Electrochemical Characterization of La0.58Sr0.4Co0.2Fe0.8O3-δ Thin Film Electrodes Prepared by Pulsed Laser Deposition

Electrochemical properties of La0.58Sr0.4Co0.2Fe0.8O3-δ (LSCF) thin films with well defined microstructures have been investigated. Symmetrical cells were characterized by impedance spectroscopy in the temperature range from 625 to 750°C and the oxygen partial pressure, range from 10-2 to 1 atm. The area specific resistance for dense films was invariant with thicknesses between 130 and 1200 nm indicating oxygen surface exchange as the process limiting oxygen transport in the films. The capacitances deduced from the impedance data show a linear dependence with the film thickness. Values were as high as 0.2 F cm-2 suggesting a chemical capacitance. The oxygen non-stoichiometry was calculated using the measured chemical capacitance and a defect chemistry model. While dense films have an area specific resistance of 8 Ω cm2 at 750°C, porous films with an increase of the surface area by 26 times have only an area specific resistance of 0.38 Ω cm2. It is shown that the polarization resistance of thin films is approximately proportional to the inverse of the surface area of the porous cathodes in the temperature regime 625 to 750°C. The activation energy of the surface oxygen exchange process depends on the thin film microstructure as it decreased from 2.4 eV for dense films to 1.6 eV for porous films.

General information

State: Published
Organisations: Department of Energy Conversion and Storage, Mixed Conductors, Swiss Federal Institute of Technology
Contributors: Plonczak, P., Søgaard, M., Bieberle-Hütter, A., Hendriksen, P. V., Gauckler, L. J.
Pages: 471-482
Publication date: 2012
Peer-reviewed: Yes

Publication information

Journal: Journal of The Electrochemical Society
Volume: 159
Issue number: 5
ISSN (Print): 0013-4651
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.48 SJR 1.267 SNIP 1.009
Web of Science (2017): Impact factor 3.662
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.97 SJR 1.222 SNIP 0.963
Web of Science (2016): Impact factor 3.259
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 3.17 SJR 1.115 SNIP 1.066
Web of Science (2015): Impact factor 3.014
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 3.36 SJR 1.213 SNIP 1.25
Web of Science (2014): Impact factor 3.266
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.92 SJR 1.169 SNIP 1.309
Web of Science (2013): Impact factor 2.859
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.61 SJR 1.329 SNIP 1.281
Web of Science (2012): Impact factor 2.588
ISI indexed (2012): ISI indexed yes