

Supporting Information

Facile synthesis of ZnCo_2O_4 mesoporous structures with enhanced electrocatalytic oxygen evolution reaction properties

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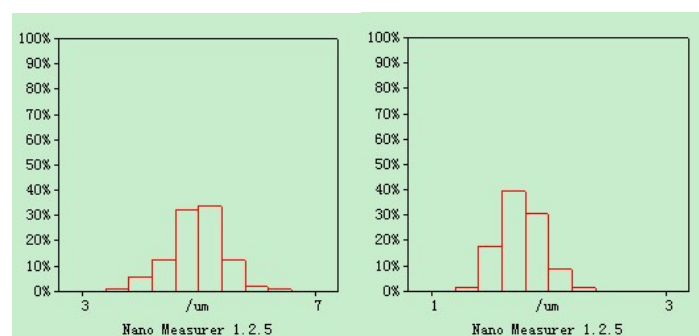


Fig.S1 The size distribution of the length (left) and diameter (right) of spindle-like ZnCo_2O_4 precursors.

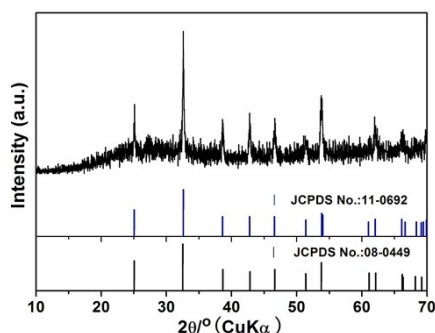


Fig.S2 The XRD pattern of spindle-like ZnCo_2O_4 precursors obtained at 180 °C for 12 h.

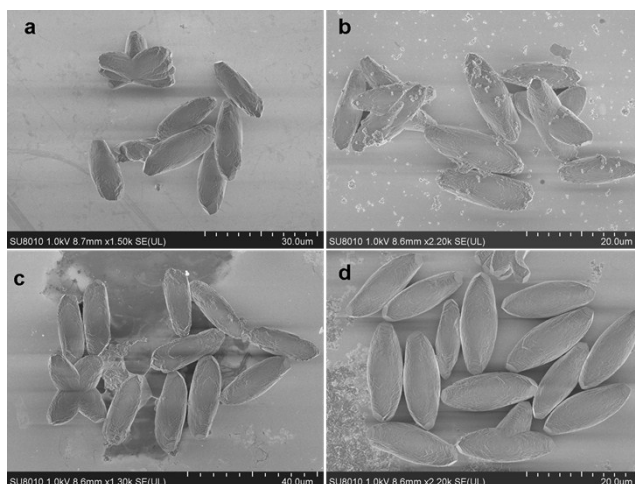


Fig.S3 SEM images of spindle-like ZnCo_2O_4 precursors obtained at $180\text{ }^\circ\text{C}$ for 12 h with different amount of PVP: (a) 0 mg, (b) 50 mg, (c) 100 mg, (d) 150 mg.

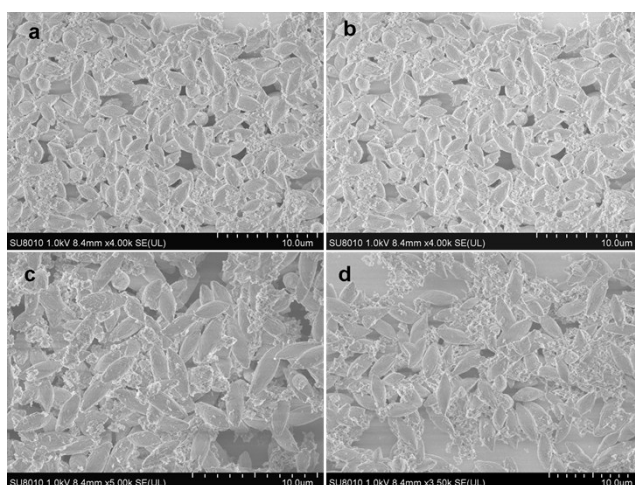


Fig.S4 SEM images of spindle-like ZnCo_2O_4 precursors obtained at $180\text{ }^\circ\text{C}$ for 12 h with different amount of hexylamine: (a) $0\text{ }\mu\text{L}$, (b) $25\text{ }\mu\text{L}$, (c) $50\text{ }\mu\text{L}$, (d) $75\text{ }\mu\text{L}$.

