Electronic Supplementary Information

Roughening of Windmill-Shaped Spinel Co_3O_4 Microcrystals Grown on a Flexible Metal Substrate by a Facile Surface Treatment for Enhanced Water Oxidation Performance

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Figures

Tables

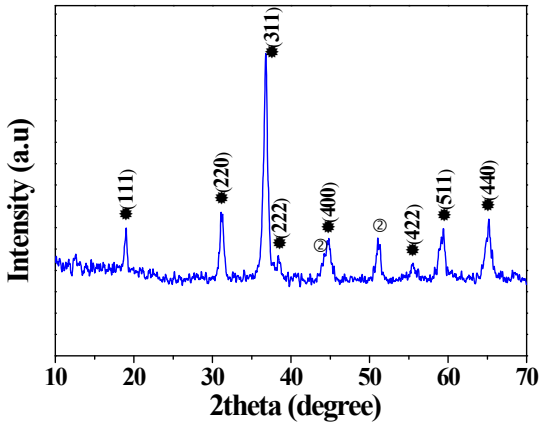

Fig. S1 XRD pattern of Co_3O_4-NW grown on a Ni foil (triangle: reflections from Ni)

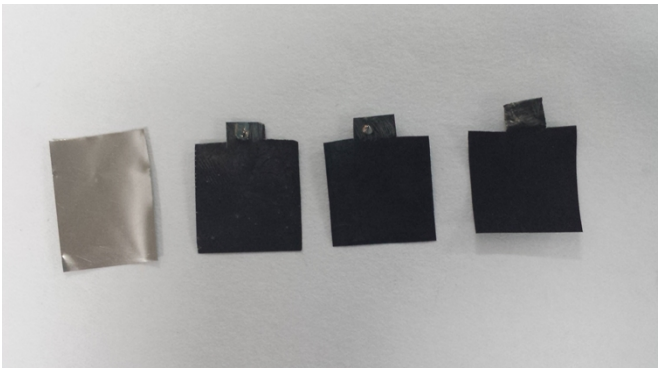

Fig. S2 Digital photos of bare substrate, Co_3O_4, Co_3O_4-3, and Co_3O_4-NW electrodes

(from left to right)

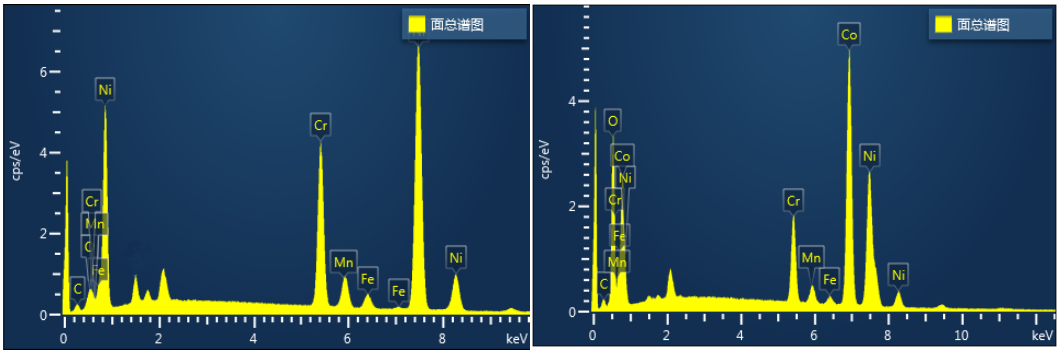

Fig. S3 Energy-dispersive X-ray spectra of substrate (left) and Co_3O_4 (right) grown on the substrate

