

Accepted Manuscript

Current density distributions in polymer electrolyte fuel cells: a tool for characterisation of gas distribution in the cell and its state of health

M. Belhadj, A. Aquino, J. Heng, S. Kmiotek, S. Raël, C. Bonnet, F. Lopicque

PII: S0009-2509(18)30189-1
DOI: <https://doi.org/10.1016/j.ces.2018.03.055>
Reference: CES 14129

To appear in: *Chemical Engineering Science*

Received Date: 18 October 2017
Revised Date: 23 March 2018
Accepted Date: 30 March 2018

Please cite this article as: M. Belhadj, A. Aquino, J. Heng, S. Kmiotek, S. Raël, C. Bonnet, F. Lopicque, Current density distributions in polymer electrolyte fuel cells: a tool for characterisation of gas distribution in the cell and its state of health, *Chemical Engineering Science* (2018), doi: <https://doi.org/10.1016/j.ces.2018.03.055>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



**Current density distributions in polymer electrolyte fuel cells:
a tool for characterisation of gas distribution in the cell and its state of health**

M. Belhadj¹, A. Aquino², J. Heng², S. Kmiotek², S. Raël^{1,3}, C. Bonnet¹, F. Lopicque¹ (*)

¹ Reactions and Chemical Engineering Laboratory, CNRS - Université de Lorraine, ENSIC, 1 rue Grandville, 54000 Nancy, France

² Department of Chemical Engineering, Worcester Polytechnic Institute, Worcester MA 01609, USA

³ Research Group in Electronics and Electrical Engineering in Nancy, Université de Lorraine, 2 Avenue de la Forêt de Haye, 54505 Vandoeuvre les Nancy, France

Abstract

Distributions of current density (cd) in a 100 cm² single polymer fuel cell have been measured, leading to a 12x12 data array. For a freshly matured MEA, the dimensionless distributions have been shown to be of moderate uniformity, whatever the cell current, with average deviations of the dimensionless cd in the range 0.16-0.25 (i.e. cd measured deviated from 16 to 25% from the expected value). More thorough examination of the data acquired showed that the non-uniformity is likely due to maldistribution of the gas in the 23 parallel channels of the multiple serpentine pattern of the commercial bipolar plates. For the sake of comparison, the MEA – including the two GDL was submitted to ageing with a standard cycling protocol (FC_DLC) emulating transportation conditions for 500 hours. Characterisation of the cell state of health afterwards revealed visible degradation of the GDL, whereas the catalytic layer and the membrane were little affected. In the aged cell, distributions were shown to be far more non-uniform, with deviations ranging from 0.30 to 0.50: the current distributions were then depending on the cell current density. Presumably, due to the GDL ageing, liquid water produced at high cd, could not be removed efficiently, resulting in very low cd's near the outlet.

Keywords: Polymer electrolyte fuel cells, current distribution, gas distribution, flow phenomena, flow patterns, degradation of fuel cells

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات