Tuning defect nonequilibrium of brownmillerite Sr1+xY2-xO4+δ for rich-oxygen-vacancy direct ammonia SOFC cathode

Fulan Zhong[1], Yan Zhang[1], Yu Luo[2], Chongqi Chen[1], Huihuang Fang[1], Chen Zhou[1], Li Lin[1], Chak-tong Au[3], and Lilong Jiang[2]

[1]Affiliation not available
[2]Fuzhou University
[3]National Engineering Research Center of Chemical Fertilizer Catalyst

April 16, 2024

Abstract

In this study, we prepared SrR2O4+δ (SRO, R=Y, Yb, Gd, Sm) of brownmillerite structure. Among the four n-type SRO semiconductors, SYO is the most negative in conduction band and the smallest in band gap. As a result, the SYO-based SOFC can offer a maximum power density (MPD) of 1.03W/cm-2 at 800°C, which is higher than that based on the other three SRO oxides. The introduction of larger Sr2+ at the B sites of Sr1+xY2-xO4+δ [SYO(x)] causes decrease of band gap, resulting in a 4-fold increase of electronic conductivity. The foreign Sr2+ creates surface oxygen vacancies to boost interfacial transport. The measurement of oxygen transport reveals that SYO(0.10) exhibits a bulk diffusion coefficient 500 folds higher than that of LSM. An anode supported Ni-YSZ|YSZ|SYO(0.10)-60YSZ DA-SOFC yields an MPD of 0.24W/cm2 at 600°C and 1.21 W/cm2 at 800°C with remarkable stability, about 1.73- and 1.29-folds higher than that of LSM-based SOFC, respectively.

Hosted file

`Manuscript.docx` available at https://authorea.com/users/738171/articles/712630-tuning-defect-nonequilibrium-of-brownmillerite-sr1-xy2-xo4-%CE%B4-for-rich-oxygen-vacancy-direct-ammonia-sofc-cathode