Oxygen transport properties of tubular Ce$_{0.9}$Gd$_{0.1}$O$_{1.95}$-La$_{0.6}$Sr$_{0.4}$FeO$_3$–d composite asymmetric oxygen permeation membranes supported on magnesium oxide

The oxygen permeation through dense Ce$_{0.9}$Gd$_{0.1}$O$_{1.95}$-La$_{0.6}$Sr$_{0.4}$FeO$_3$–d dual-phase composite asymmetric membranes supported on a porous MgO tube was studied. The membranes were prepared by thermoplastic extrusion, dip coating, co-sintering and infiltration of a catalyst. Oxygen permeation measurements and electrical conductivity characterization of the membrane were performed as a function of temperature and oxygen partial pressure. The oxygen flux through the membrane in a H$_2$/air gradient at 850 °C reached 15 N ml cm$^{-2}$ min$^{-1}$. The measured oxygen flux was in good agreement with the theoretically estimated one, taking into account the transport properties of the composite, surface exchange losses, gas diffusion and gas conversion in the MgO support. The performance of the membrane was limited by the surface exchange for the operation in N$_2$/air, CO$_2$/air and H$_2$/air at low temperatures and most probably by the porosity of the MgO support for the operation in H$_2$/air at 850 °C. The stability tests of the membrane in CO$_2$/air and H$_2$/air configurations revealed that an initial degradation of the oxygen flux occurs and it is followed by a relatively stable performance. Post-mortem analysis of the membrane after 900 h of operation did not reveal any significant microstructural degradation of the membrane layer.

General information
Publication status: Published
Organisations: Department of Energy Conversion and Storage, Mixed Conductors, Ceramic Engineering & Science, Fundamental Electrochemistry
Contributors: Ovtar, S., Gurauskis, J., Bjørnetun Haugen, A., Chatzichristodoulou, C., Kaiser, A., Hendriksen, P. V.
Number of pages: 12
Pages: 576-587
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: Journal of Membrane Science
Volume: 523
ISSN (Print): 0376-7388
Ratings:
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.93 SJR 2.4 SNIP 1.898
Web of Science (2017): Impact factor 6.578
Web of Science (2017): Indexed yes
Original language: English
Keywords: Oxygen permeation membrane, Dual-phase composite, Asymmetric membrane, Oxygen flux, Electrical conductivity relaxation
Electronic versions:
Manuscript_CGO_LSF_post_print.pdf. Embargo ended: 01/10/2018
DOIs:
10.1016/j.memsci.2016.09.060
Source: FindIt
Source-ID: 2346834381
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review