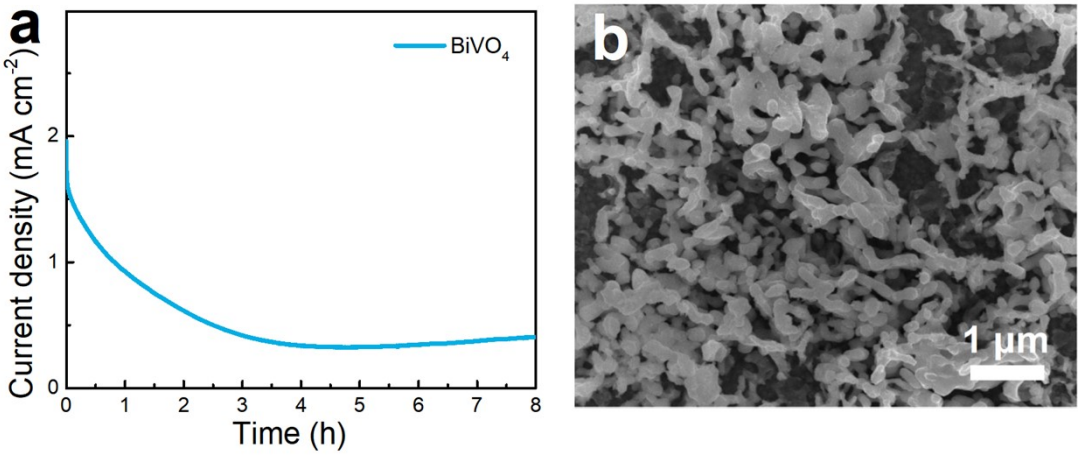

Fig. S7 (a) PEC stability of bare $BiVO_4$ photoanode at 1.23 V vs.RHE and (b) SEM image of the $BiVO_4$ photoanode after stability test.

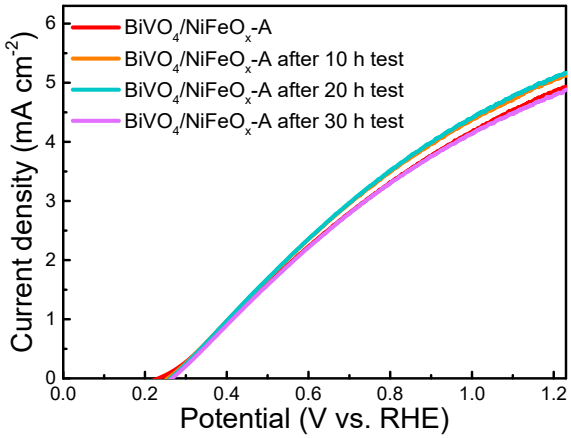

Fig. S8 LSV curves of $BiVO_4/NiFeO_x$-A photoanode after stability test.

