Electronic Supplementary Information (ESI)

Al³⁺ inducing growth of α-Co(OH)₂ nanoplates as high capacity supercapacitors and water oxidation electrocatalyst

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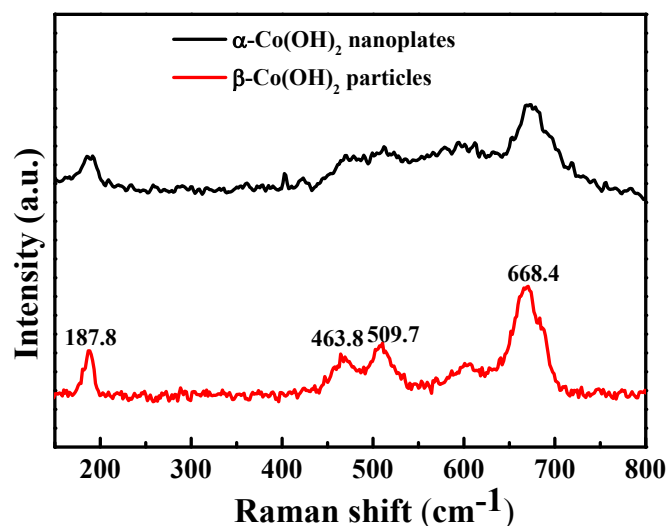
Fig. S1 Raman spectroscopy for the samples.

Figure S1 shows the Raman spectrum of the α-Co(OH)₂ nanoplates and β-Co(OH)₂ particles, which would provide additional insights into the chemical composition of the samples. All the Raman peaks at 187.8, 463.8, 509.7 and 668.4 cm⁻¹ can be assigned to the characteristic $E_g(T)$, $A_{1g}(T)$, $A_{2u}(T)$ and $E_g(R)$ modes of the hexagonal brucite-like Co(OH)₂, respectively.[1,2] When introduced Al³⁺ ions into the reaction system, Al³⁺ ions partly substitude the position of Co²⁺ ions and form layer α-Co(OH)₂ nanoplates, the Raman modes of α-Co(OH)₂

nanoplates broaden compared with that of the β-Co(OH)₂ particles. This behavior could be attributed to attributed to vacancies, structural defects and chemical impurities.[1,3]
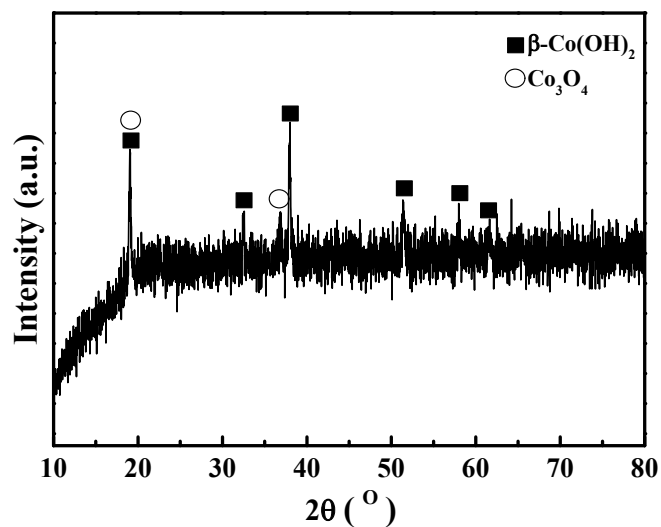

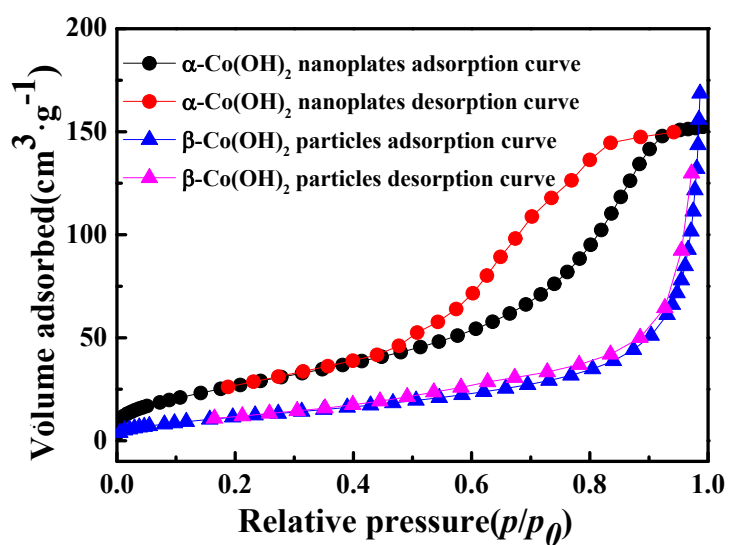**Fig. S2** XRD pattern of the sample controlled by NaCl.

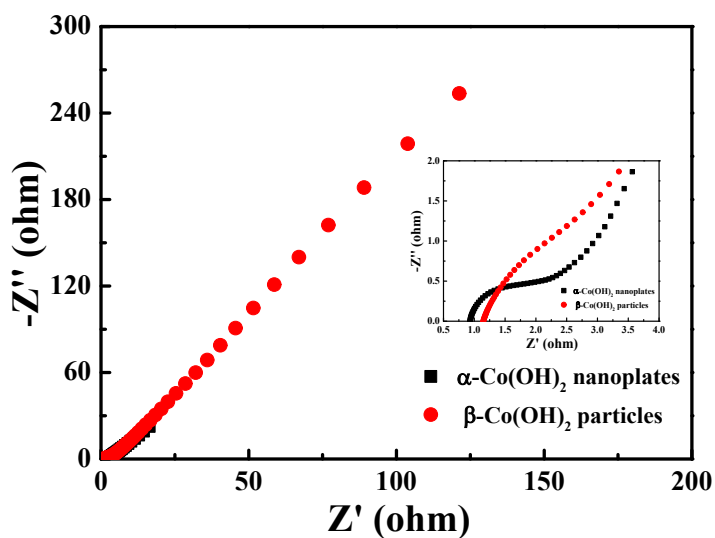**Fig. S3** Nitrogen adsorption-desorption isotherms of the samples.

Fig. S4 Electrochemical impedance spectra of α-Co(OH)$_2$ nanoplates and β-Co(OH)$_2$ particles for supercapacitor.

Table S1. The OER activities of different samples in 1M KOH

sample	Onset potential (V vs. RHE)	ŋ at 10 mA·cm^{-2} [mV]	Mass activity at ŋ=348 mV （A/g）	Tafel slope [mV/dec]
α-Co(OH)$_2$ nanoplates	1.51	348	28.2	151.8
β-Co(OH)$_2$ particles	1.59	449	0.2	95.6

References

1   S. R. Shieh, T. S. Duffy, *Phys. Rev. B*, 2002, **66,** 134301-134308.

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3   M.C. Bernard, R. Cortes, M. Keddam, H. Takenouti, P. Bernard, S. Senyarich, *J. Power Sources*, 1996, **63**, 247-254.