A HIGHLY ACTIVE AND DURABLE LANTHANUM STRONTIUM COBALT FERRITE CATHODE FOR INTERMEDIATE-TEMPERATURE SOLID OXIDE FUEL CELLS

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Solid oxide fuel cells (SOFCs) are promising techniques for high energy efficiency, fuel flexibility, and low pollutant emissions. For commercialization of SOFCs, it is required to decrease the operating temperature. At this intermediate temperature region, the cathodic polarization resistance significant due to the thermally activated oxygen reduction reaction (ORR). To compensate this, highly active cathode materials have been considered and lanthanum strontium cobalt ferrite (LSCF6428, $La_{0.6}Sr_{0.4}Co_{0.2}Fe_{0.8}O_{3-\delta}$) has been attracted as a cathode material for SOFCs because of its high mixed electronic and ionic conducting (MIEC) nature. However, one of the major concerns of LSCF6428 is the degradation during the long-term operation. Currently, Sr segregation has been reported as one of the major reasons for the LSCF degradation. In this study, we investigated LSCF2882 ($La_{0.2}Sr_{0.8}Co_{0.8}Fe_{0.2}O_{3-\delta}$) and compared with LSCF6428 as a SOFC cathode. X-ray diffraction (XRD) and Rietveld refinement were applied to analyze phase structures. By electrical conductivity relaxation (ECR) technique, Oxygen surface exchange coefficients (k_{chem}) and chemical diffusion coefficients (D_{chem}) of LSCF2882 were evaluated and we observed enhancements compare to LSCF6428. For interpretation of enhanced oxygen transport kinetics, we tried to visualize the interstitial oxygen conduction pathways and the bond valence sum (BVS) mapping method was utilized by Valence program. BVS mapping results show clearly demonstrating the 3D network of the interstitial pathways at 600ºC in LSCF2882. Electrochemical performances were investigated by EIS (Electrochemical Impedance Spectroscopy) and single cell performance was also evaluated. In addition, long-term stability test was performed for over 500 hours. LSCF2882 showed better performances and it exhibited no degradation during the stability test.

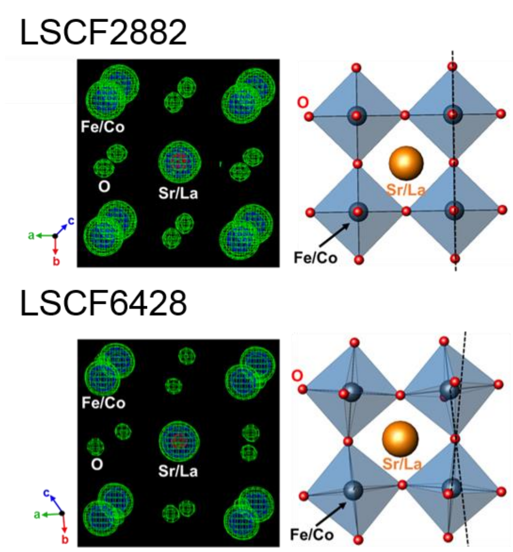

Figure 1 – Electron density map and unit cell structure of LSCF2882 and LSCF6428

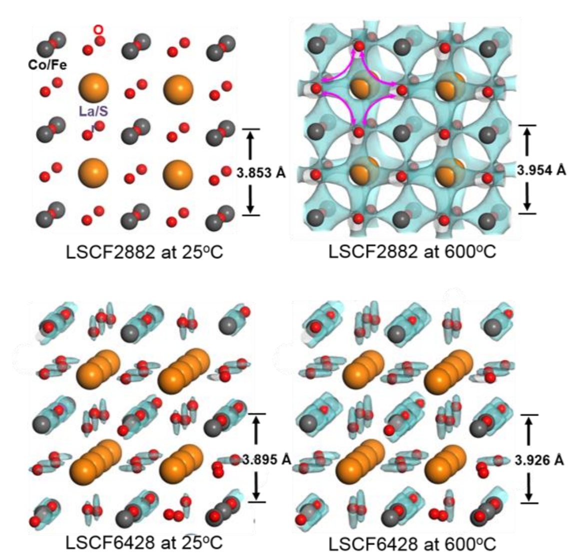

Figure 2 – bond valence sum (BVS) mapping results of LSCF2882 and LSCF6428