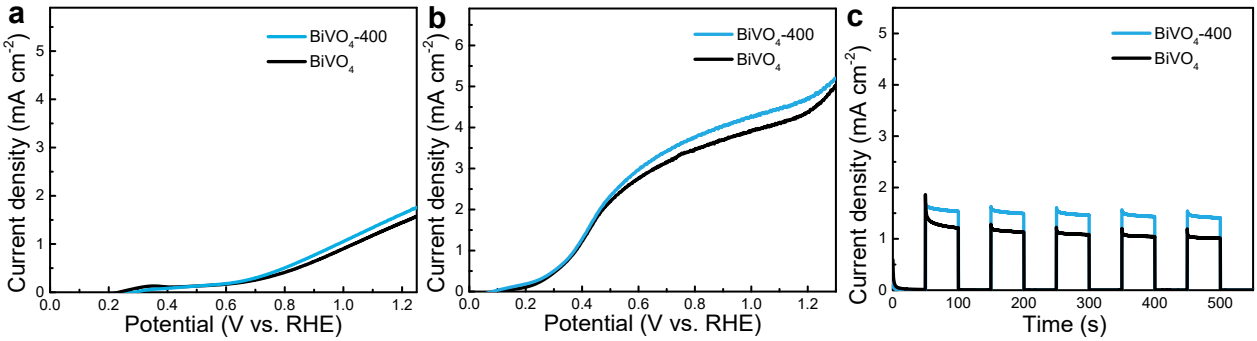

Fig. S9 (a) LSV curves for water oxidation, (b) LSV curves for sulfite oxidation, and (c) chopped light current-time curves of $BiVO_4$ and $BiVO_4$ calcined at 400 ℃ for 2 h.

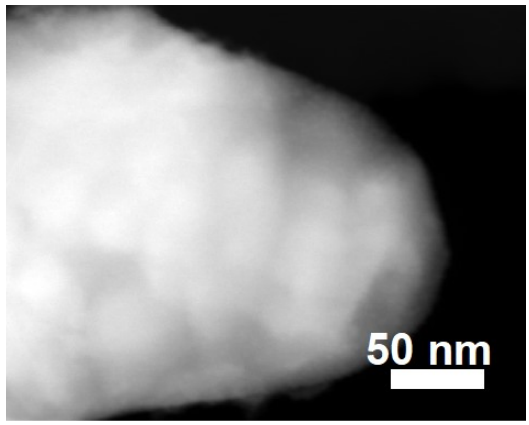

Fig. S10 HAADF image of the $BiVO_4/NiFeO_x$-A.

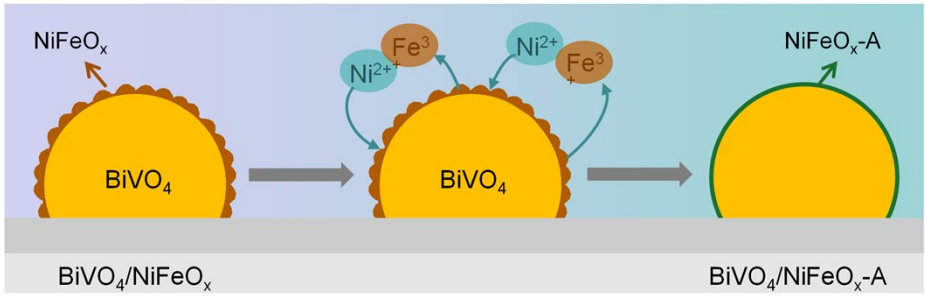

Fig. S11 Schematic illustration of the surface reconstruction process.

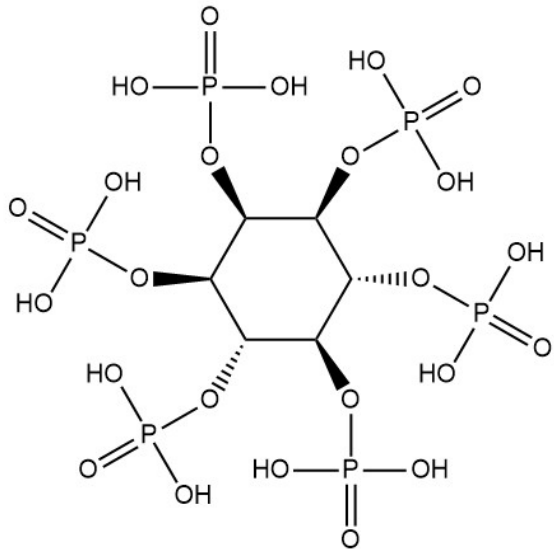

Fig. S12 The constitutional formula of PA molecule.

