Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supplementary Information

Engineering ZnCo-Layered Double Hydroxide Nanowalls toward High-Efficiency Electrochemical Water Oxidation

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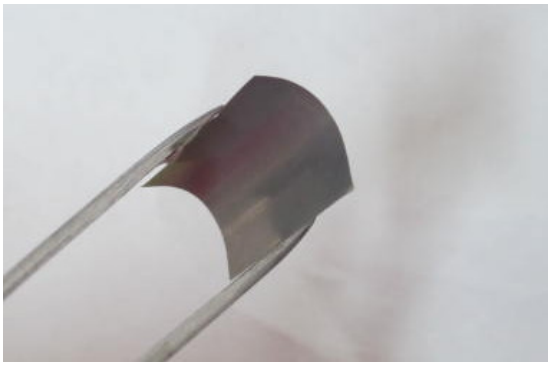


Fig. S1 Digital photo of ZnCo-LDH-100 film directly grown on a flexible Ni foil

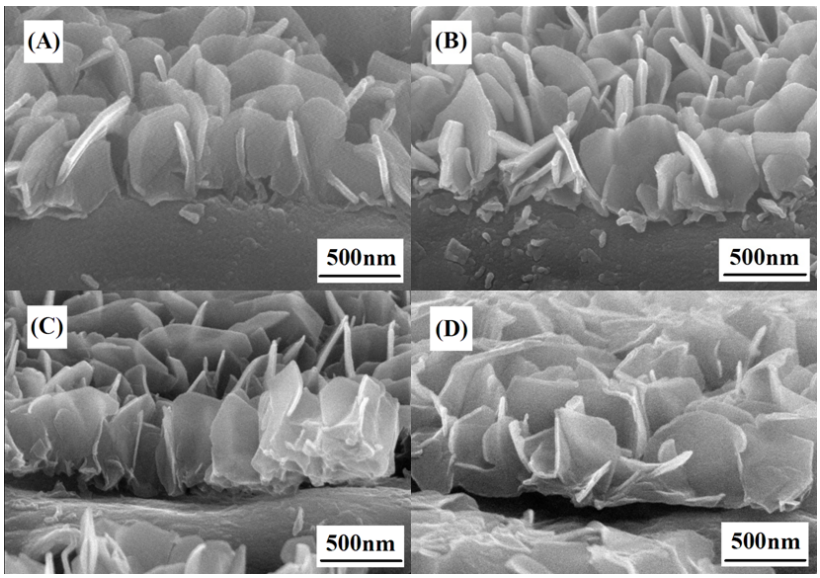
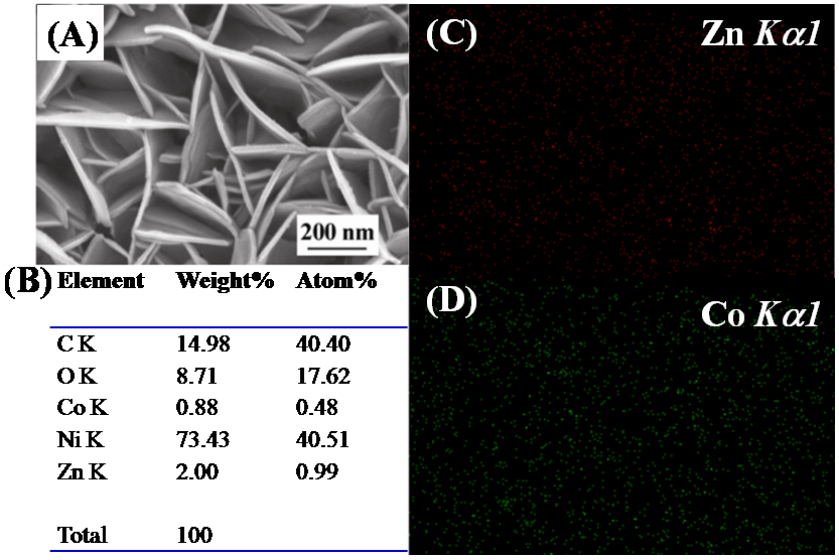


Fig. S2 Cross-sectional SEM images of ZnCo-LDH nanowalls (A) ZnCo-LDH-50, (B) ZnCo-LDH-100, (C) ZnCo-LDH-150, (D) ZnCo-LDH-180. The film thickness is approximately 480, 510, 570 and 600 nm, respectively.



