Supporting Information

Enhanced Catalytic Activity of Perovskite $La_{1-x}Sr_xMnO_{3+\delta}$ for Oxygen Reduction Reaction

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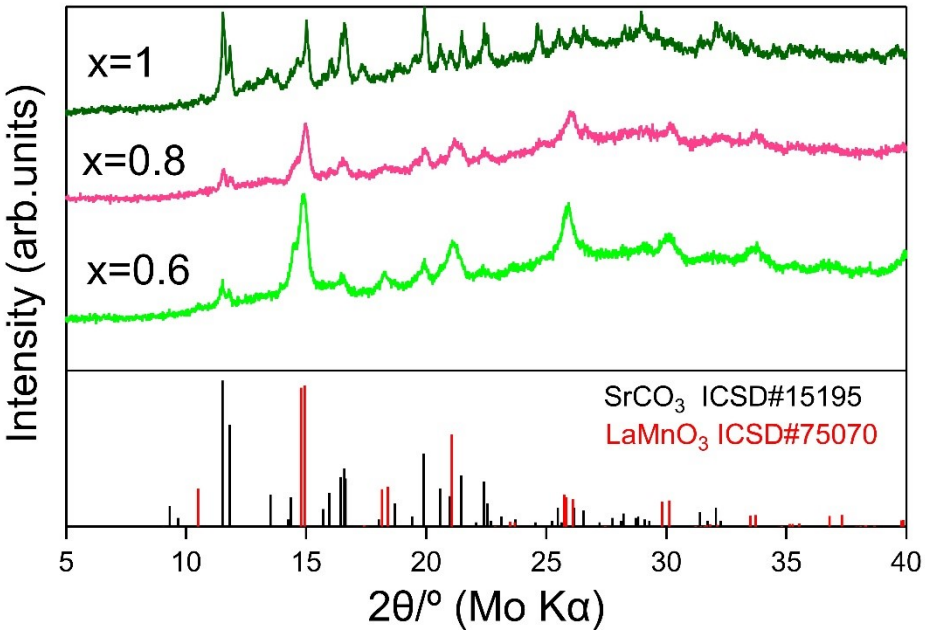

Figure S1. XRD patterns of $La_{1-x}Sr_xMnO_{3+\delta}$ (x = 0.6, 0.8, and 1.0) measured using Mo Kα radiation (wavelength: 0.7107 Å).

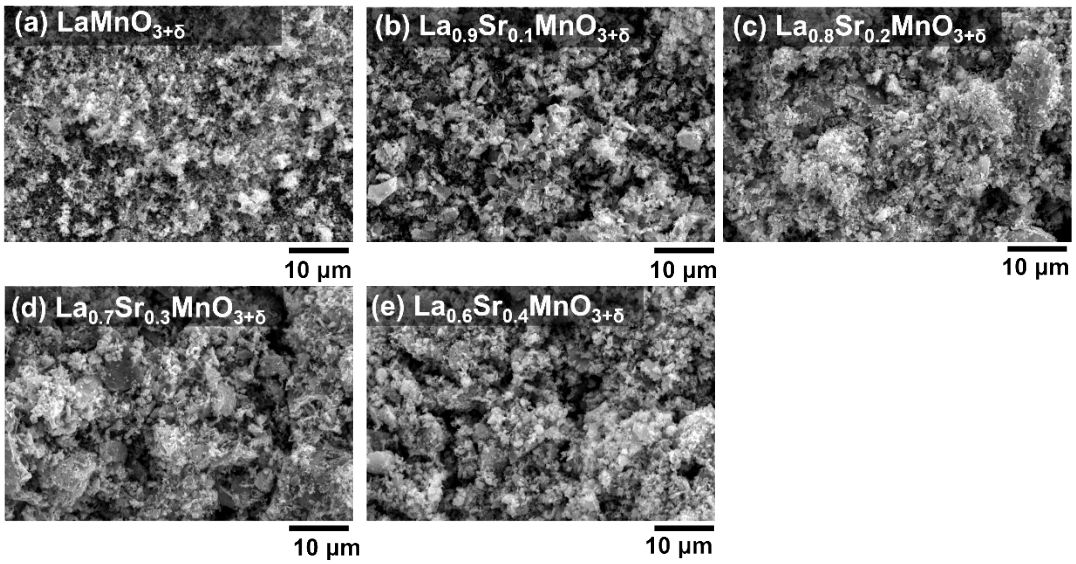

Figure S2. SEM images of $La_{1-x}Sr_xMnO_{3+\delta}$.