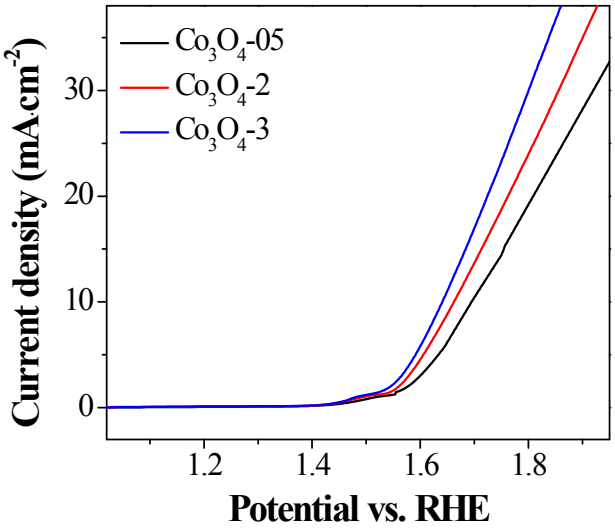

Fig. S4 Linear sweep voltammetry (LSV) curves of Co_3O_4 electrodes treated with different amount of solute (tested in 0.1 M KOH): Co_3O_4-05 (0.5wt%), Co_3O_4-2 (2wt%), Co_3O_4-3 (3wt%).

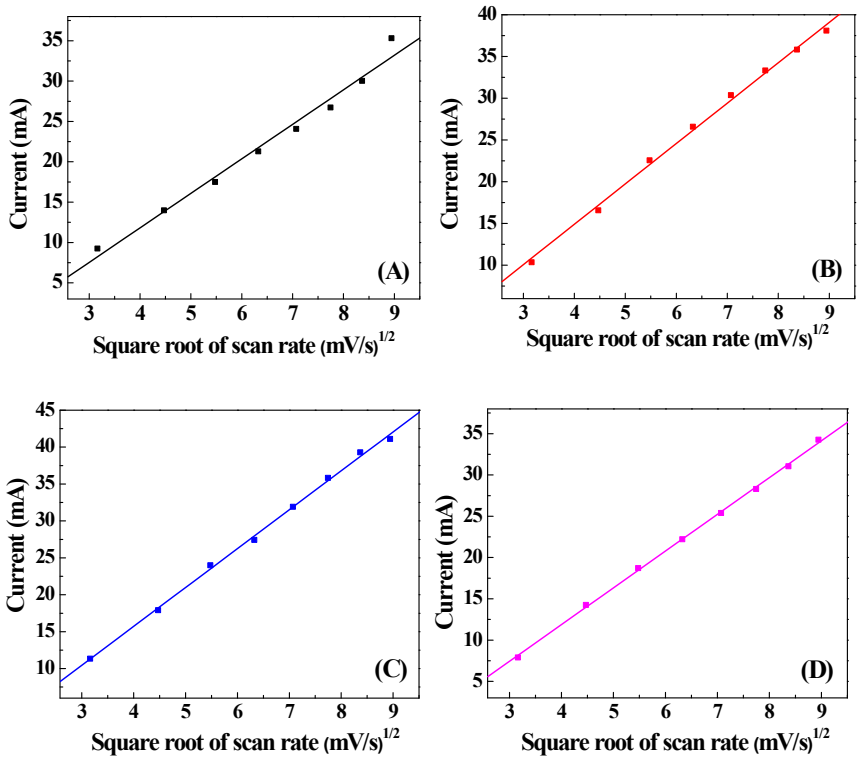

Fig. S5 Linear dependence of the peak current of the Co^{3+}/Co^{2+} oxidation wave with the square root of scan rate (A) Co_3O_4, (B) Co_3O_4-1, (C) Co_3O_4-3, (D) Co_3O_4-5 (tested in 0.1 M KOH)

