

Supplementary Information

Precursor Accumulation on Nanocarbons for the Synthesis of LaCoO_3
Nanoparticles as Electrocatalysts for Oxygen Evolution Reaction

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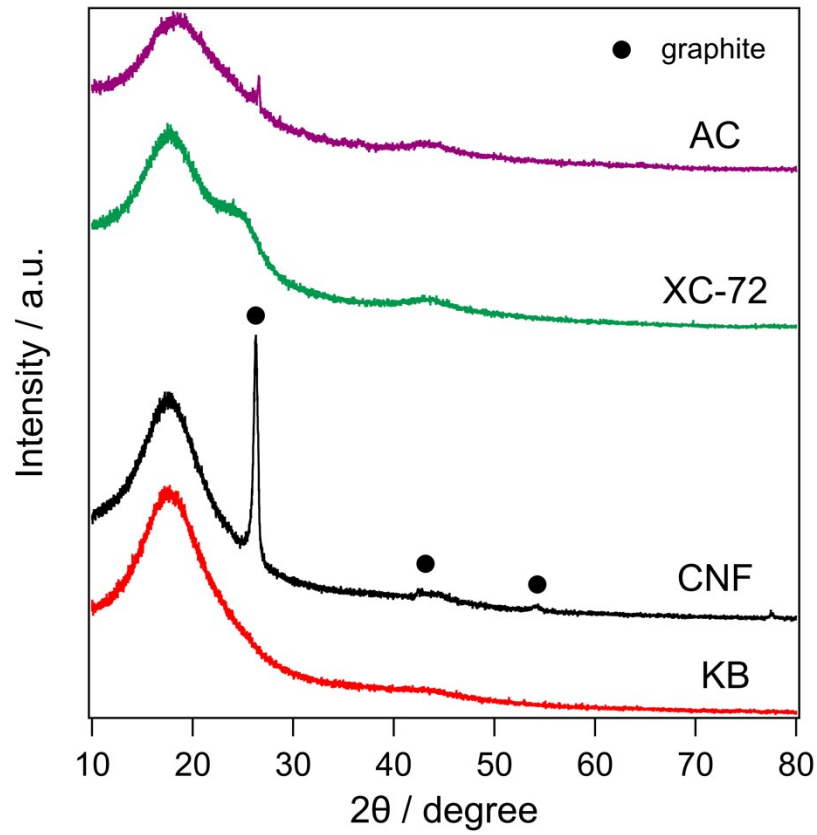


Fig. S1 XRD patterns of KB, CNF, XC-72, and AC. The graphite peaks are indicated by black dots. The broad peak at ca. 18° is attributed to liquid paraffin used to fix the carbon powder on the sample holder.