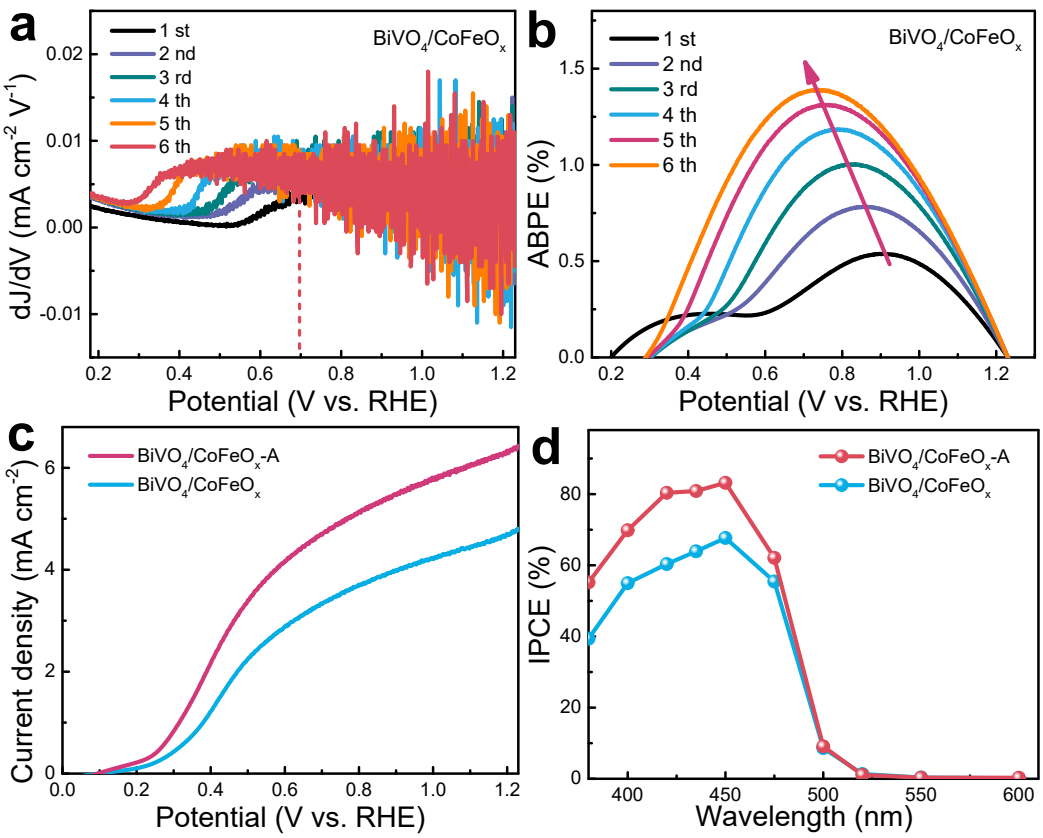

Fig. S13 (a) The first derivatives of photocurrent densities versus voltages and (b) ABPE plots of $BiVO_4/CoFeO_x$ photoanode. (c) LSV curves and (d) (IPCE) plots of $BiVO_4/CoFeO_x$ and $BiVO_4/CoFeO_x$-A photoanodes.

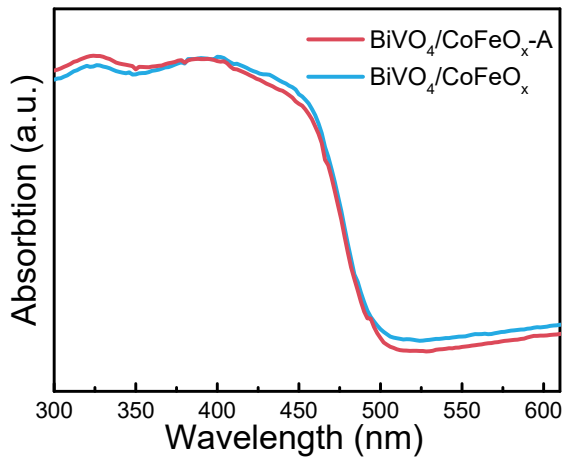

Fig. S14 UV-vis diffuse reflectance spectra of $BiVO_4/CoFeO_x$ and $BiVO_4/CoFeO_x$-A.