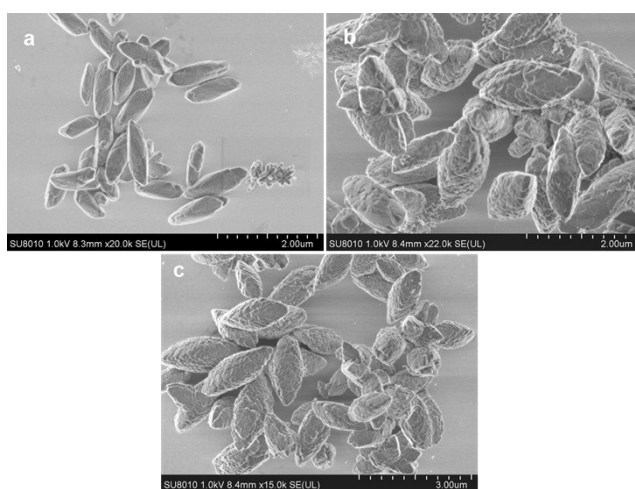


Fig.S5 SEM images of spindle-like ZnCo_2O_4 precursors obtained at $180\text{ }^\circ\text{C}$ for 12 h with different reactant concentrations: (a) $1/4$, (b) $1/2$, (c) $3/4$.