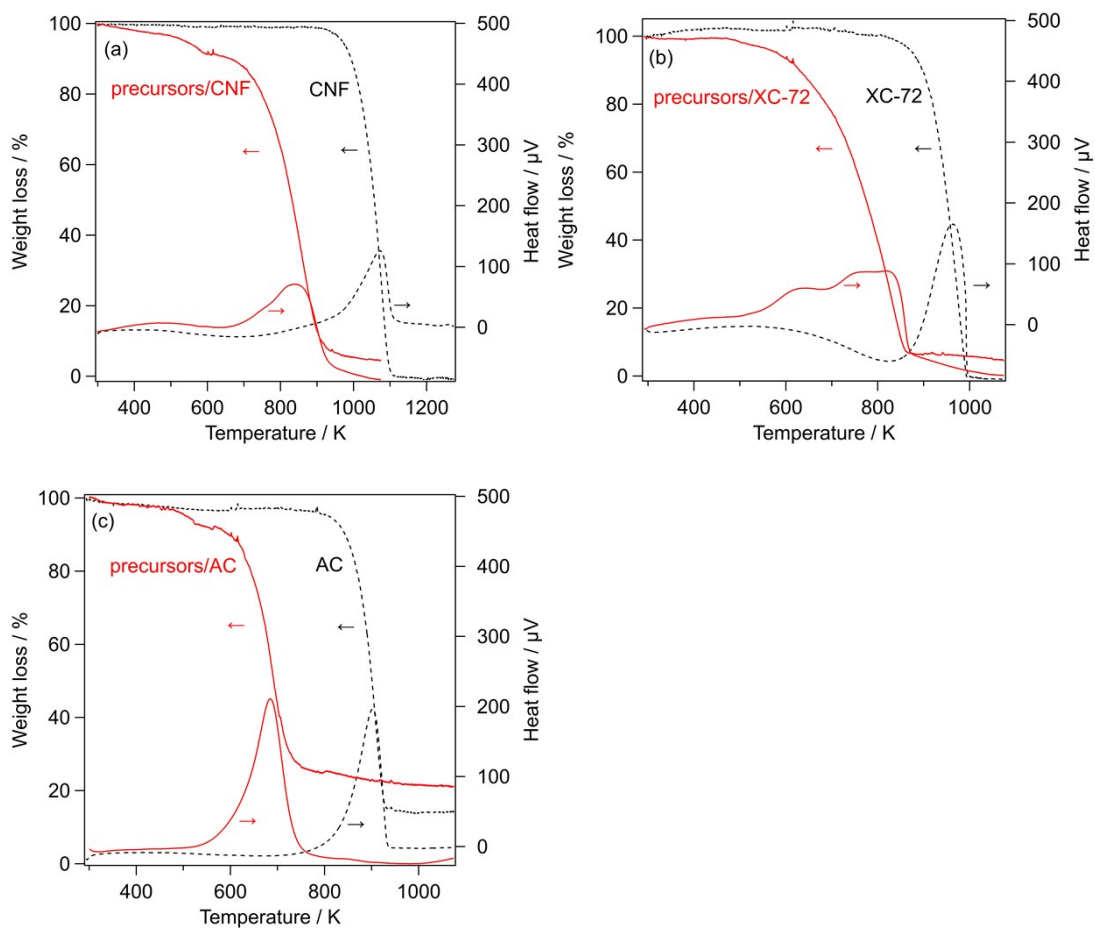


Fig. S2 TG/DTA curves of carbon supports and precursor/carbon composites (the perovskite precursors were accumulated on the carbon support): (a) CNF, (b) XC-72, and (c) AC. Precursors: $\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ and $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$; Drying temperature for precursor/carbon: 403 K.

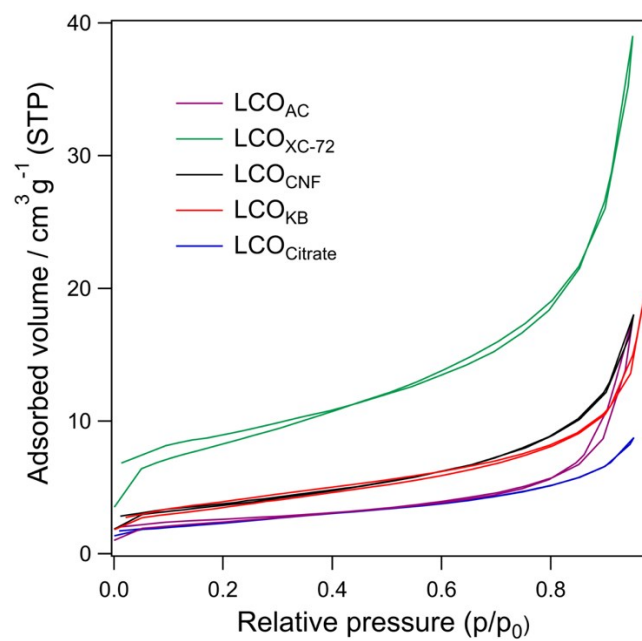


Fig. S3 Nitrogen adsorption/desorption isotherms of LCO_{KB}, LCO_{CNF}, LCO_{XC-72}, and LCO_{AC}.