(B)

Element	Weight%	Atom%
C K	14.98	40.40
O K	8.71	17.62
Co K	0.88	0.48
Ni K	73.43	40.51
Zn K	2.00	0.99
Total	100	

Fig. S3 (A) SEM image of ZnCo-LDH-100 sample, (B) the elemental analyses, (C) and (D) EDX mapping of Zn and Co elements

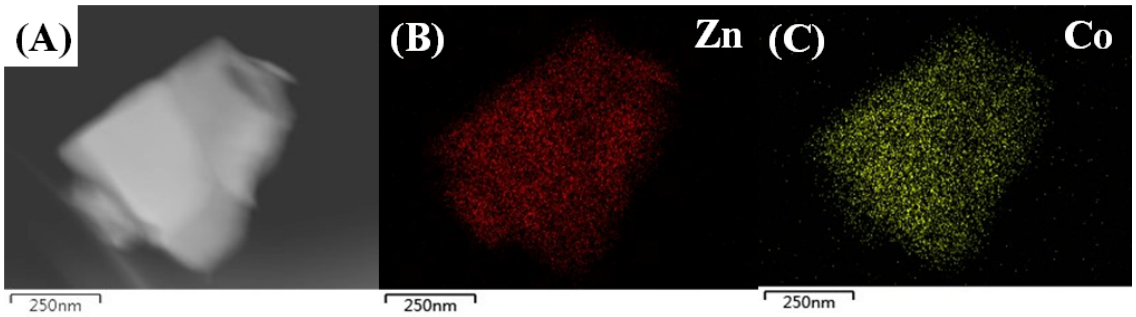


Fig. S4 HAADF image (A) and EDX mappings (B) and (C) of ZnCo-LDH-100

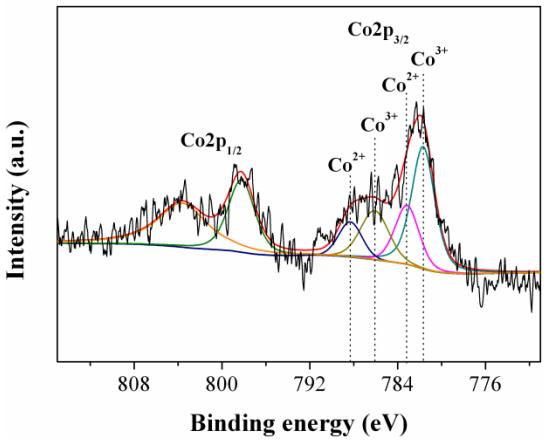


Fig. S5 XPS core level spectra of Co2p in the ZnCo-LDH-100

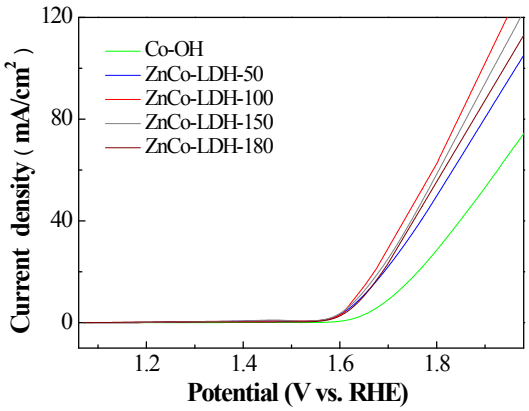


Fig. S6 LSV curves tested in 1 M KOH solution with ZnCo-LDH films and Co-OH as electrocatalysts.

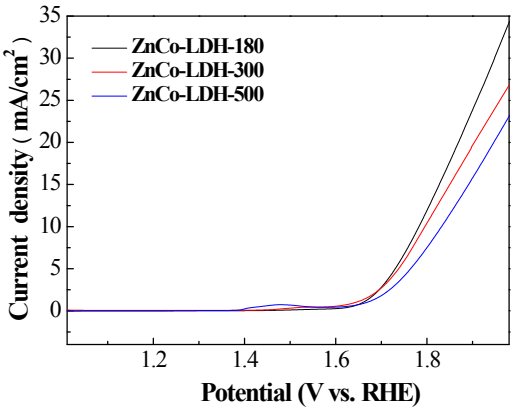


Fig. S7 LSV curves tested in 0.1 M KOH solution with ZnCo-LDH films at longer deposition time

