

Supplementary materials

The detailed information of all medications and reagents is as follows: iron nitrate hexahydrate (98.5 wt%) and N, N-dimethylformamide (DMF) are purchased from Sinopharm Chemical Reagent Co., Ltd. Lanthanum nitrate hexahydrate (99.99 wt%) and palladium nitrate dihydrate (99 wt%) are obtained from Shanghai Aladdin Biochemical Technology Co., Ltd. Citric acid (99.5 wt%) and ethylene glycol (98 wt%) were supplied by Macklin Co., Ltd. The solutions used in the test were not further processed either. Absolute ethanol (99.7 wt%), acetone (99.5 wt%), methanol (99.5 wt%), aqueous ammonia (25 wt%–28 wt%) are purchased from Sinopharm Chemical Reagent Co., Ltd. Isopropanol (99.5 wt%) were supplied by Macklin Co., Ltd.

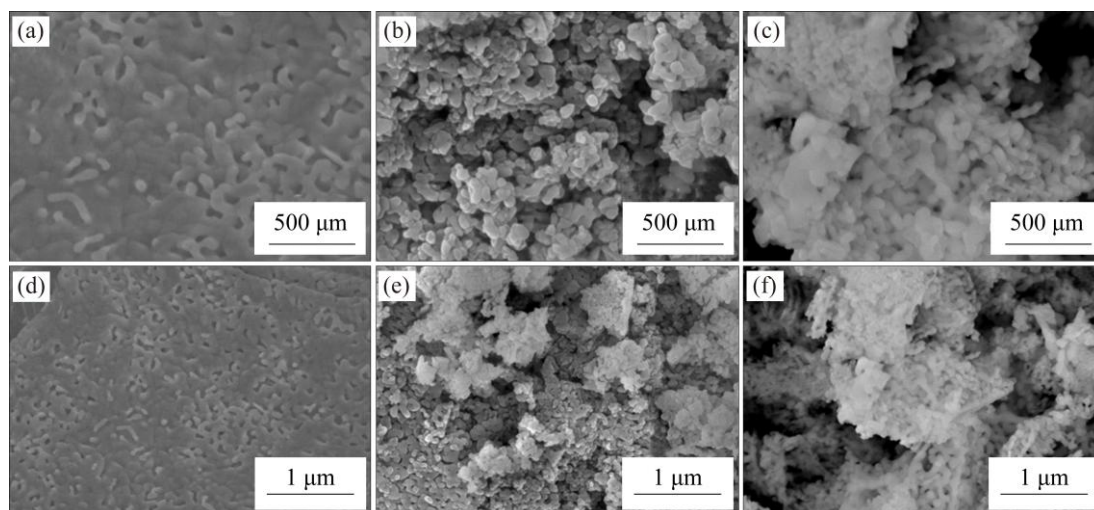


Figure S1 (a, d) SEM images of LFO-S-750 °C; (b, e) SEM images of LFO-F-650 °C; (c, f) SEM images of LFO-F-750 °C

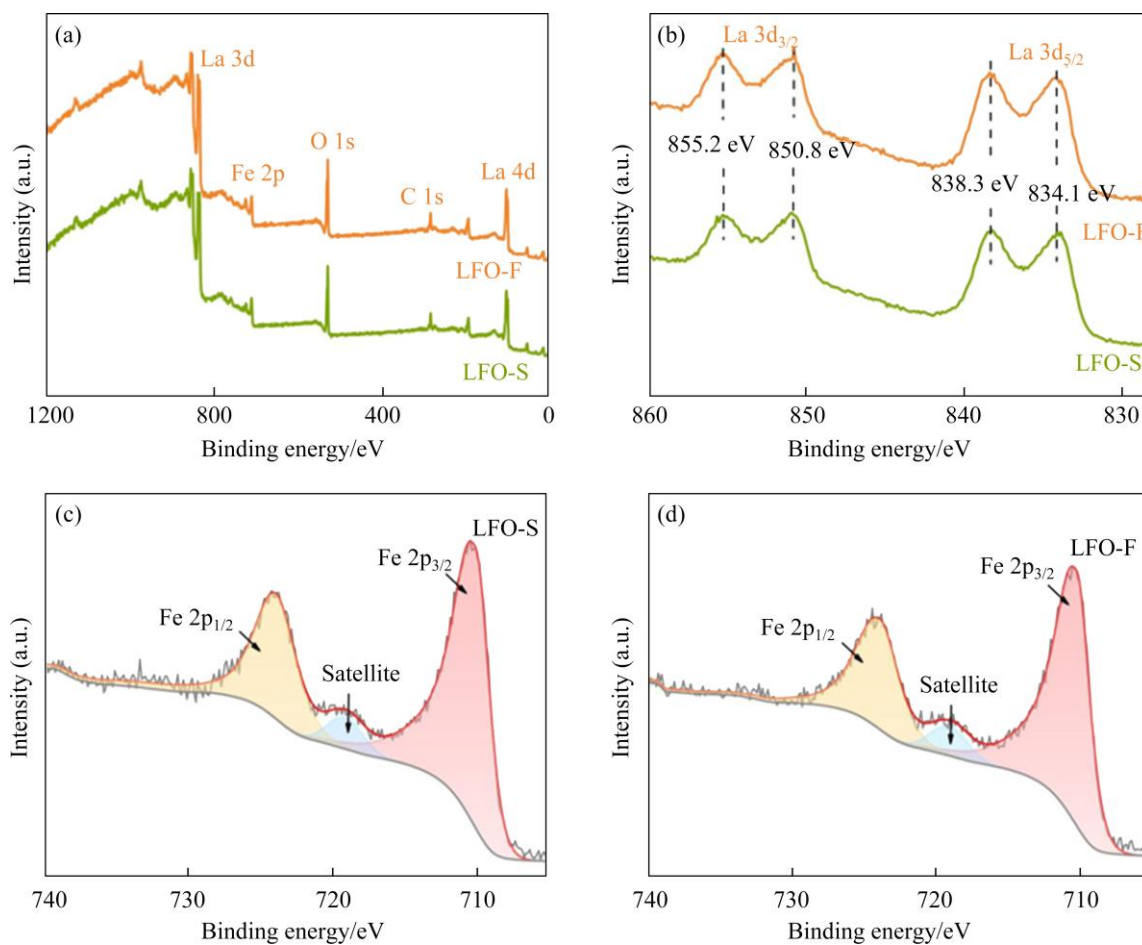


Figure S2 (a) XPS fully scanned survey spectra for LFO-S and LFO-F; (b) XPS spectra of La 3d for as-prepared samples; XPS spectra of Fe 2p for (c) LFO-S and (d) LFO-F

Table S1 Binding energy and relative content of each oxygen species in LFO-S and LFO-F

Sample	Oxygen species	Binding energy/eV	Relative percentage
LFO-F	O _L	529.2	61.25%
	O _v	531.5	28.94%
	O _c	532.9	9.81%
LFO-S	O _L	529.2	67.86%
	O _v	531.6	24.10%
	O _c	533.0	8.04%

