

Supported PtRu electrocatalysts for fuel cells of the DMFC type

E. A. de Souza⁽¹⁾, R. R. Passos^{(1)*}, V. L. S. Marinho⁽¹⁾, C. de S. Silva⁽¹⁾ J. da S. Chaar⁽¹⁾

(1) DQ, Universidade Federal do Amazonas, Amazonas, 69077-000, Brasil

* e-mail: rpassos@ufam.edu.br

Abstract – The electrochemical performance of the electrocatalysts is related to their morphology, and this also can be related to the method of preparation. Thus, the electrocatalysts PtRu/C prepared by three different methods of reduction/impregnation and electrochemically characterized in half-cell and single-cell, showed a good performance in voltammetric and chronoamperometric analysis and curves of potential vs. the current density and power density vs. current density, especially the electrocatalyst PtRu/C MRE that reached density of 74.88 mWcm⁻² to 234 mV.

Electrocatalysts with the base metal platinum has been widely employed in the fuel cells operating with methanol as fuel (DMFC), to avoid the effect of poisoning of the catalyst through intermediates adsorbed on the catalytic surface; the CO in particular is the more harmful. In this context, the ruthenium is considered as a second efficient metal. Thus, in this work, PtRu electrocatalysts supported in carbon with high surface area were obtained by three methods of preparation involving the process of reducing the metals and impregnating the carbon support, using bath maintained at 90°C for the method of formic acid (MRE) [1] and reflux system at 130°C for the reduction with ethyl eneglycol (MRE) and 90°C for the reduction with met hanol (MRA) as reducing agents [2].

In overview, the best catalyst is characterized by better anticipating potential in the electrooxidation of methanol in half-cell. As Figure 1a, no difference was observed between the catalysts prepared in the potential for electrooxidation of methanol (about 0.4 V vs. ERH), but higher current values during the anodic scan are observed for the electrocatalysts prepared MRE and lower current values for the electrocatalysts PtRu MRA. In the area of technological interest, (around 0.6 V) was observed that the electrodic material prepared by the MRE method presents a greater electrocatalytic effect and the electrodic material prepared by the MRA method presents a smaller effect, which is confirmed by the quasi-stationary state over 250s, Figure 1b.

The electrochemical characterization in single cells was through the curves (potential vs. current density and power density vs. current density) Figure 2. In low current (up to 0.1 mAcm⁻²) where losses through activation are recorded, the electrocatalyst MRA showed a worse electrochemical performance, on the other hand electrocatalyst MRE along the curve *E* vs. *i* showed higher values of potential. The electrocatalyst PtRu/C MAF showed intermediate behavior for the electrocatalysts. All electrocatalysts showed different behavior when compared to the E-TEK, which can be attributed to the own characteristic of each electrocatalyst that may be because of the method of preparation. The highest maximum power density was obtained for the PtRu/C 74.88 mWcm⁻² to 234 mV, which confirms a better performance of this electrocatalyst in voltammetric and chronoamperometry analyses realized in half-cell.

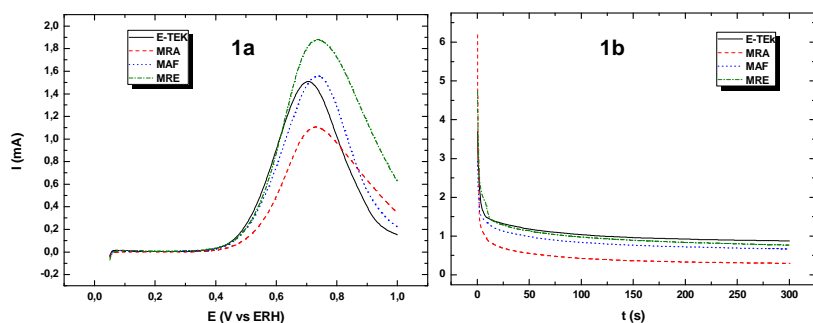


Figure 1: The electrochemical characterization in half-cell with PtRu/C prepared by MAF, MRA e MRE e E-TEK to oxidation methanol 1,0 molL⁻¹ in H₂SO₄ 0,5 molL⁻¹. **a)** Linear sweep voltammetric curves, with speed rate 2 mVs⁻¹; **b)** Current-time curves at 0,6 V vs. RHE..

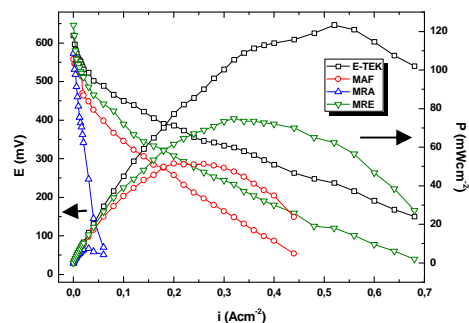


Figure 2: Potential vs. current density curves and power density at 90°C and 3 atm in cathode side, with prepared PtRu/C eletrodes and E-TEK. Nafion® 117 as electrolyte, gas diffusion electrodes with 1 mgPtcm⁻², 15% Nafion® and 40% metal/C. 15% PTFE.

[1] W.H. Lizcano-Valbuena, A. Souza, V.A. Paganin, C.A.P. Leite, F. Galembeck, E.R. Gonzalez, Electrochim. Acta. 48 (2003) 3869.

[2] A.O. Neto, R.R. Dias, M.M. Tusi, M. Linardi, E.V. Spinacé, J. Power Sources, 166 (2007) 87.