On the Performance of a Direct Formic Acid Fuel Cell Using a Pt-PbO_X/C Anode as Catalyst

G S. Buzzo[1], R. F. B. De Sousa[1], A. O. Neto[2], M. C. Santos[1] and H. B. Suffredini[1,*]

[1] *LEMN – CCNH - UFABC R. Santa Adélia 166, CEP 09210-170- Bangu - Brazil.*
[2] *IPEN-CNEN/SP, CCCH, Av. Prof. Lineu Prestes, 2242 - São Paulo – SP - Brazil*
**hugo.suffredini@ufabc.edu.br*

Direct formic acid fuel cells (DFAFC´s) constitute interesting alternatives for clean energy generation. Formic acid is a non-flammable and non-toxic liquid and its transportation and storage are not dangerous as hydrogen, showing several advantages in comparison with the methanol, as the possibility of using high fuel concentrations [1].

In this present work, we discuss the preparation of Pt-PbO_x/C catalysts (20 % of catalyst load) synthesized by the sol-gel method on carbon powder [2] to promote the oxidation of the formic acid (HCOOH). As demonstrated by Transmission Electron Microscopy (TEM) studies, the distribution of Pt-PbO_x/C catalyst on the substrate is composed of heterogeneous clusters of Pt, surrounded by homogeneously distributed small submicroscopic lead particles [3].

Experimental parameters used in fuel cells tests were: T = 80^{o}C, pressurization = 2 bar , formic acid concentration of 5 mol L^{-1} (flow = 2 ml min^{-1}). The solid electrolyte was a nafion® 117 membrane.' The material showed a very interesting activity in a single direct formic acid fuel cell, presenting high density of power with an important conversion of HCOOH in energy.

Formic acid oxidation mechanism was investigated by ATR-FTIR experiments, using carbon cloth as support for the Pt-PbOx/C catalyst. These studies indicate that the conversion of formic acid to CO_2 is significantly higher than the production of reaction intermediates [4]. Additionally, the tests indicate that the CO_2 formation started in low potential, increasing significantly in higher potentials.

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References

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