

Electronic Supplementary Material (ESI) for New Journal of Chemistry

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## Supporting Information

### Ultra-sensitive hydrogen peroxide electrochemical sensor based on dual-phase perovskite oxide tubular nanofiber

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**Fig. S1** (a) The EDS spectra and (b) Comparison of ICP-OES and EDS results of dual-phase LaSrNiO NFs.

**Fig. S2** (a) FT-IR spectra of LaNiO NFs and LaSrNiO NFs.

**Fig. S3** CV curves of LaSrNiO NFs at different temperatures with or without 2.5 mM H<sub>2</sub>O<sub>2</sub>: (a) 500 °C, (b) 600 °C, (c) 700 °C, (d) 800 °C, (e) 900 °C, (f) 1000 °C.

**Fig. S4** (a) CVs of the LaSrNiO/GCE-700 obtained in 0.1 M NaOH with 0.5 mM H<sub>2</sub>O<sub>2</sub>, scan rate:100 mV/s. (b) CV curves of the LaSrNiO/GCE-700 obtained in 0.1 M PBS with 0.5 mM H<sub>2</sub>O<sub>2</sub>, scan rate:100 mV/s.

**Fig. S5** (a) The CVs of (a)Bare GCE, (b) LaNiO/GCE-700, and (c) LaSrNiO/GCE-700 obtained in 0.1 M NaOH with and without 1 mM H<sub>2</sub>O<sub>2</sub>, scan rate:100 mV/s.

**Fig. S6** CV curves of (a) LaNiO/GCE-700 and (c) LaSrNiO/GCE-700 obtained at different scan rates (50 ~ 100 mV/s). The corresponding linear relationship between the scan rate and the current density of (b) LaNiO/GCE-700 and (d) LaSrNiO/GCE-700.

**Fig. S7** (a) The linear relationship of CV reduction peak potential versus  $\ln v$  for LaSrNiO/GCE-700 at different scan rates.

**Fig. S8** Amperometric response of (a) LaNiO/GCE-700 and (b) LaSrNiO/GCE-700 at 0.1 M NaOH with 100  $\mu$ M H<sub>2</sub>O<sub>2</sub>.

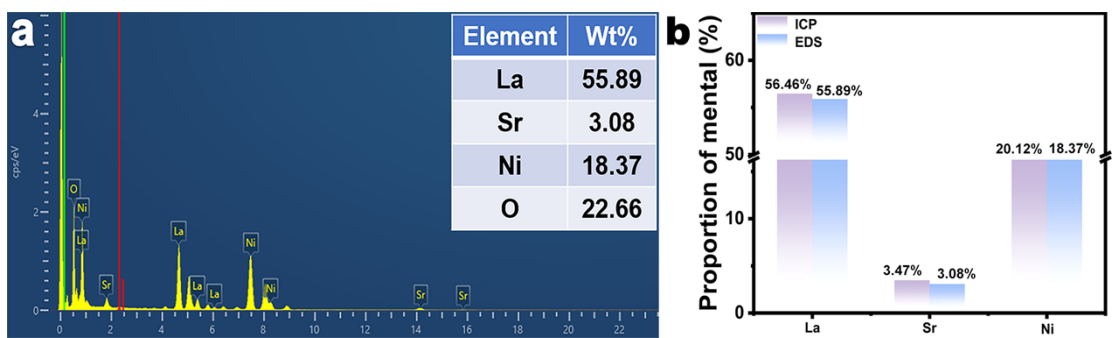
**Table S1** Performance comparison of different hydrogen peroxide detection techniques.