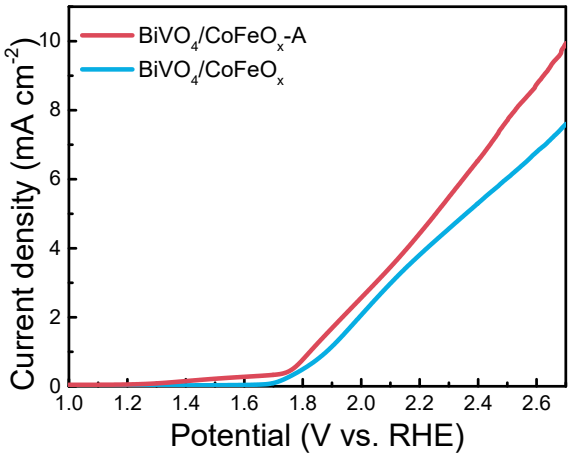

Fig. S15 LSV curves in dark of $BiVO_4/CoFeO_x$ and $BiVO_4/CoFeO_x$-A.

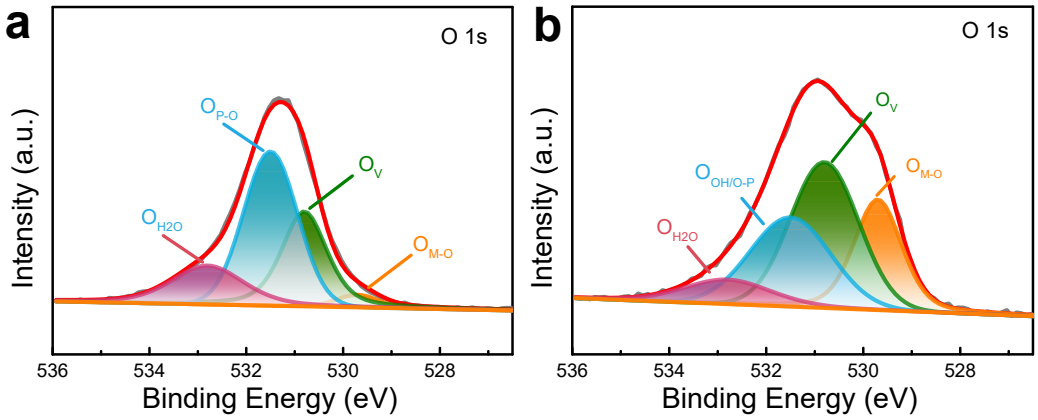

Fig. S16 O 1s XPS spectra of the (a) $BiVO_4/CoFeO_x$ and (b) $BiVO_4/CoFeO_x$-A.