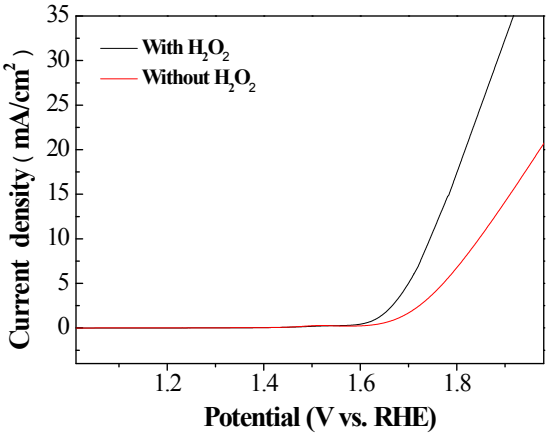


Fig. S8 LSV curves of ZnCo-LDH-100 films with addition of H_2O_2 (black) and without H_2O_2 (red) during the preparation of films, the LSV was tested in 0.1 M KOH solution.

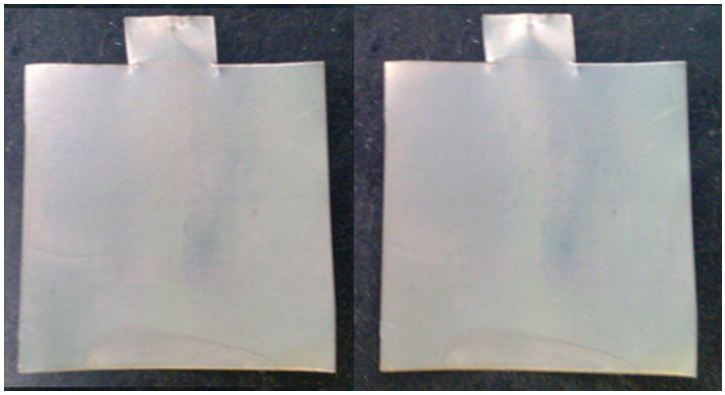


Fig. S9 Digital photos of ZnCo-LDH-100 films on Ni substrate before (left) and after (right) OER operation of 2 hr at an applied potential of 1.667 V

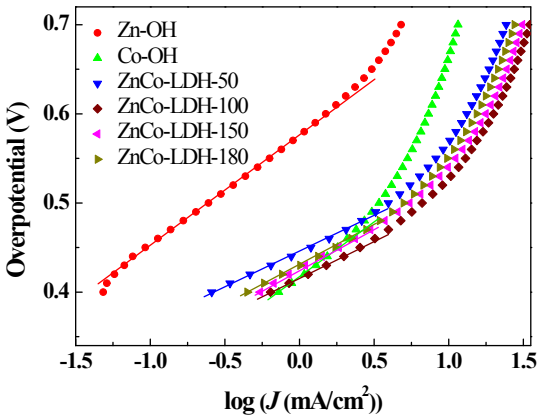


Fig. S10 Tafel plots of ZnCo-LDH electrocatalysts and the control samples

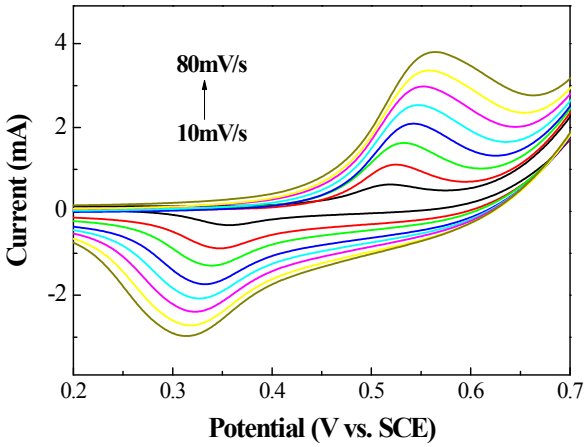


Fig. S11 Cyclic voltammogram curves of ZnCo-LDH-150 under different scan rate tested in 0.1 M KOH solution.

