Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Supplementary Information (ESI)

Tuning layer-structured $La_{0.6}Sr_{1.4}MnO_{4+\delta}$ into a promising electrode for intermediate-temperature symmetrical solid oxide fuel cells through surface modification

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Table S1 The lattice parameters of $LSMO_4$-pristine, $LSMO_4$-H_2-Ar treatment and $LSMO_4$ re-oxidized.

	$LSMO_4$-pristine	$LSMO_4$-H_2-Ar treatment	$LSMO_4$ re-oxidized
Space group	I4/mmm	I4/mmm	I4/mmm
a (Å)	3.861(1)	3.85(4)	3.862(5)
b (Å)	3.861(1)	3.85(4)	3.862(5)
c (Å)	12.43(2)	12.53(3)	12.43(8)
Rp (%)	6.64	7.84	5.62
Rwp (%)	8.81	11.12	7.52
χ^2	5.482	8.796	3.985

Table S2 The porosity of each sample measured by Archimedes method.

Sample	$LSMO_4$	$LSMO_4$-NiO	$LSMO_4$-SDC	$LSMO_4$-SDC-NiO
Porosity	50.34%	46.86%	33.90%	27.23%

Table S3 ASRs of the various electrodes at different temperatures.

Temperature (°C)	ASR (Ω cm^2)			
	$LSMO_4$-pristine	$LSMO_4$-NiO	$LSMO_4$-SDC	$LSMO_4$-SDC-NiO
800	0.46	0.16	0.021	0.020
750	1.31	0.39	0.069	0.052
700	3.90	1.02	0.18	0.17
650	12.77	2.80	0.52	0.39
600	46.99	8.18	1.56	1.05

Table S4 PPDs of cells with symmetrical configurations at temperatures of 600-800 °C.

Temperature	PPDs (mW cm^{-2})			
(°C)	$LSMO_4$-pristine	$LSMO_4$-NiO	$LSMO_4$-SDC	$LSMO_4$-SDC-NiO
800	67	340	294	614
750	34	242	174	477
700	18	168	103	339
650	10	105	53	215
600	5	61	25	124

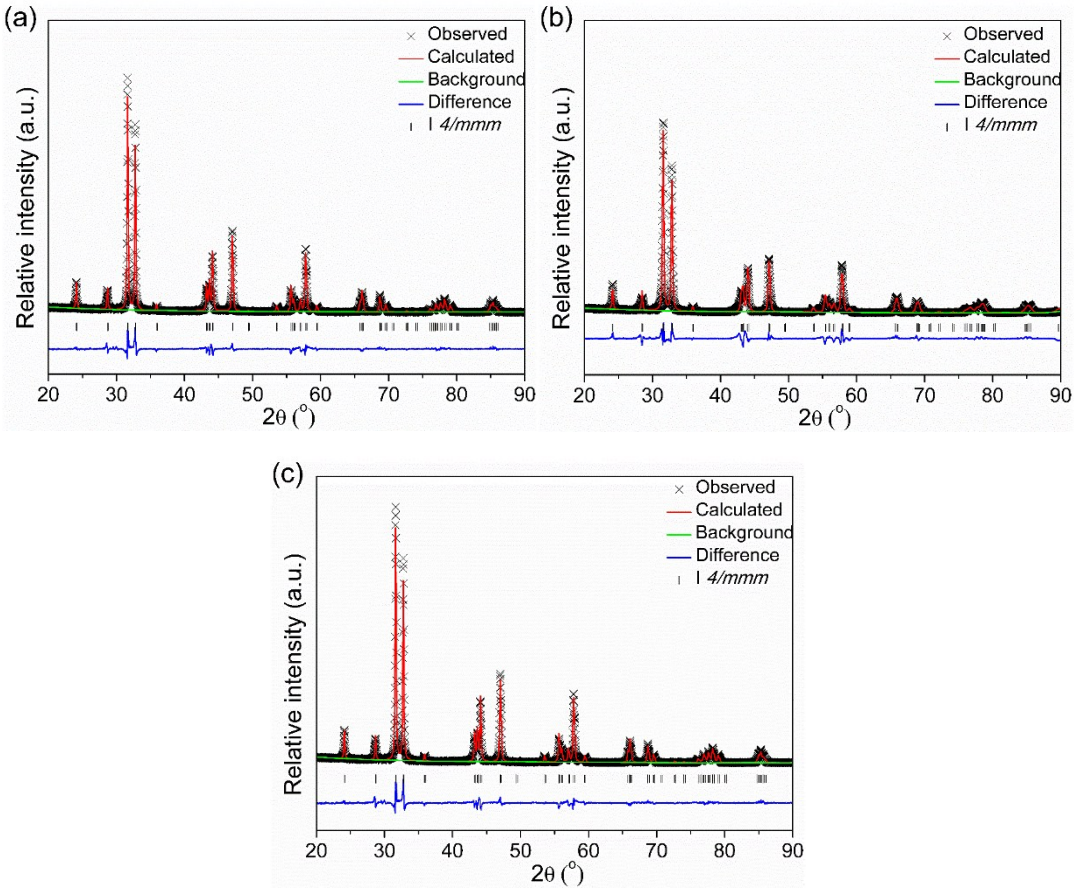

Fig. S1 Refined diffraction patterns of powders of $LSMO_4$: fresh (a), after treatment in 10% H_2-Ar at 800 °C for 10 h (b) and after re-oxidation in air at 800 °C for 2 h (c).

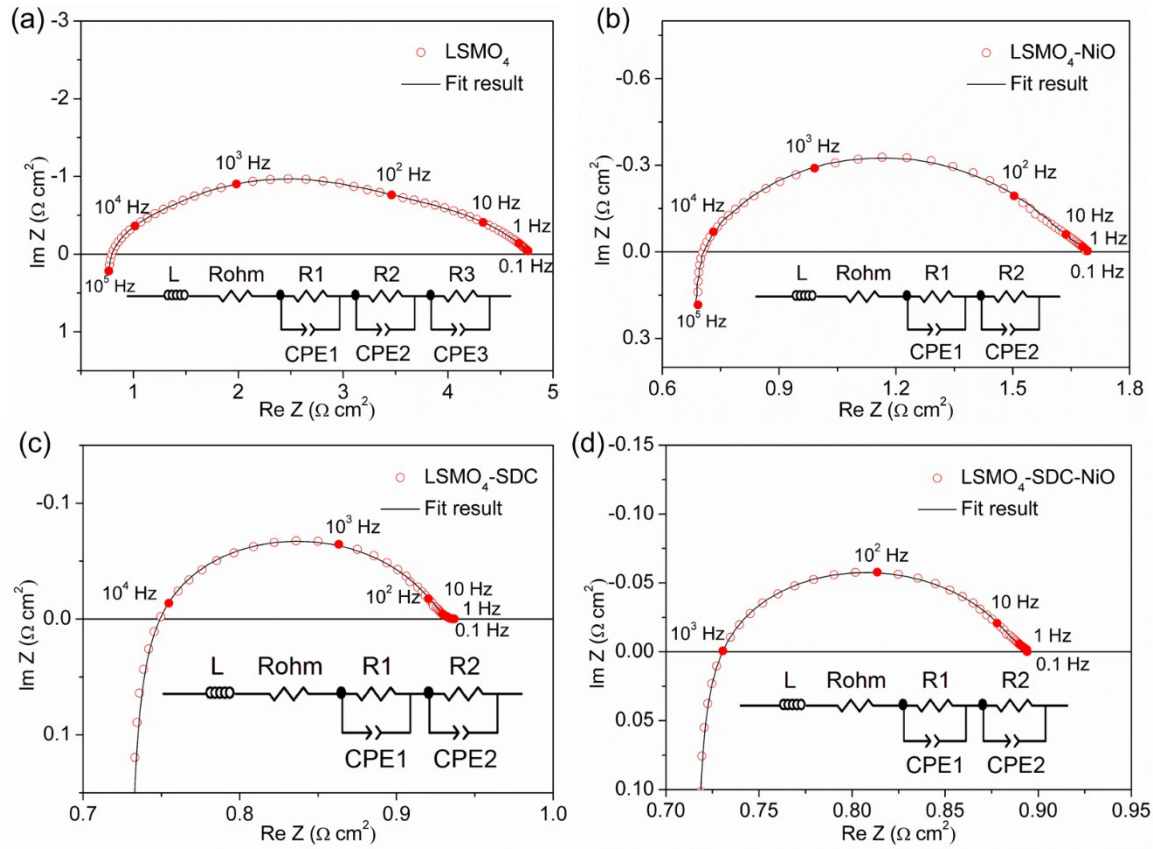

Fig. S2 Experimental and fit Nyquist plots for symmetrical cells with the $LSMO_4$-based electrodes measured in an open circuit at 700◦C. The equivalent circuit adopted for fitting the EIS data is presented inside the Nyquist plots.