Electrochemical Impedance Modeling of a Solid Oxide Fuel Cell Anode

A simulation package for the impedance response of SOFC anodes is presented here. The model couples the gas transport in gas channels and within a porous electrode with the electrochemical kinetics. The gas phase mass transport is modeled using mass conservation equations. A transmission line model (TLM), which is suitably modified to account for the electrode microstructural details, is used for modeling the impedance arising from the electrochemical reactions. In order to solve the system of nonlinear equations, an in-house code based on the finite difference method was developed. Some of the model constants have been calibrated against experimental data. It is demonstrated that the simulation tool is capable of predicting the impedance response of an experimental data set obtained on symmetrical cells with Ni/ScYSZ SOFC anodes. A parametric study is also carried out using the developed simulation tool and the results are further discussed.

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Mixed Conductors, Fundamental Electrochemistry, Arak University, K.N. Toosi University of Technology
Contributors: Mohammadi, R., Søgaard, M., Ramos, T., Ghassemi, M., Mogensen, M. B.
Pages: 645–659
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Fuel Cells
Volume: 14
Issue number: 4
ISSN (Print): 1615-6846
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.88 SJR 0.559 SNIP 0.748
Web of Science (2017): Impact factor 2.149
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.79 SJR 0.495 SNIP 0.603
Web of Science (2016): Impact factor 1.706
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.02 SJR 0.685 SNIP 0.779
Web of Science (2015): Impact factor 1.769
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.05 SJR 0.615 SNIP 0.792
Web of Science (2014): Impact factor 2.08
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.99 SJR 0.835 SNIP 0.833
Web of Science (2013): Impact factor 1.546
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 2.76 SJR 1.24 SNIP 0.993
Web of Science (2012): Impact factor 2.364
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 3.31 SJR 1.639 SNIP 1.247
Original language: English
Keywords: Electrochemical Impedance Spectroscopy, Gas Diffusion Impedance, Solid Oxide Fuel Cell, Transient Simulation, Transmission Line Model
DOIs:
10.1002/fuce.201300292
Research output: Research - peer-review › Journal article – Annual report year: 2014