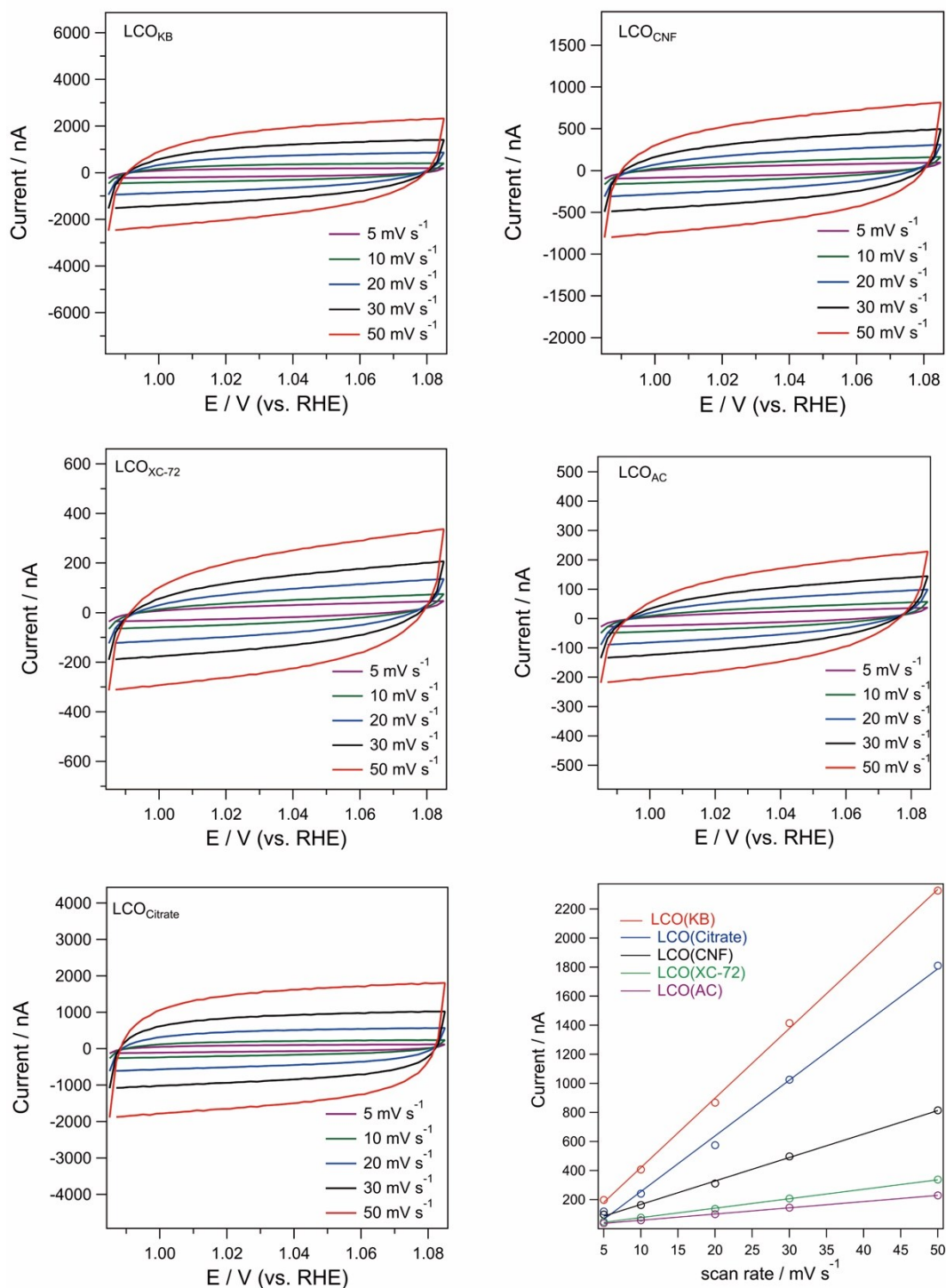


Fig. S4 CV curves and current-scan rate plots for the measurements of double layer capacitance (C_{DL}) to determine the electrochemically active surface area (ECSA) of LMO samples.