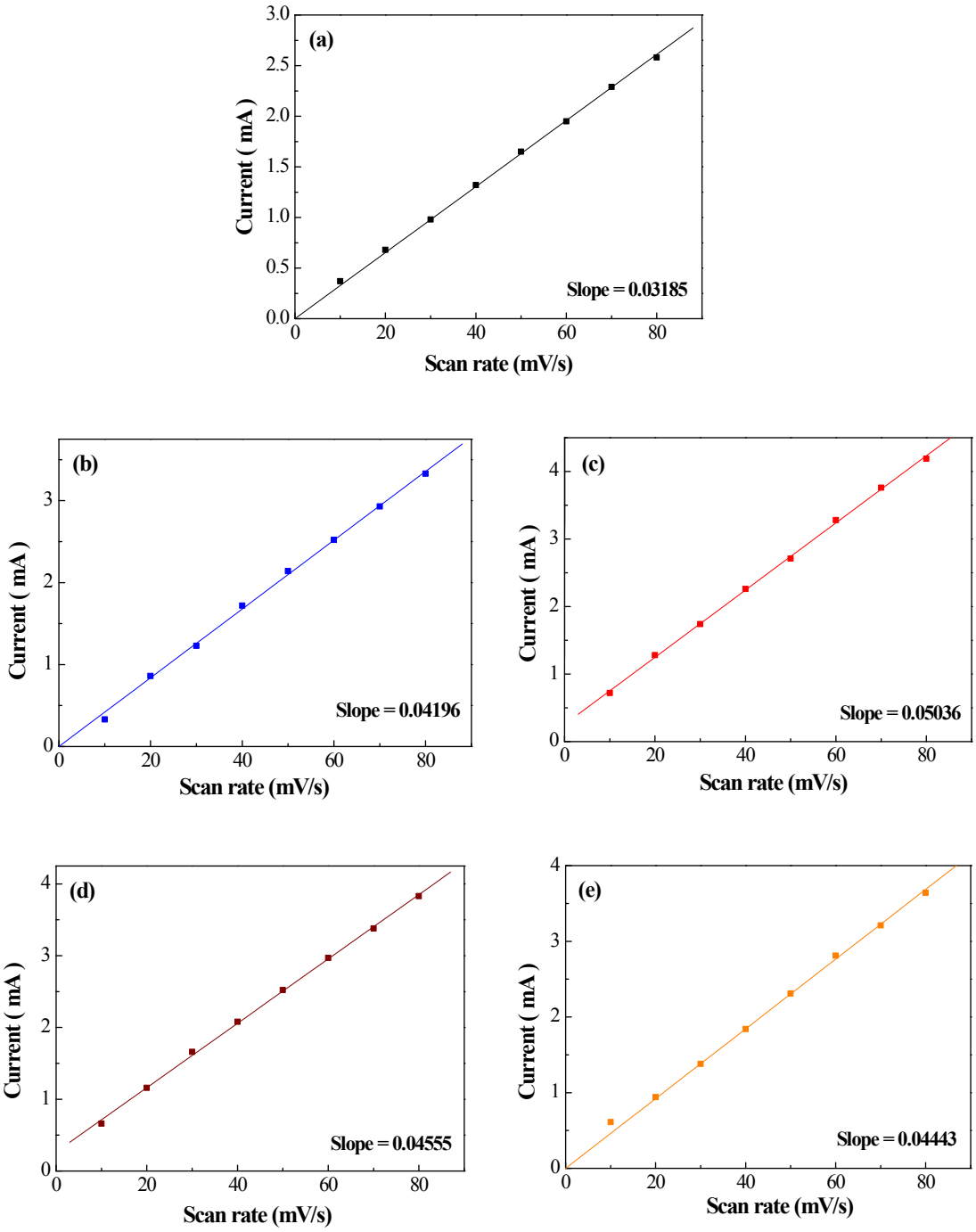


Fig. S12 Linear relationship of the peak current of Co^{3+}/Co^{2+} oxidation wave with the scan rate (a) Co-OH, (b) ZnCo-LDH-50, (c) ZnCo-LDH-100, (d) ZnCo-LDH-150, (e) ZnCo-LDH-180

