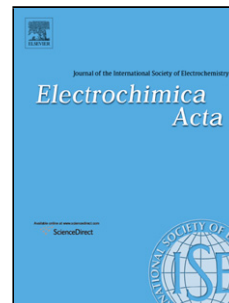


Accepted Manuscript

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PII: S0013-4686(16)31486-4
DOI: <http://dx.doi.org/doi:10.1016/j.electacta.2016.06.157>
Reference: EA 27598

To appear in: *Electrochimica Acta*

Received date: 21-3-2016
Revised date: 26-6-2016
Accepted date: 29-6-2016

Please cite this article as: Yunfeng Zhai, Olga Baturina, David E. Ramaker, Erik Farquhar, Jean St-Pierre, Karen E. Swider-Lyons, Bromomethane Contamination in the Cathode of Proton Exchange Membrane Fuel Cells, *Electrochimica Acta* <http://dx.doi.org/10.1016/j.electacta.2016.06.157>

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Bromomethane Contamination in the Cathode of Proton Exchange Membrane Fuel Cells

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Abstract

The effects of bromomethane (BrCH_3), an airborne contaminant, on the performance of a single PEMFC are compared with that of another halocarbon, chlorobenzene. Under a constant current of 1 A cm^{-2} and at $45 \text{ }^\circ\text{C}$, 20 ppm bromomethane causes approximately 30% cell voltage loss in approximately 30 h, as opposed to much more rapid performance degradation observed with chlorobenzene. Electrochemical impedance spectroscopy, cyclic voltammetry, linear scanning voltammetry, and polarization measurements are applied to characterize the temporary electrochemical reaction effect and permanent performance effects. X-ray absorption spectroscopy is used to confirm that Br is adsorbed on the Pt electrocatalyst surface. We conclude that airborne bromomethane poisons a PEMFC in a different way from chlorobenzene because it is largely hydrolyzed to bromide, Br^- , which is then excluded from the Pt catalyst by the negatively charged Nafion ionomer. The little Br^- and bromomethane that adsorbs on the Pt surface can be partially removed by cycling but causes some irreversible surface area loss.

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