**Table S2** Comparison of the performance of different perovskite materials for hydrogen peroxide sensing.

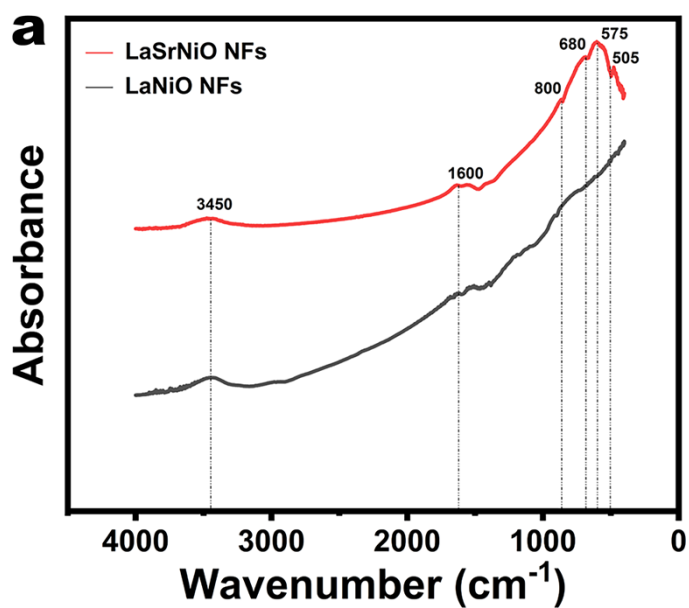
### 1. Materials and instruments

Lanthanum nitrate hexahydrate ( $\text{La}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$ , AR, 99%), strontium nitrate ( $\text{Sr}(\text{NO}_3)_2$ , AR, 99%), nickel nitrate ( $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ , AR, 99%) and polyvinyl pyrrolidone (PVP,  $M_w \approx 1.3 \times 10^6$ ) were commercially available from Shanghai Macklin Biochemical Technology Co., Ltd. Ethanol absolute ( $\text{CH}_3\text{CH}_2\text{OH}$ , 99.7%), N, N-Dimethylformamide (DMF, AR, 99.5%),  $\text{KH}_2\text{PO}_4$ ,  $\text{K}_2\text{HPO}_4$ ,  $\text{K}_2\text{S}_2\text{O}_8$ , and Nafion solution were purchased from Sinopharm Chemical Reagent Co., Ltd.  $\text{H}_2\text{O}_2$ , NaOH, ascorbic acid (AA), bisphenol A (BPA), glucose, KI and formaldehyde (HCHO) were all bought from Sinopharm Chemical Reagent. 2, 2'-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) free radicals (ABTS) were bought from Merck KGaA (ABTS reacts with  $\text{K}_2\text{S}_2\text{O}_8$  to form  $\text{ABTS}^{\bullet+}$  free radicals). 1,1-diphenyl-2-picryl-hydrazyl radical (DPPH $\bullet$ ) was bought from Med Chem Express. All solutions were prepared using distilled water and all chemicals were used without further treatment.

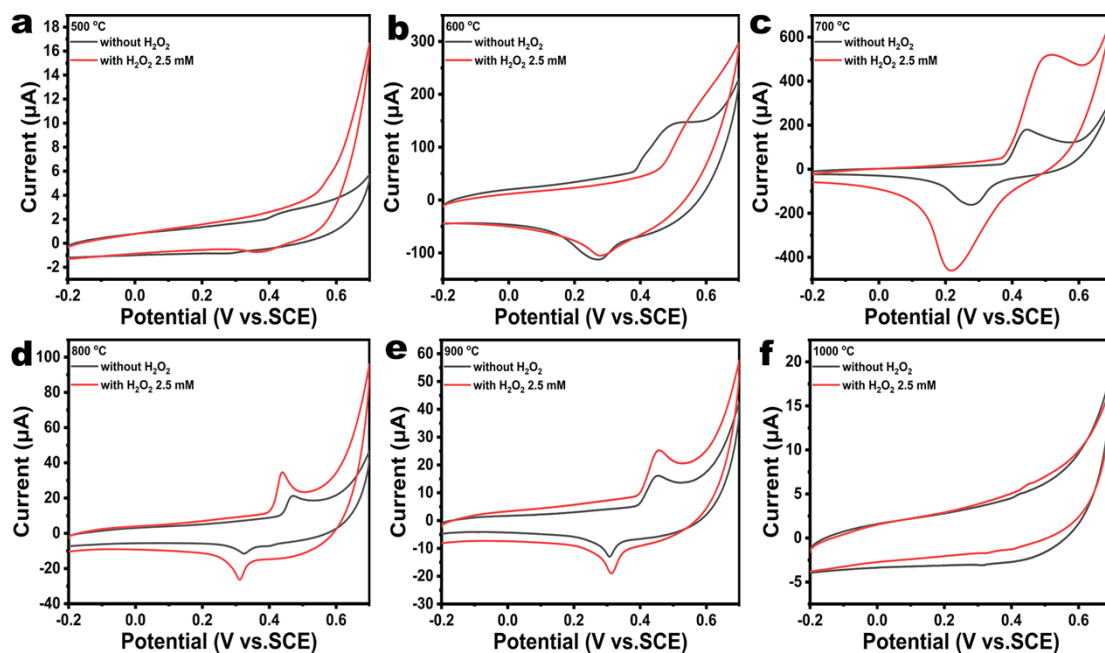
The morphology and structure of the products were investigated by the scanning electron microscopy (SEM, HITACHI S-4800, Japan), the transmission electron microscopy (TEM, JSM-2100, JEOL, Japan), the scanning transmission electron microscopy (STEM, Tecnai G2 F30S-Twin, Philips-FEI) at an acceleration voltage of 300 kV. The contents of different metal elements were analyzed by energy dispersive spectroscopy (EDS, HITACHI S-4800, Japan) and inductively coupled plasma optical emission spectroscopy (ICP-OES, Aglient 5110). The crystal phases were furtherly analyzed by X-ray diffraction (XRD) with  $\text{Cu K}_\alpha$  radiation ( $\lambda = 1.5418 \text{ \AA}$ ) at a scanning rate of  $0.02^\circ$  in the  $2\theta$  range of  $10 \sim 80^\circ$ . The Fourier transform infrared (FT-IR, Nicolet 6700, America) spectra investigate the changes in the functional groups of structural features. The elemental composition of the products was investigated by X-ray photoelectron spectra (XPS) on a Kratos Axis Ultra DLD at an acceleration voltage of 15 kV. Electron paramagnetic resonance (EPR, Bruker EMX Plus) was used to investigate the intensity of oxygen vacancy under the air atmosphere.



