

Abstract

The properties of $(\text{La}_{0.8}\text{Sr}_{0.2})_{2-x}\text{Ca}_x\text{NiO}_4$ (LSN- Ca_x), $(\text{La}_{0.8}\text{Sr}_{0.2})_{2-x}\text{Ca}_x\text{Ni}_{0.9}\text{Co}_{0.1}\text{O}_4$ (LSNC- Ca_x) and $\text{La}_{2-x}\text{Ca}_x\text{Ni}_{0.9-y}\text{Co}_{0.1}(\text{Fe}, \text{Zn})_y\text{O}_4$ (LNCF- Ca_x and LNCZ- Ca_x) as cathode materials for solid oxide fuel cell were investigated. All compounds prepared by modified citrate method exhibited K_2NiF_4 -type with tetragonal structure using calcination and sintering temperature of 900°C and 1350°C for 10 hours, respectively. LSN- Ca_x and LSNC- Ca_x ($x=0-0.5$) substituted with Ca^{2+} on the A-site in composition of $x=0.2$ showed the single phase of K_2NiF_4 -type structure and the highest electrical conductivity of 176.9 and 166.9 S/cm at 800°C , respectively. To improve oxygen permeation of $\text{La}_2\text{Ni}_{0.9}\text{Co}_{0.1}\text{O}_4$ (LNC), Ni-site was firstly substituted with Fe^{3+} or Zn^{2+} to obtain LNC- Fe_y and LNC- Zn_y ($y=0-0.2$). Then Ca^{2+} was incorporated into La-site of LNC- $\text{Fe}_{0.05}$ and LNC- $\text{Zn}_{0.05}$ which had the highest oxygen permeation rate, to improve the electrical conductivity. The highest electrical conductivity was achieved for LNCF- $\text{Ca}_{0.5}$ and LNCZ- $\text{Ca}_{0.5}$ and the values were 98.4 and 84.9 S/cm at 800°C . Additionally, the single cell performance of LNCF- $\text{Ca}_{0.5}$ and LNCZ- $\text{Ca}_{0.5}$ with LSGM electrolyte was measured and maximum power densities were 322 and 312 mW/cm^2 at 800°C , respectively. This indicated that LNCF- $\text{Ca}_{0.5}$ and LNCZ- $\text{Ca}_{0.5}$ could be potential cathode materials for IT-SOFC.