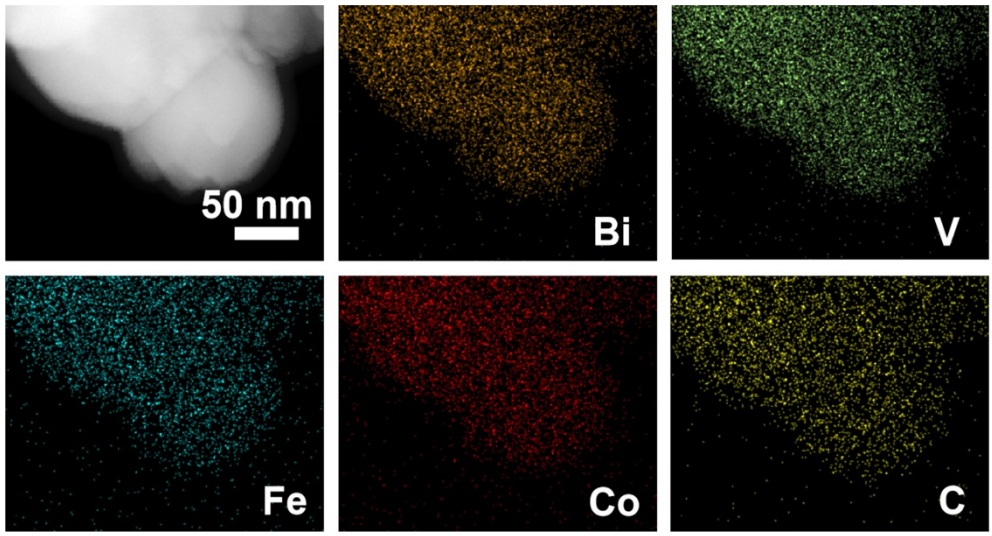

Fig. S17 HAADF image and corresponding EDX mapping of the $BiVO_4/CoFeO_x$-A.

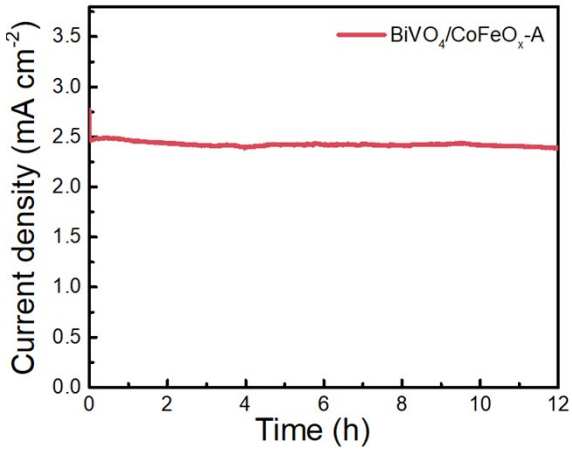

Fig. S18 Long-term stability test of the $BiVO_4/CoFeO_x$-A at 0.7 V vs.RHE.

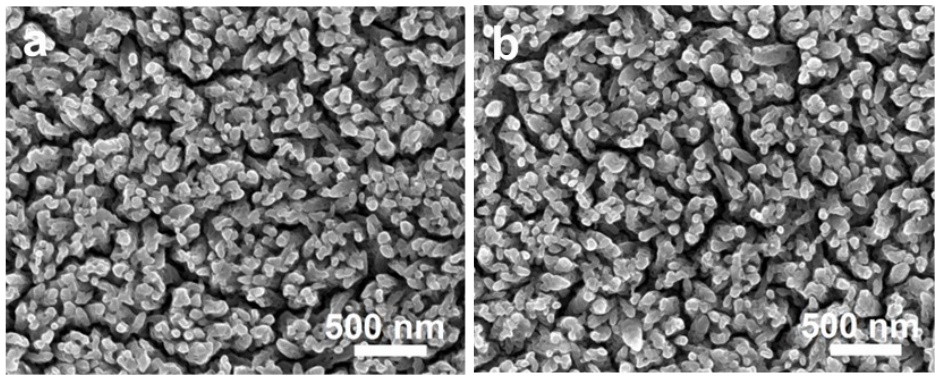

Fig. S19 SEM image of (a) Fe_2O_3 and (b) $Fe_2O_3/NiFeO_x$ films.

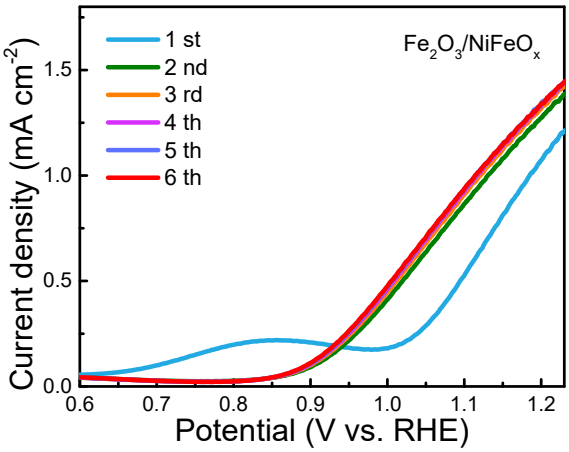

Fig. S20 Self-adaptive reconstruction of $Fe_2O_3/NiFeO_x$ photoanode.