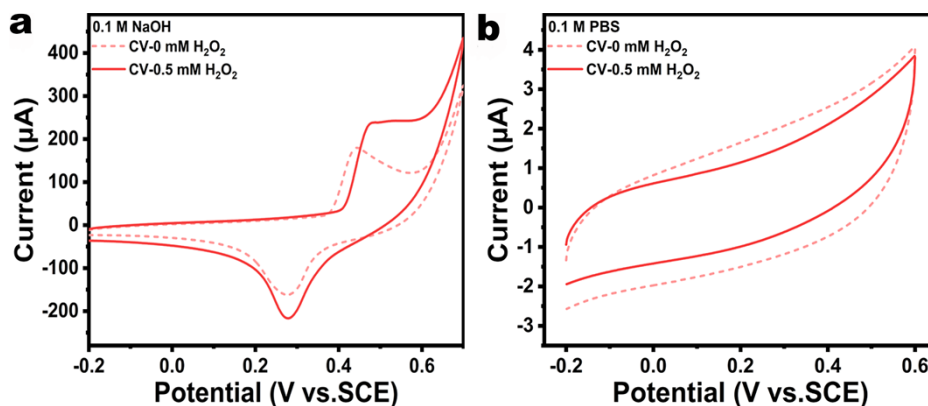
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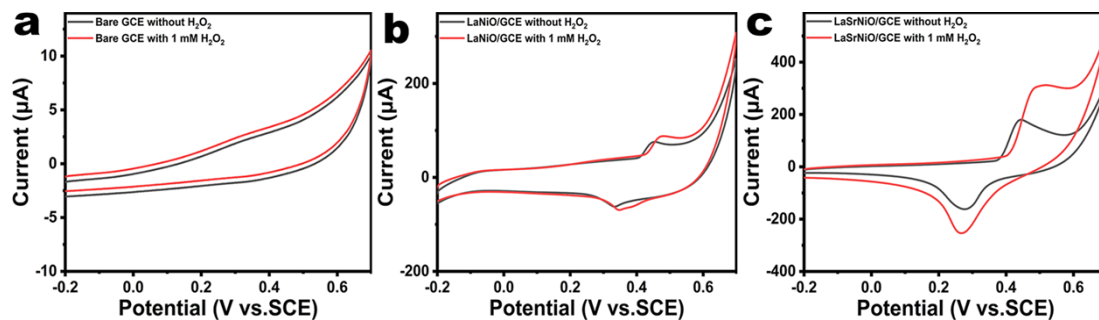
**Fig. S2** (a) FT-IR spectra of LaNiO NFs and LaSrNiO NFs.



