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# PtSn/C and PtRu/C electocalaysts for oxidation of methanol in DMFC

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**Abstract** - The electrocatalysts for PtSn/C and PtRu/C were prepared with the method of reduction through alcohol. The technique of cyclic voltammetry shows the similarity of electrocatalyst of PtSn/C with the capacitance of pure Pt and the anticipating of the start of the oxidation of methanol. The studies of the nature of catalysts and the performance of the single cell were analyzed by chronoamperometry. The catalysts of PtSn/C showed similar behavior than the catalyst of PtRu/C prepared by alcohol reduction of the method in low current.

Increase the kinetics of the electrocatalysis of methanol oxidation in fuel cells of the DMFC-type is the biggest challenge for this type of technology due to the poisoning of the electrode by intermediate species [1]. The increase of the electrocatalysis can be obtained by modifying the structure and nature of the electrode and possible changes in relation of the global mechanism of the reaction [1]. Electrocatalysts with tin as the second metal has been little studied for the oxidation of methanol, but it can be verified that exists searching for this metal for the oxidation of ethanol (2.3). The electrocatalysts PtRu/C and PtSn/C prepared by chemical reduction method using reducing reagents such as alcohol (MRA) were evaluated by using different techniques such as cyclic voltammetry, linear scan voltammetry and chronoamperometry in a half-cell and curve of the dependence of potential and current in single cells.

Figure 1 shows the cyclic voltammetry for the electrocatalyst PtSn/C prepared by the method of reduction for alcohol with 0.05 to 1 V in $H_2SO_4$ 0,5M at ambient temperature. The area of adsorption-desorption of hydrogen is unclear (0,05-0,35 V vs. ERH) and low currents achieved, 0.1 mA at least compared to the electrocatalysts PtRu MRA and the commercial was observed in Figure 1.a. This may be related to the own characteristic of the structure of the catalyst, which may include degrees in the formation of the alloys (2). However, the result obtained for the region of electric double layer (0,35-0,8 vs V. ERH) of the electrocatalyst PtSn/C has a similarity to pure Pt, Figure 1b, which is concluding that they have similar capacitance.

The behavior near a stationary situation for the electrocatalyst of a different nature of the second metal was also observed. The adsorption of species on the surface of the electrocatalyst can be observed due to the decrease in the amount of the current for the anode PtSn/C, and only above 250 s there was little change in current, which characterizes certain stability of this material in this current. The behavior of the potential of curve vs. current density was unique for each electrocatalyst, showing the open circuit potentials for Sn of 620 mV to 80°C and a small increase when the high temperature to 90 °C, 630 mV, as shown in Figure 2. The catalyst of PtSn/C showed similar behavior with PtRu MRA at low current densities, but at high current densities the performance is not very satisfactory.

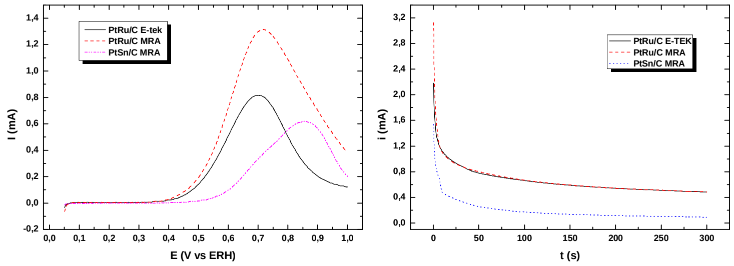

**Figure 1:** The electrochemical characterization in half-cell with PtRu/C prepared by MRA e E-TEK to oxidation methanol 1,0 $molL^{-1}$ in $H_2SO_4$ 0,5 $molL^{-1}$. **a)** Linear sweep voltametric curves, with speed rate 2 $mVs^{-1}$; **b)** Current–time curves at 0,6 V *vs.* RHE.

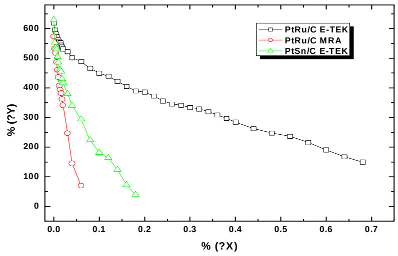

**Figure 2:** Potential vs. current density curves and power density at 90℃ and 3 atm in cathode side, with prepared PtRu/C eletrodes and E-TEK. Nafion® 117 as electrolyte, gas diffusion electrodes

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