Table S1 OER activity and ECSA for LCO samples.

Sample	onset potential at 0.1 mA cm ⁻² (V)	Tafel slope (mV dec ⁻¹)	ECSA (cm ²)
LCO _{Citrate}	1.51	81	0.96
LCO _{KB}	1.51	74	1.2
LCO _{CNF}	1.54	71	0.4
LCO _{XC-72}	1.59	106	0.16
LCO _{AC}	1.72	107	0.11

Electrochemically active surface area (ECSA) of LCO samples was determined by the measurements of electrochemical double layer capacitance (C_{DL}). By using the same electrolyte solution as OER tests, CV was measured from 0.1 to 0.2 V vs. Hg/HgO at 5, 10, 20, 30, and 50 mV s⁻¹. C_{DL} was calculated by using the following equation.

$$C_{DL} = I_{DL} / \nu \quad (S1)$$

I_{DL} is the current at 0.2 V vs. Hg/HgO and ν is the scan rate. The slope for I_{DL} - ν plot gives C_{DL} . Dividing C_{DL} by the specific capacitance (C_S), ECSA was obtained as shown in Eq S2.

$$ECSA = C_{DL} / C_S \quad (S2)$$

Here, we used C_S of 0.040 mF cm⁻².^[1]

[1] X. Li, H. Wang, Z. Cui, Y. Li, S. Xin, J. Zhou, Y. Long, C. Jin, J. B. Goodenough, *Sci. Adv.* 2019; **5**: eaav6262.

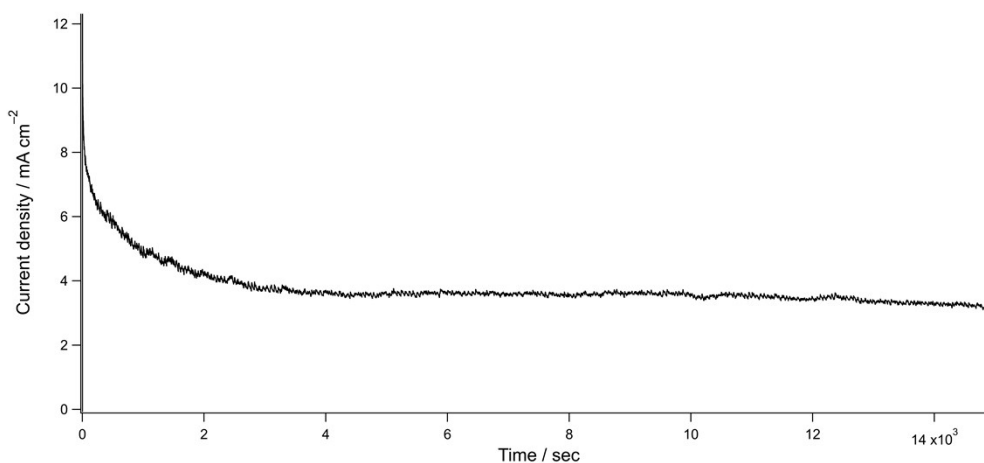


Fig. S5 Chronoamperometry of LCO_{KB} for OER at 1.73 V vs. RHE.

Chronoamperometry was carried out as the following procedure. A glassy carbon disk electrode (0.196 cm²), a Hg/HgO electrode (internal solution: 1 M NaOH; +0.118 V vs. reversible hydrogen electrode (RHE)), and a Pt wire were used as the working, reference, and counter electrodes, respectively. A catalyst ink was prepared by sonicating a mixture of LCO_{KB} (5 mg), carbon black (1 mg, DENKA Black Li-435; Denka Co. Ltd.), ethanol (0.97 mL), deionized water (30 μ L), and 5 wt% Nafion perfluorinated resin solution (50 μ L). Then, 4 μ L of the catalyst ink was dropped on the glassy carbon disk electrode and dried at room temperature. An O₂-saturated KOH aqueous solution (0.1 M; pH = 13) was used as the electrolyte. Stable potential at 1.73 V vs. RHE was applied on the working electrode.