

## Electrochemical Characterization of $\text{La}_2\text{NiO}_4$ Infiltrated LSM Oxygen Electrode of Solid Oxide Cells

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### Abstract

In this study, lanthanum nickelate ( $\text{La}_2\text{NiO}_4$  (LNO)) as a mixed ionic and electronic conductor (MIEC) has been infiltrated into porous structure of strontium doped lanthanum manganite (LSM) oxygen electrode of solid oxide cells. The effects of temperature and infiltration on the impedance spectra was investigated under open circuit voltage (OCV) condition. X-ray diffraction (XRD) and field emission scanning electron microscope (FE-SEM) results showed formation of pure ruddlesden popper phase of LNO and uniform distribution of LNO into the porous LSM backbone. To characterize electrochemical behavior of pure and LNO infiltrated LSM oxygen electrode, electrochemical impedance spectroscopy (EIS) measurement at temperature range of 650-850 °C at intervals of 50 °C was carried out. Results showed that infiltration of 2M LNO, reduced polarization resistance of pure LSM by 90% (from 24.61 to 2.52  $\Omega\cdot\text{cm}^2$ ) and 83% (from 1.36 to 0.23  $\Omega\cdot\text{cm}^2$ ) at 650 °C and 850 °C, respectively. In addition, calculated activation energy of oxygen oxidation/reduction reactions in both infiltrated (124  $\text{kJ}\cdot\text{mol}^{-1}$ ) and non-infiltrated electrodes (103  $\text{kJ}\cdot\text{mol}^{-1}$ ) also showed enhancement of activation phenomena on LSM electrode. Therefore, infiltration of LNO into LSM backbone by extending the reaction sites to the bulk of the electrode is a promising approach to achieve better electrochemical performance.

**Keywords:**  $\text{La}_2\text{NiO}_4$ , solid oxide cell, LSM, electro catalyst, infiltration.

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