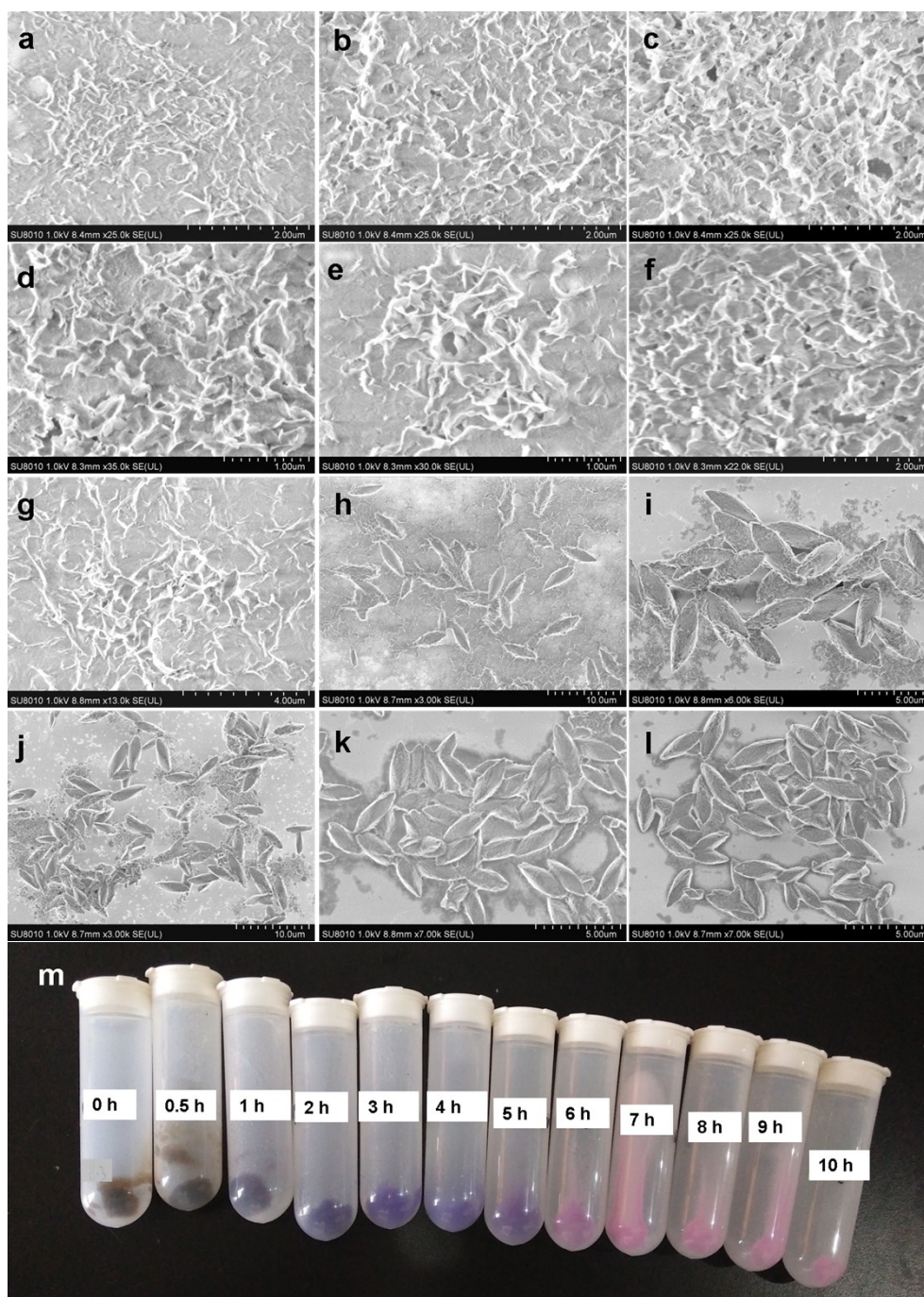


Fig.S6 SEM images of spindle-like ZnCo₂O₄ precursors obtained at 180 °C with different reaction time: (a) 0 h, (b) 0.5 h, (c) 1 h, (d) 2 h, (e) 3 h, (f) 4 h, (g) 5 h, (h) 6 h, (i) 7 h, (j) 8 h, (k) 9 h, (l) 10 h, (m) the photographs of the above samples.