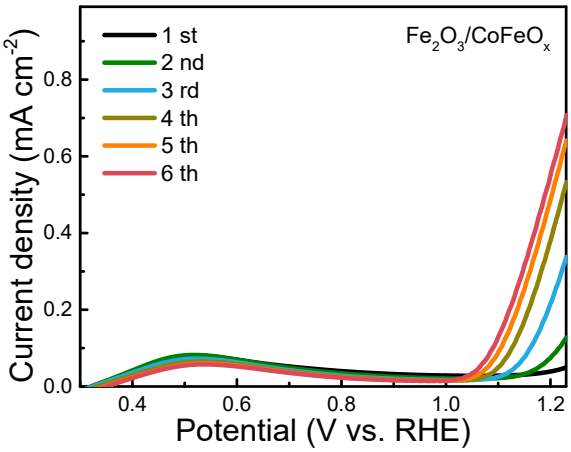

Fig. S21 Self-adaptive reconstruction of $Fe_2O_3/CoFeO_x$ photoanode.

Table S1 Comparison of the PEC performance for $BiVO_4$/cocatalyst photoanodes.

Simple	J (mA cm^{-2}) @1.23 V_{RHE}	Stability	Electrolyte (pH)	Ref.
Ov-$BiVO_4$@NiFe-MOFs	5.3	10 h@0.7 V_{RHE}	1 M KBi + V^{5+}	1
NiOOH/FeOOH/$BiVO_4$	4.7	500 h@0.6 V_{RHE}	1 M KBi + V^{5+}	2
NiFe-OEC/Mo: $BiVO_4$	2.6@0.6 V_{RHE}	1100 h@0.6 V_{RHE}	1 M KBi + Fe^{2+}	3
NiFe-OEC/BVO	4.0@0.8 V_{RHE}	200 h@0.8 V_{RHE}	1 M KBi + Fe^{2+}	4
BVO/NiFe-H	3.65	2.5 h@1.23 V_{RHE}	0.5 M Na_2SO_4	5
$BiVO_4$/$Fe_xNi_{1-x}OOH$	5.8	3 h@1.23 V_{RHE}	0.5 M KBi	6
Urea-NiFeOOH/$BiVO_4$	4.85	40 h@0.7 V_{RHE}	1 M KBi	7
F-$BiVO_4$@NiFe-LDH	3.26	60 min@1.23 V_{RHE}	1 M KBi	8
A-$CoMoO_{4-x}$/BVO	3.5	8 h@1.23 V_{RHE}	0.5 M Na_2SO_4	9
NiFeY LDH/$BiVO_4$	5.2	25 h@0.8 V_{RHE}	1 M KBi	10
$FeCoO_x$/$BiVO_4$	4.82	10@1.23 V_{RHE}	1 M KBi	11
$NiCo_2O_4$/Mo: $BiVO_4$	4.5	1 h@1.23 V_{RHE}	1 M KPi	12
β-FeOOH/$BiVO_4$	4.3	2 h@1.23 V_{RHE}	0.2 M Na_2SO_4	13
$BiVO_4$/O_v/FeO_x	3.13	2 h@1.23 V_{RHE}	0.1 M KPi	14
$BiVO_4$/$NiFeO_x$-A	**5.1**	**30 h@1.23 V_{RHE}**	**0.5 M NaBi**	**This work**

Table S2 The fitted values of Nyquist plots according to the equivalent circuit in Fig. 3h.

Samples	R_s (Ω cm^{-2})	R_{ct} (Ω cm^{-2})
$BiVO_4$	43.1	3895
$BiVO_4/NiFeO_x$	44.9	415.9
$BiVO_4/NiFeO_x$-A	43.6	146.5

Reference

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