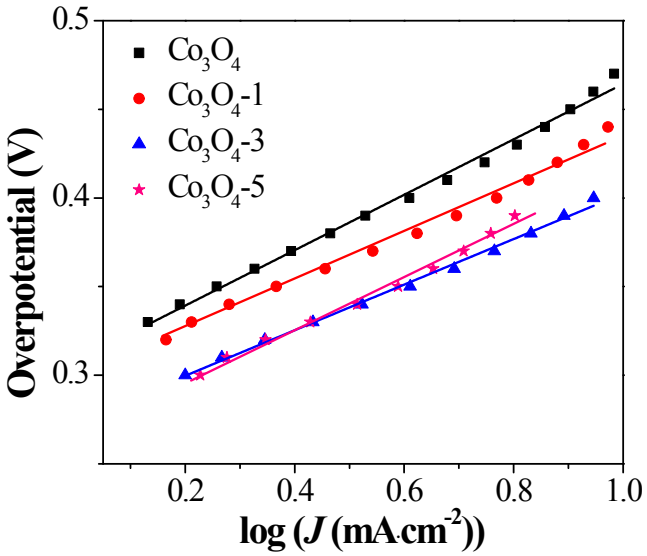

Fig. S6 Tafel plots of Co_3O_4 electrodes. The Tafel slopes were derived by fitting data in the linear part of the plots.

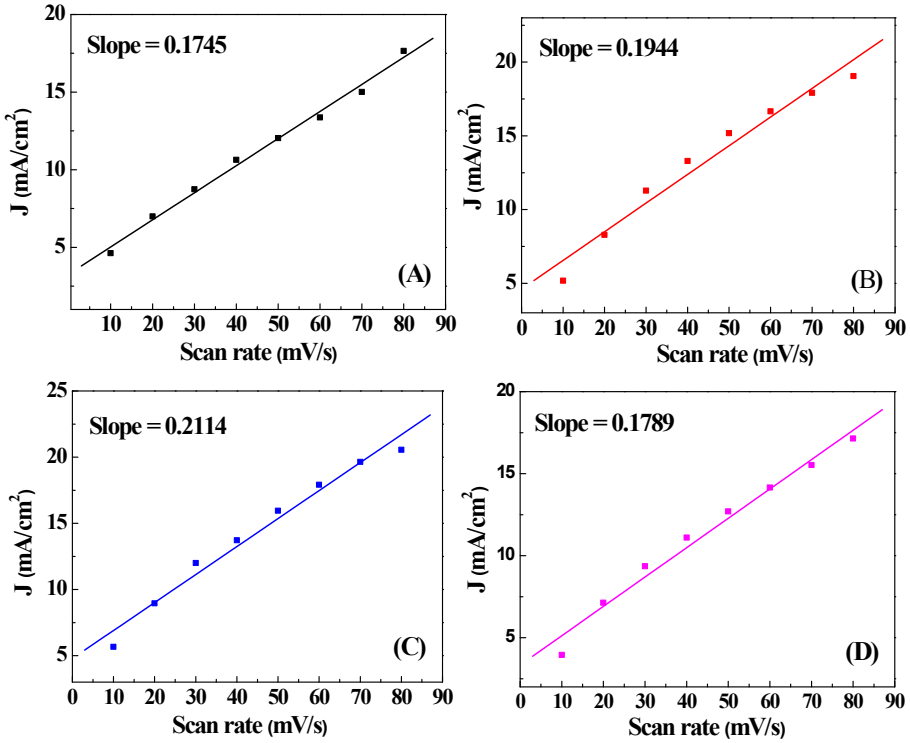

Fig. S7 Linear relationship of the peak current density of Co^{3+}/Co^{2+} oxidation wave with the scan rate (A) Co_3O_4, (B) Co_3O_4-1, (C) Co_3O_4-3, (D) Co_3O_4-5 (tested in 0.1 M KOH)