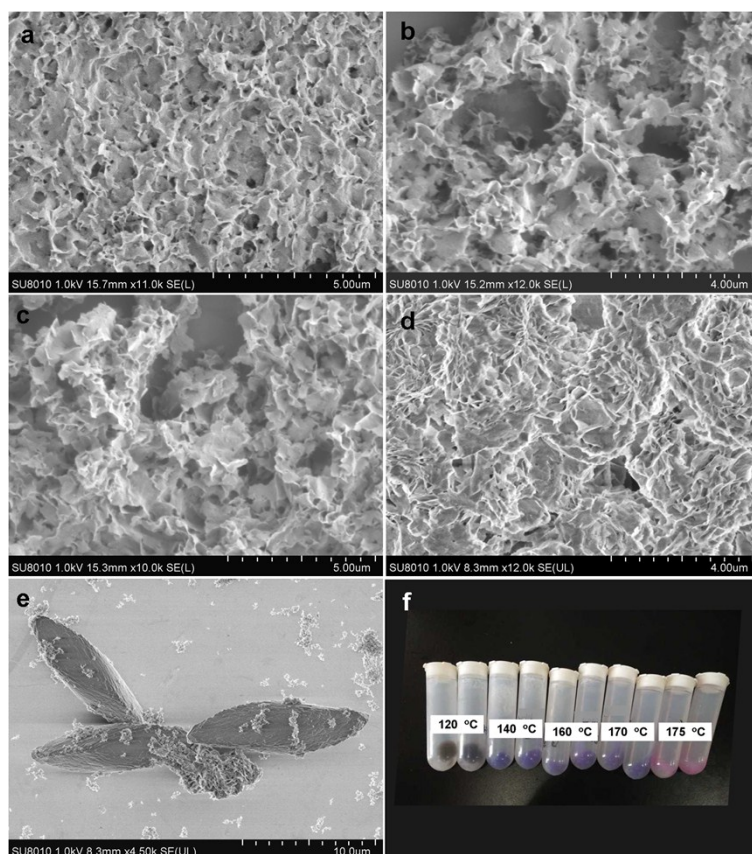


Fig.S7 SEM images of spindle-like ZnCo_2O_4 precursors synthesized by keeping the reaction time of 12 h with different reaction temperatures: (a) 120 °C, (b) 140 °C, (c) 160 °C, (d) 170 °C, (e) 175 °C, (f) the photograph of the corresponding precursors in (a-e).

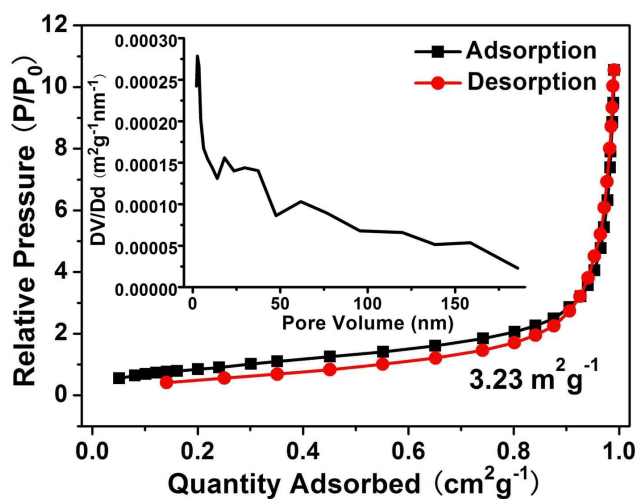


Fig.S8 The isotherm plot and the corresponding pore distribution curve of spindle-like ZnCo_2O_4 precursors.

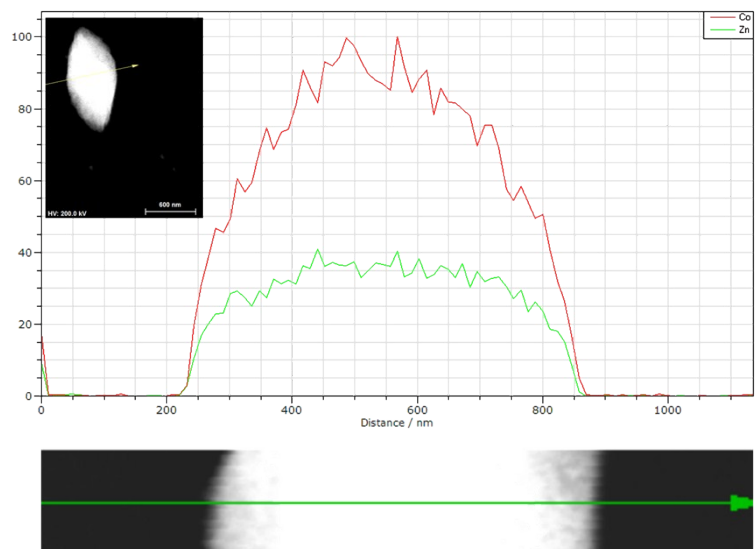


Fig.S9 Line scan and corresponding element distribution of a spindle-like ZnCo_2O_4 precursor synthesized at 180°C for 12 h.