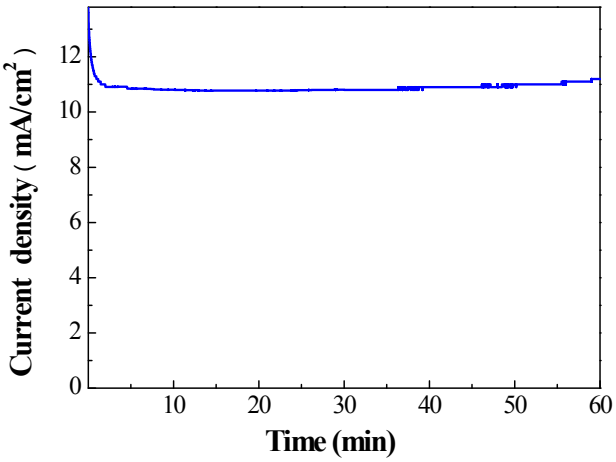


Fig. S13 Current-time curve during OER with ZnCo-LDH-100 as electrocatalyst at an applied potential of 1.767 V

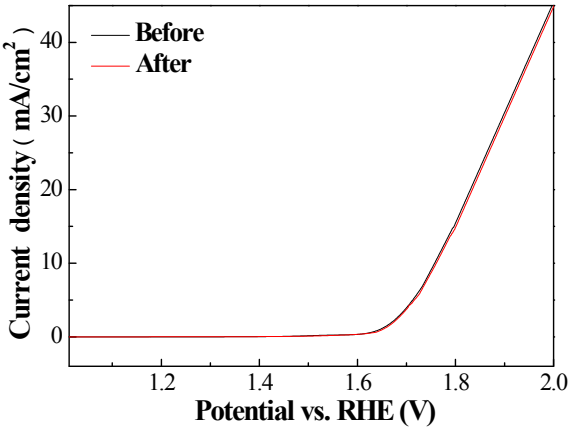


Fig. S14 LSV curves of ZnCo-LDH-100, before OER (black) and after 1 h OER operation (red) (tested in 0.1 M KOH)

Table S1 Comparison of ZnCo-LDH electrocatalysts based on a mass activity

Catalyst	**ZnCo-LDH-50**	**ZnCo-LDH-100**	**ZnCo-LDH-150**	**ZnCo-LDH-180**
Mass (mg)[a]	0.22	0.32	0.37	0.42
Mass activity @$\eta_{= 400mV}$ (A/g)[b]	2.3	5.8	3.2	2.1
Mass activity @$\eta_{= 450mV}$ (A/g)	11	21	11	8.3
Mass activity @$\eta_{= 500mV}$ (A/g)	36	51	32	24

[a] The mass was calculated by weighing the mass of Ni foil before and after the electrodeposition reactions.

[b] The current values were obtained from LSV curves tested in 0.1 M KOH solution.

Table S2 Electrochemical performance comparison of ZnCo-LDH and Co_3O_4 OER catalysts reported in the literatures

Catalyst	**Current density(mA/cm^2)**	**η (mV)**	**pH**	**TOF(s^{-1})**	**Refs**
ZnCo-LDH-100	0.67	300	14	0.0245	This work
ZnCo-LDH-100	0.917	330	14	0.045	This work
Co_3O_4	/	328	14	0.0187	[1]
Co_3O_4	/	300	14	0.04	[2]

Table S3 Electrochemical performance comparison of ZnCo-LDH and IrO_2 or RuO_2 OER catalysts reported in the literatures

Catalyst	Current density (mA/cm^2)	η (mV)	Tafel slope (mV/dec)	TOF(s^{-1})	pH	Refs
ZnCo-LDH-100	0.26	330	83	0.025	13	This work
ZnCo-LDH-100	0.67	300	61	0.0245	14	This work
IrO_2	0.5	300	/	/	13	[3]
RuO_2	0.7	300	/	/	13	[3]
IrO_2	11[a]	300	/	0.02	13	[3]
IrO_x	15[a]	300	49	0.009	14	[4]

[a] The values are in unit of A/g.

References

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2. N. H. Chou, P. N. Ross, A. T. Bell and T. D. Tilley, *ChemSusChem*, 2011, **4**, 1566-1569.

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4. L. Trotochaud, J. K. Ranney, K. N. Williams and S. W. Boettcher, *J. Am. Chem. Soc.*, 2012, **134**, 17253-17261.