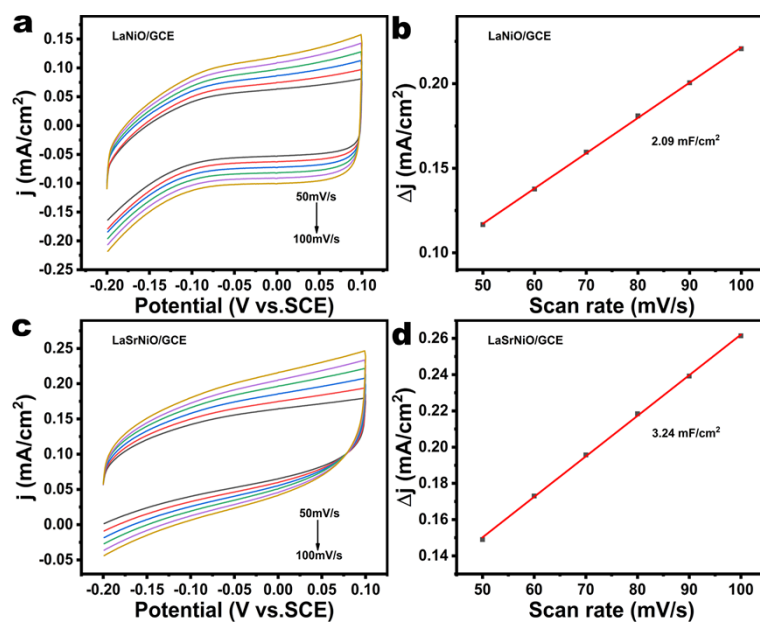
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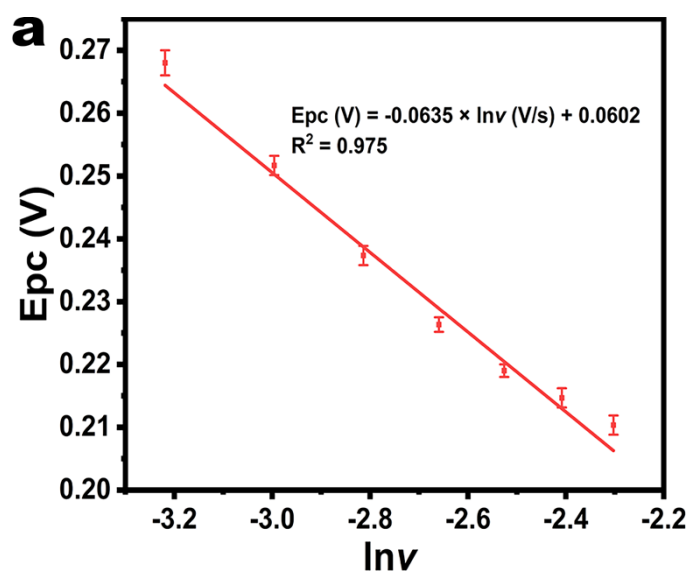
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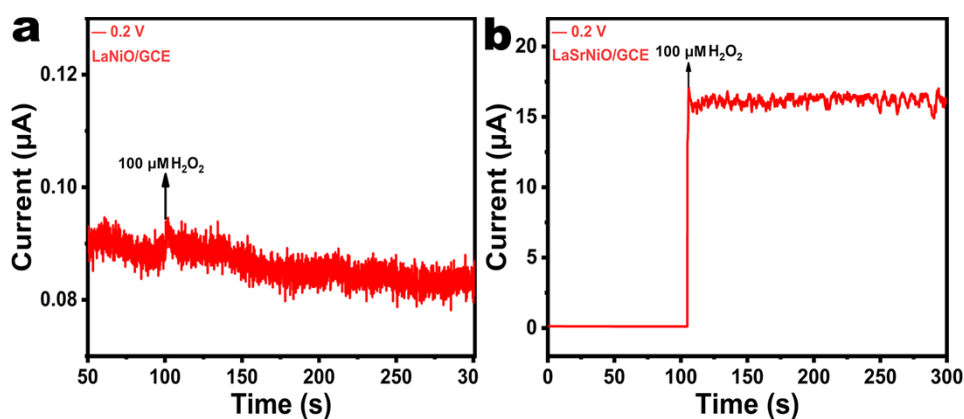
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**Table S1** Performance comparison of different hydrogen peroxide detection techniques.

Methods	LOD ( $\mu\text{M}$ )	Sensitivity ( $\mu\text{A} \cdot \text{mM}^{-1} \cdot \text{cm}^2$ )	Linear range ( $\mu\text{M}$ )	reference
A novel quinoxalinamine based fluorescent probe	0.046	--	--	1
A near-infrared fluorescent probe	0.065	-	0~7	2
Near-infrared fluorescence probe	0.14	-	-	3
Boronate-Based fluorescence	-	--	10	4
Fluorescent $\text{Fe}_3\text{O}_4$ Quantum Dots	0.0038			5
Colorimetric $\text{H}_2\text{O}_2$ Detection	10		0.1-1000	6
Electrochemical	0.018	1667.9	10-7000	This work

**Table S2** Comparison of the performance of different perovskite materials for hydrogen peroxide sensing.

Catalysis	Potential (V)	LOD ( $\mu\text{M}$ )	Sensitivity ( $\mu\text{A} \cdot \text{mM}^{-1} \cdot \text{cm}^2$ )	Linear range ( $\mu\text{M}$ )	reference
$\text{Co}_{0.4}\text{Fe}_{0.6}\text{LaO}_3$	0.55 V	0.002	2376.7	0.01-800	7
$\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{0.75}\text{Co}_{0.25}\text{O}_3$	-	0.17	1371.5	0.5-1000	8
$\text{Sr}_{0.85}\text{Ce}_{0.15}\text{FeO}_3$	0.4 V	10	60	0-500	9
$\text{LaNi}_{0.6}\text{Co}_{0.4}\text{O}_3$	0.55 V	0.001	1218.84	0.01-100	10
$\text{La}_{0.1}\text{Sr}_{0.9}\text{NiO}_3$ NFs	0.2 V	0.018	1667.9	10-7000	This work

rGO: Reduced Graphene Oxide

CPE: Carbon Paste Electrode

NFs: Nanofibers

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