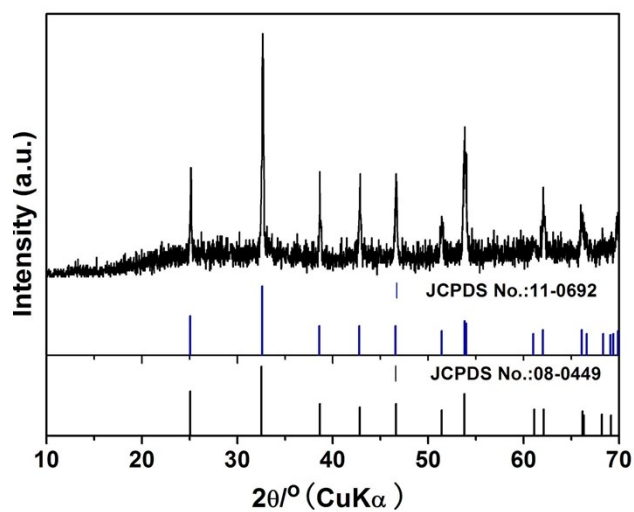


Fig.S10 The XRD pattern of truncated drum-like ZnCo_2O_4 precursors obtained at 180°C for 12 h.

Table 1 Comparison of OER activity in alkaline medium for different electrocatalytic materials

Catalysts	Electrolyt	Onset potential	Overpotential (mV) @10 mAcm ⁻²	Tafel slope (mV/dec)	Ref.
NiCo ₂ O ₄ nanosheets/NF	1 M KOH		360	50-60	66
NiCo ₂ O ₄ /GC	1 M KOH		400	50-60	
Mn _{2.1} Co _{0.9} O ₄	0.1 M KOH		1.76 V vs. RHE (530)	31	67
NiCo ₂ O ₄ nanowires	1 M KOH		460	90	68
La _{0.8} Sr _{0.2} Co _{0.2} Fe _{0.8} O _{3-δ} (LSCF-10%)	0.1 M KOH	1.583Vvs.RHE	1.643 V vs. RHE (413)	81.59	69
CoxSy@C-1000	0.1 M KOH		470		70
ZnCo ₂ O ₄ truncated drum	1 M KOH		419	63.52	Our
ZnCo ₂ O ₄ spindle	1 M KOH		389	57.32	work

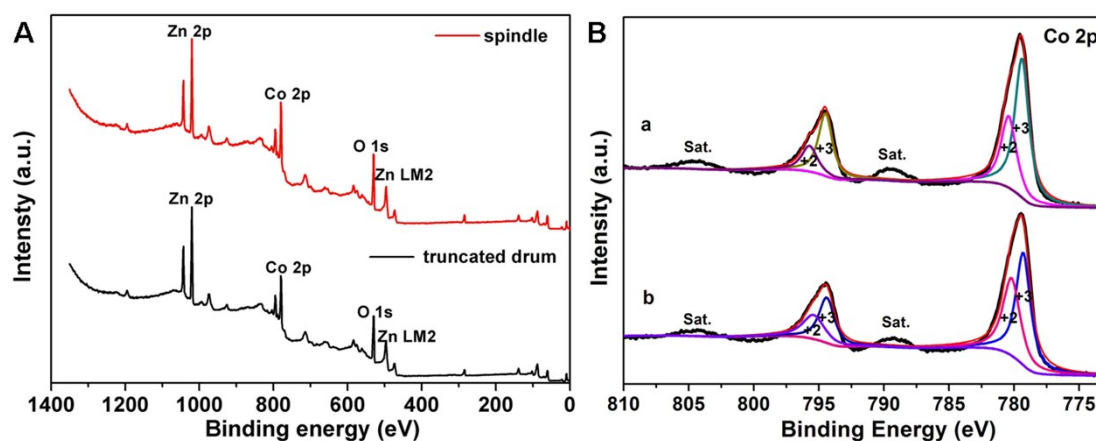


Fig.S11 (A) XPS spectra of ZnCo₂O₄ with different morphologies, (B) Co 2p XPS spectra of (a) spindle-like samples. (b) truncated drum shaped samples.

Table 2 Comparison of the ratios of Co³⁺/Co²⁺ by integrating the XPS peaks of Co2p of ZnCo₂O₄ micro-crystals with different morphologies.