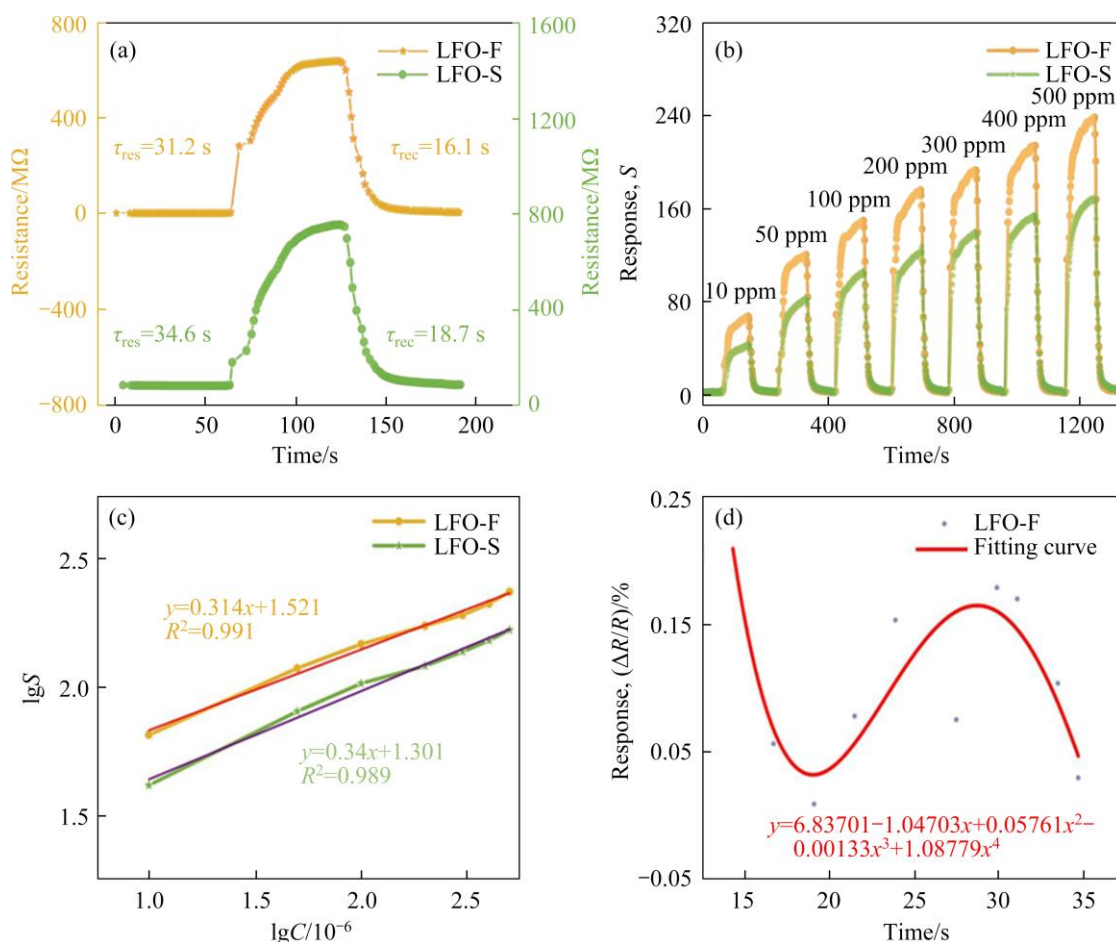


Figure S3 (a) Response/recovery time of the two sensors to 50 ppm acetone; (b) The curves of response value changes under the concentration of acetone ranging from 10 to 500 ppm; (c) The liner fitting curve between the response value and the concentration of acetone at the ppm level; (d) Fourth-order polynomial curve fitting of the data versus time

Table S2 The atomic concentration and active oxygen ratio in the LFO-S and LFO-F samples at%

Sample	LFO-F	LFO-S
C 1s (XPS)	26.70	24.34
Fe 2p (XPS)	8.35	8.12
La 3d (XPS)	11.30	12.19
Total O 1s (XPS)	53.65	55.35
O _v content	28.94(relative)/15.52(absolute)	24.10 (relative)/13.34 (absolute)
O _c content	9.81 (relative)/5.26 (absolute)	8.04 (relative)/4.45 (absolute)
(O _v +O _c)/total O (active oxygen)	38.73	32.14

Table S3 Relevant information of BET characterization

Sample	$S_{\text{BET}}/(\text{m}^2 \cdot \text{g}^{-1})$	$V_p/(\text{cm}^3 \cdot \text{g}^{-1})$	d_p/nm
LFO-F	8.1499	0.0259	19.78
LFO-S	5.0383	0.0247	19.29

Table S4 Calculation process of LOD

Time/s	R_a	$Y_i/\%$	Y	$(Y_i-Y)^2$
14.303	8645421	0.217525555	0.210562537	4.8484×10^{-5}
16.703	8631486	0.056432925	0.070016332	1.8451×10^{-4}
19.103	8625824	0.009170138	0.035876362	7.1322×10^{-4}
21.503	8633361	0.078138746	0.062439502	2.4647×10^{-4}
23.903	8639857	0.153266426	0.112664288	1.6485×10^{-3}
27.503	8620126	0.075277322	0.172654669	9.4823×10^{-3}
29.903	8611235	0.178603882	0.176819339	3.1846×10^{-6}
31.103	8611992	0.169798114	0.164818852	2.4793×10^{-5}

Note: R_a is the resistance in the air, Y is the fitted $\Delta R/R$.

Curve-fitting equation obtained from the fourth order polynomial fit:

$$Y=6.83701-1.04703X-0.05761X^2-0.00133X^3+1.08779X^4$$

$$\text{RMS}_{\text{noise}} = \sqrt{S^2 / N} \quad (\text{S1})$$

$$\text{LOD} = 3 \times \text{RMS}_{\text{noise}} / \text{slope} \quad (\text{S2})$$

where Y_i is the measured data point and Y is the corresponding value calculated from the above curve-fitting equation. Here, $\text{RMS}_{\text{noise}}$ represents the root-mean-square standard deviation of the noise. The curve fitting utilizes 10 data points ($N=10$) in air environment, with the slope representing the value derived from the linear calibration curve of the response-concentration relationship. The standard deviation ($S^2=(Y_i-Y)^2$) of the response curve for the LFO-F sensor is 0.0144, and the calculated $\text{RMS}_{\text{noise}}$ is 0.0379. Based on the calculated $\text{RMS}_{\text{noise}}$, the theoretical LOD of the LFO-F sensor is determined to be 19.3 ppb.