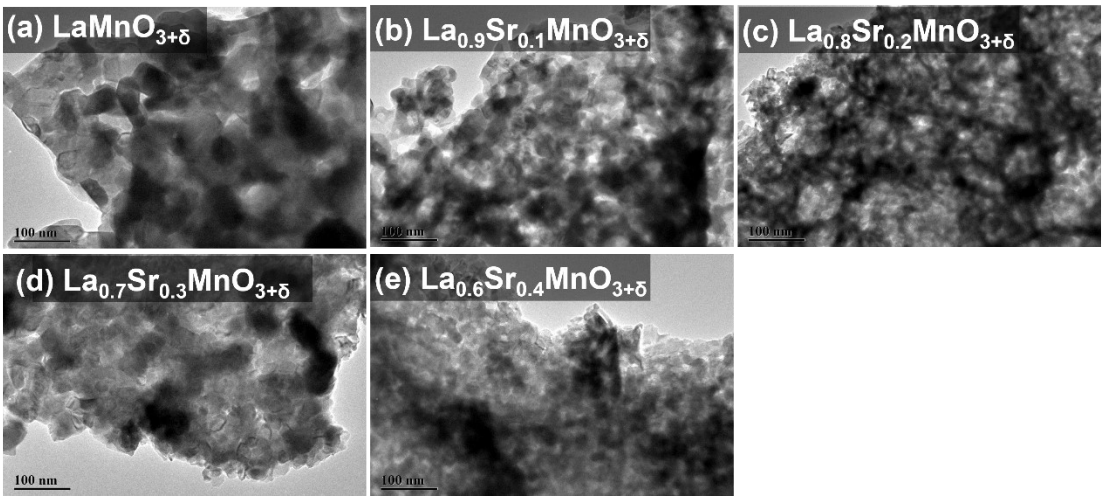

Figure S3. TEM images of $La_{1-x}Sr_xMnO_{3+\delta}$.

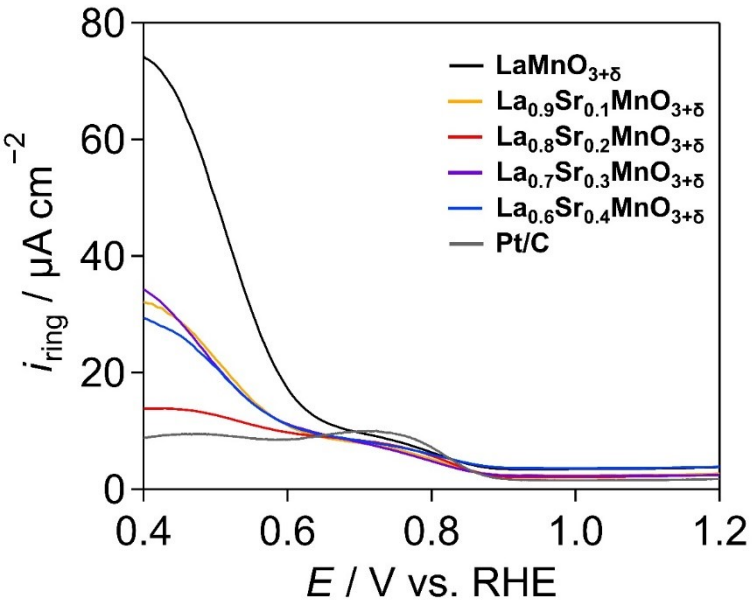

Figure S4. Ring currents for the different $La_{1-x}Sr_xMnO_{3+\delta}$ (x = 0, 0.1, 0.2, 0.3, and 0.4) perovskites measured in 0.1 M KOH aqueous solutions at a scan rate of 10 mV s^{-1} for a speed of 1600 rotations per min (rpm). Pt/C served as the reference electrode.