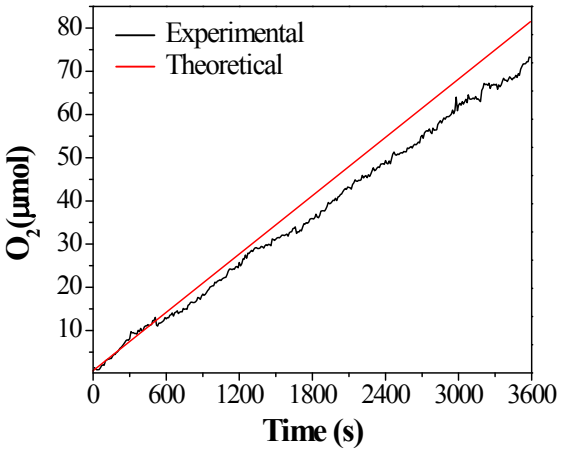

Fig. S8 O_2 evolution measurements from the Co_3O_4-3 electrode using an O_2 probe method (at 1.64 V vs RHE)

Fig. S9 SEM images of Co_3O_4 samples after 12 hr OER operation (1.58 V, 0.1 M KOH). (A) Co_3O_4, (B) Co_3O_4-1, (C) Co_3O_4-5

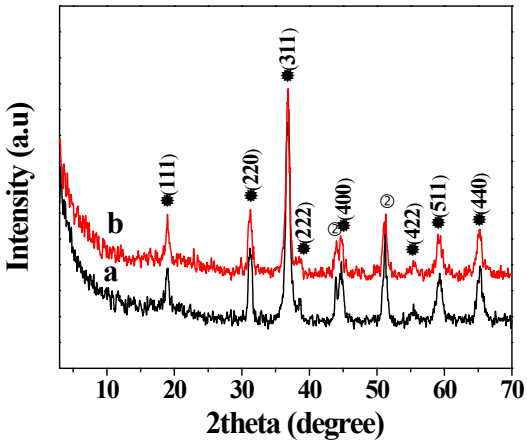

Fig. S10 XRD pattern of Co_3O_4-3 electrocatalyst before OER (a) and after 12 hr OER operation (b) (triangle: reflections from Ni)

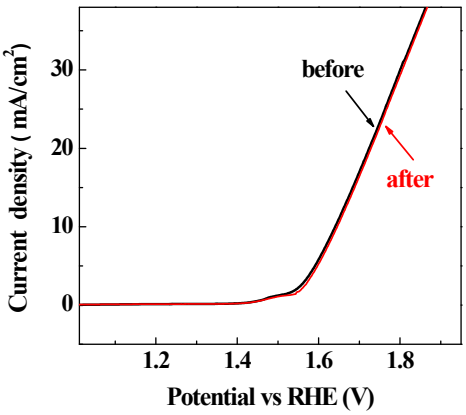

Fig. S11 LSV curves of Co_3O_4-3 electrocatalyst before OER (black) and after 12 hr OER operation (red) (1.58 V vs RHE, 0.1 M KOH)

Tables

Table S1 Elemental analysis of the substrate and Co_3O_4 sample measured by EDS

Element	wt%	
	Substrate	**Co_3O_4**
Co	/	46.82
Ni	73.21	27.98
Cr	21.10	8.40
Mn	1.90	0.83
Fe	2.31	1.02
O	1.48	14.95
Total	100	100

Table S2 Elemental analysis of Co_3O_4-3 sample measured by EDS instrument attached to TEM

Element	**at%**	**wt%**
Co	21.18	49.38
O	78.35	49.60
Ni	0.08	0.18
Cr	0.17	0.36
Mn	0.17	0.36
Fe	0.05	0.12
Total	100	100

Table S3 Comparison of Co_3O_4 electrocatalysts on a substrate based on a mass activity

Catalyst	Co_3O_4	Co_3O_4-1	Co_3O_4-3	Co_3O_4-5	Co_3O_4-NW
Mass (mg) [a]	3.0	3.1	3.1	3.2	3.5
Mass activity @$\eta_{= 400mV}$ (A/g)[b]	2.7	3.8	5.7	4.3	4.1
Mass activity @$\eta_{= 500mV}$ (A/g)	8.0	9.7	13	8.2	9.6

[a] The mass was calculated by weighing the foil before and after the growth of Co_3O_4.

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