Electronic Supplementary Information

Oxygen-deficiency-dependent Seebeck coefficient and electrical properties of mesoporous $La_{0.7}Sr_{0.3}MnO_{3-x}$ films

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SEM was used to measure the thickness of mesoporous LSMO films with various annealing atmospheres and the results were shown in Fig. S1. As shown in the figure, thickness values of all samples were around 123 nm.

In order to confirm the change of the residual carbon and nitrogen according to the annealing atmosphere, wide scan and narrow scan analyses of mesoporous LSMO films were carried out using XPS. As shown in Fig. S2, the nitrogen was not observed in all samples. But a small amount of carbon was detected in all samples. However the detected amount (less than 2.5 at %) and chemical bonding state (around 285 eV as C-C/H bond) of carbon were similar to the general air-contaminated carbon, C-C/H [1-3]. Also it has been known that the thermal decomposition temperature of the surfactant and organic groups used in this study is lower than 450°C maximum [4]. Then the annealing condition of this experiment as 650°C for 2 hrs was sufficient condition to get LSMO films without residual organic contaminants. Furthermore although it was reported that the residual carbon might reduce the Seebeck

coefficient and increase the electrical conductivity [5], the amount of observed carbon is not applicable to this study.

References

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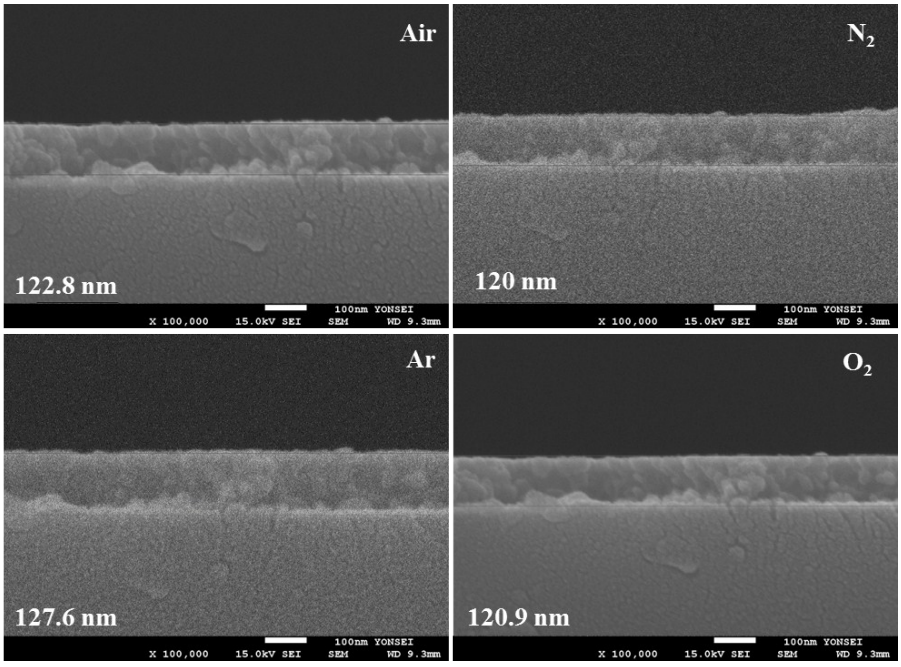

Figure S1. Thickness images of mesoporous LSMO films with various annealing atmospheres.

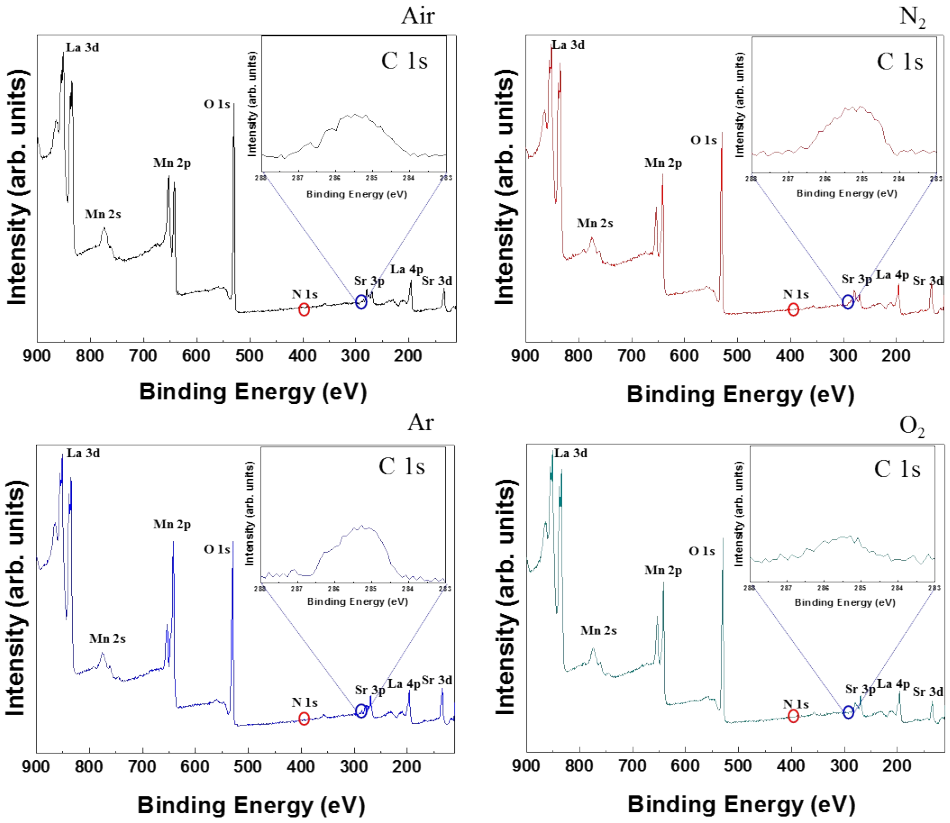

Figure S2. Wide scan spectra of mesoporous LSMO films synthesized using various annealing atmospheres. The inset figure presents the XPS C 1s core level spectra of mesoporous LSMO films synthesized using various annealing atmospheres.