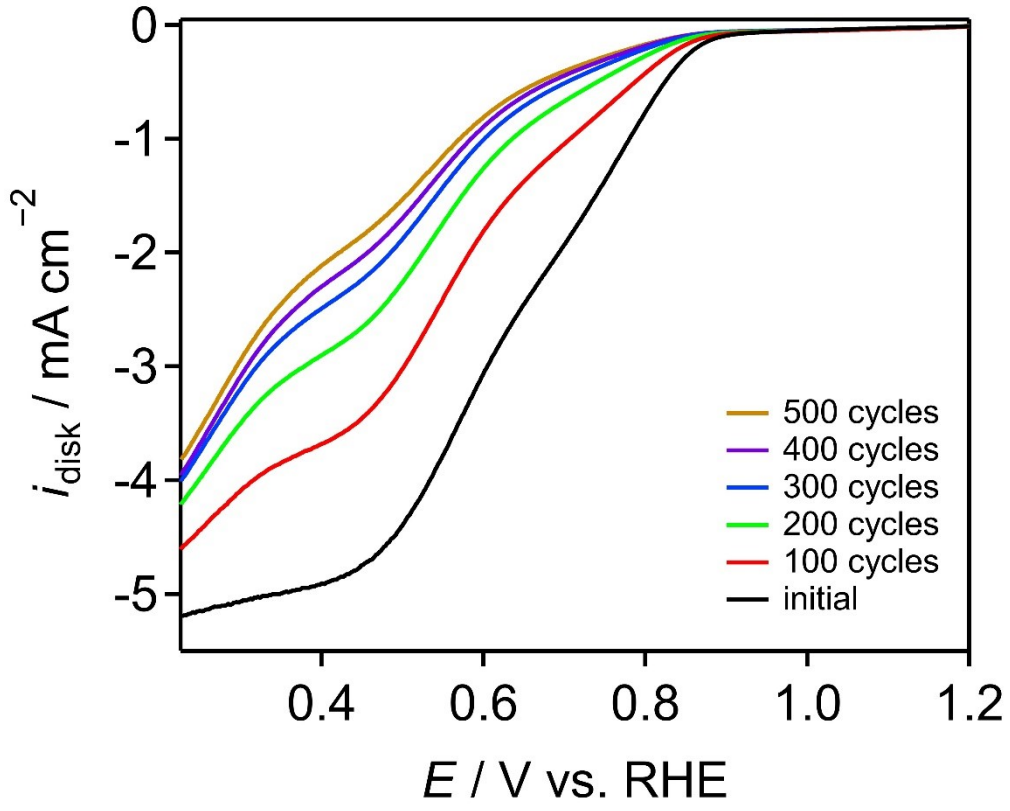

Figure S5. LSV curves of the disk electrodes modified with the $La_{0.8}Sr_{0.2}MnO_3$ perovskite catalyst measured in 0.1 M KOH aqueous solutions at a scan rate of 10 mV s^{-1} at a speed of 1600 rpm.