Sample	Areas of fitted peak				
	Co ³⁺ (2p _{3/2})	Co ²⁺ (2p _{3/2})	Co ³⁺ (2p _{1/2})	Co ²⁺ (2p _{1/2})	Co ³⁺ /Co ²⁺
ZnCo ₂ O ₄ truncated drum	116036.5	97289.34	49383.88	37028.75	1.23
ZnCo ₂ O ₄ porous spindle	112678.6	62529.64	49666.42	23274.31	1.89

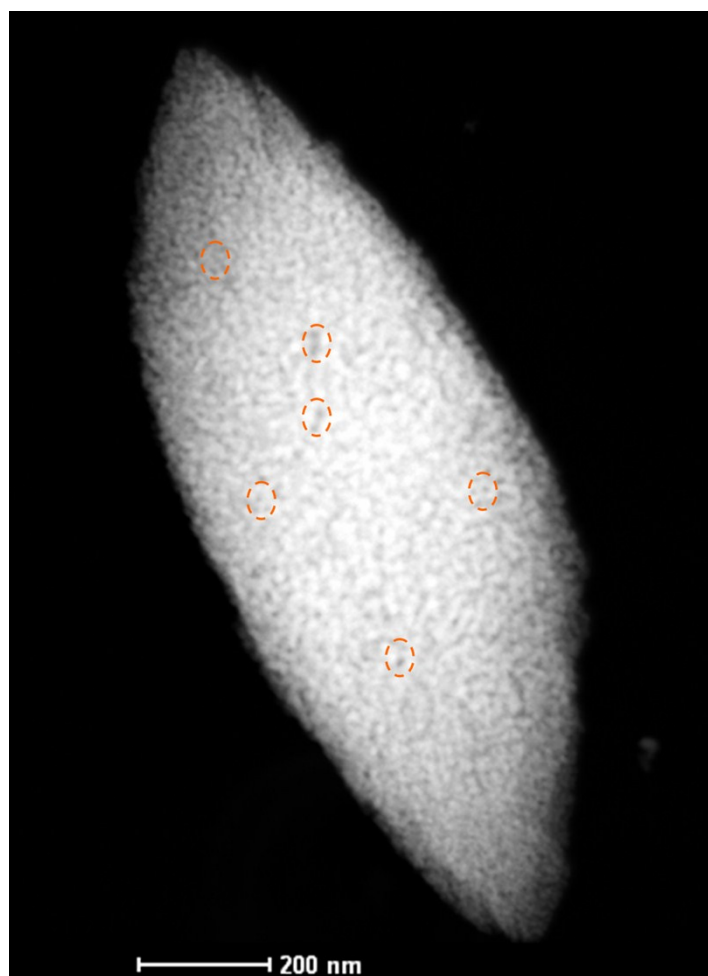


Fig.S12 The STEM image of an individual ZnCo₂O₄ micro-spindle (inset cycles present mesopores obtained from the annealed ZnCo₂O₄ precursor).

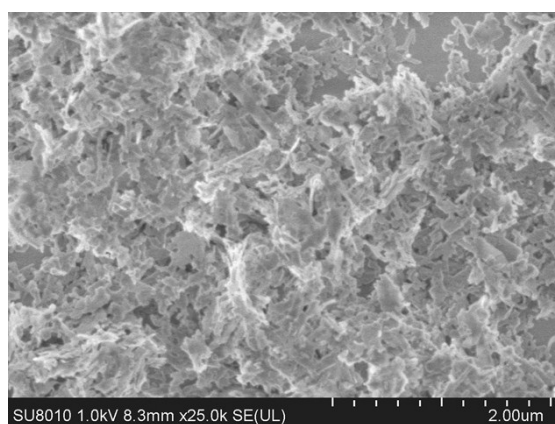


Fig.S13 SEM images of truncated drum shaped ZnCo₂O₄ precursors obtained at 180 °C for 12 h with 0.3 mL of triethylamine.