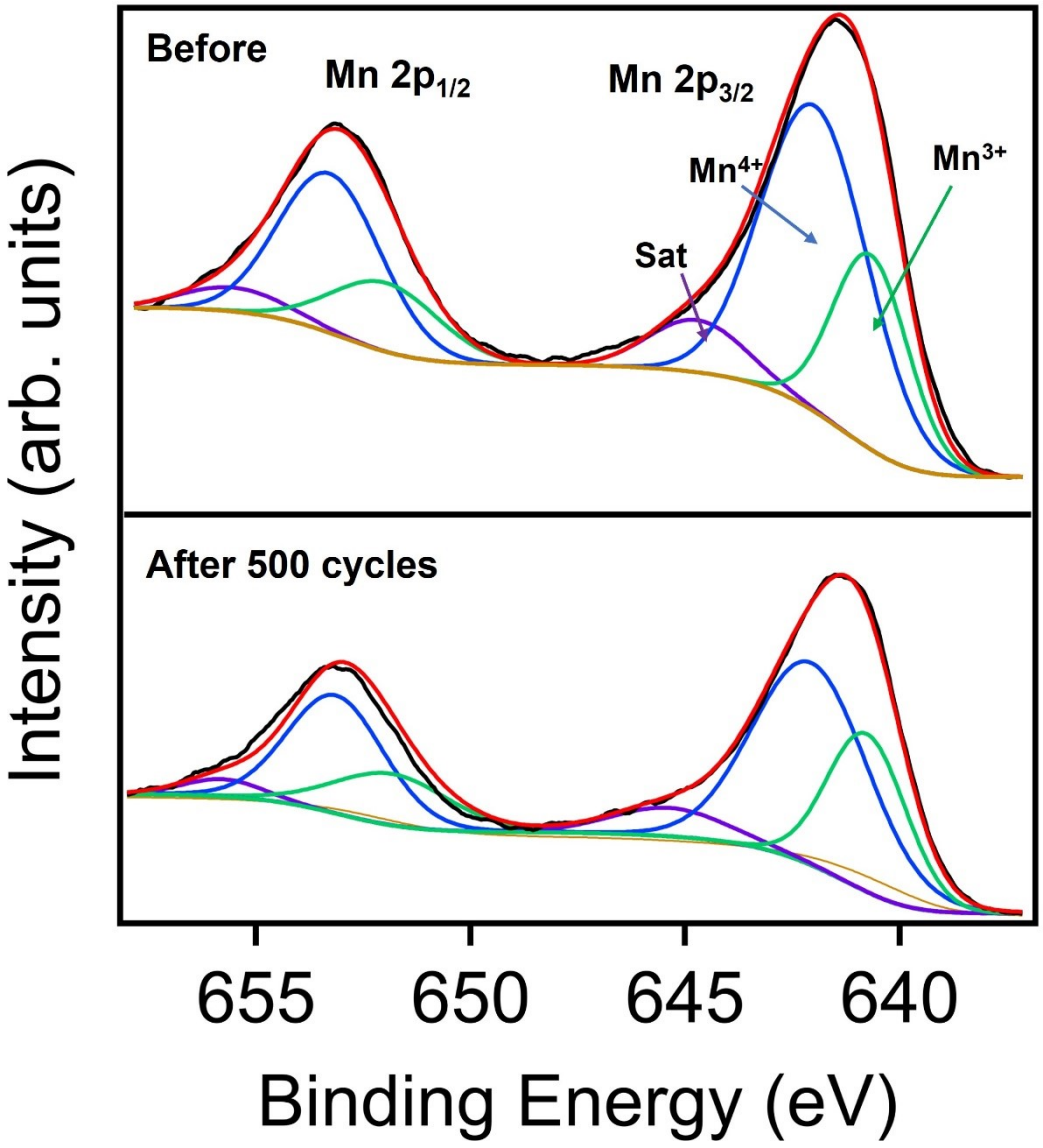

Figure S6. Mn 2p XPS profiles for $La_{0.8}Sr_{0.2}MnO_{3+\delta}$ before and after 500 cycles of cyclic voltammetry at 10 mV s^{-1} using 0.1 M KOH aqueous solution (pH ~13).

Table S1. Lattice parameters obtained from XRD patterns using the Jade software.

Samples	*a* (Å)	*b* (Å)	*c* (Å)	*α* (º)	*β* (º)	*γ* (º)
$LaMnO_{3+\delta}$	5.50	5.50	13.12			
$La_{0.9}Sr_{0.1}MnO_{3+\delta}$	5.54	5.54	13.20			
$La_{0.8}Sr_{0.2}MnO_{3+\delta}$	5.51	5.51	13.22	90	90	120
$La_{0.7}Sr_{0.3}MnO_{3+\delta}$	5.45	5.45	13.44			
$La_{0.6}Sr_{0.4}MnO_{3+\delta}$	5.49	5.49	13.52			

Table S2. Mn $2p_{3/2}$ and O 1s binding energies for $La_{1-x}Sr_xMnO_{3+\delta}$

	Mn $2p_{3/2}$ (eV)	**O 1s (eV)**
$LaMnO_{3+\delta}$	641.2	529.3
	642.5	531.3
	645.1	
$La_{0.9}Sr_{0.1}MnO_{3+\delta}$	641.2	529.3
	642.5	531.2
	644.9	
$La_{0.8}Sr_{0.2}MnO_{3+\delta}$	640.7	529.0
	642.0	530.7
	644.8	
$La_{0.7}Sr_{0.3}MnO_{3+\delta}$	640.7	529.4
	642.0	531.4
	645.1	
$La_{0.6}Sr_{0.4}MnO_{3+\delta}$	640.2	529.2
	641.5	531.3
	644.2	

Table S3. EXAFS fitting results of $La_{1-x}Sr_xMnO_{3+\delta}$ assuming a rhombohedral $LaMnO_3$ structure with the first nearest shell model using the Artemis program integrated with the IFEFFIT package in the 1.0−2.0 Å range.

	CN	S_0^2	σ^2	R
$LaMnO_{3+\delta}$	6	0.586 ± 0.09287644	0.00474 ± 0.00234199	1.92162 ± 0.00560875
$La_{0.9}Sr_{0.1}MnO_{3+\delta}$	6	0.571 ± 0.09464044	0.00448 ± 0.00226041	1.91925 ± 0.00514623
$La_{0.8}Sr_{0.2}MnO_{3+\delta}$	6	0.574 ± 0.09126875	0.00428 ± 0.00202992	1.91335 ± 0.00369724
$La_{0.7}Sr_{0.3}MnO_{3+\delta}$	6	0.604 ± 0.05071973	0.00504 ± 0.00123801	1.91778 ± 0.00572550
$La_{0.6}Sr_{0.4}MnO_{3+\delta}$	6	0.540 ± 0.08233287	0.00411 ± 0.00195352	1.91531 ± 0.00435403

Table S4. Atomic ratios of Mn^{3+} and Mn^{4+} of $La_{0.8}Sr_{0.2}MnO_{3+\delta}$ before and after 500 cycles of cyclic voltammetry estimated by fitting the XPS profiles shown in **Figure. S6**.

	Mn^{3+} (%)	Mn^{4+} (%)	**Mn average valence number**
Initial	41.1	58.9	3.59
After 500 cycles	48.4	51.6	3.52