

## Microemulsion synthesis of PtCo/C catalyst: electrochemical and morphological characterization.

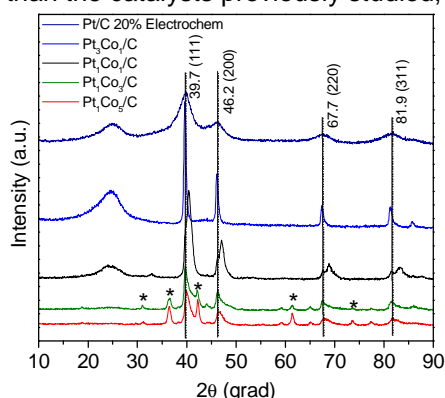
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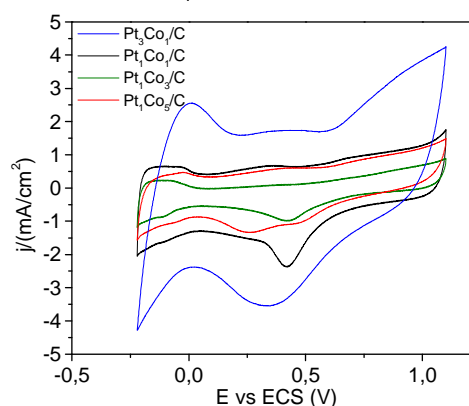
**Abstract** – PtCo/C electrocatalysts with different Pt:Co atomic ratios were obtained by the microemulsion method. All the catalysts exhibited mean particle size calculated by Scherrer equation between 3,6 and 5,7 nm and showed electroactivity for hydrogen and methanol oxidation, as evidenced by electrochemical studies. Chronoamperometry showed the higher performance for Pt<sub>3</sub>Co<sub>1</sub>/C with  $j_{eq} = 2.6 \text{ mA/cm}^2$  after 15 minutes. The catalysts prepared by the microemulsion method showed lower electrochemical activity than the catalysts previously studied and obtained by TPR and NaBH<sub>4</sub> reduction.

In order to decrease the mean particle size and improve electrocatalytic performance, some synthesis routes have been tested to obtain bimetallic catalysts for application in PEMFC, such as the impregnation method followed by reduction for Temperature Programmed Reduction (TPR) or chemical reducing agents. Alternatively, methods using surfactant-based particle stabilization and templating, such as a reverse (water-in-oil) microemulsion stabilized by non-ionic surfactants, could be of great interest. This method allows to proceed the material synthesis in the nanometer size inside aqueous droplets and it has also been showed more effective to control the size of nanoparticles [1, 2].

In the present work, bimetallic PtCo nanoparticles were synthesized by a method involving two microemulsions adapted from Zang and co-workers [3, 4], and catalysts were obtained using Carbon Vulcan XC 72R as support. All the samples obtained were characterized by XRD, electrochemical measurements by cyclic voltammetry to determinate the catalyst-specific electrochemical surface area (ESA) and also to determine the characteristics of the hydrogen and methanol electro-oxidation. The samples were also characterized by chronoamperometry and TEM. The morphologic studies showed control of the particle size, which present a narrow size distribution and the average particles size calculated using the Scherrer equation were found between 3.6 and 5.7 nm, depending of the Co concentration. The electrochemical analysis showed that sample Pt<sub>3</sub>Co<sub>1</sub>/C presented the highest performance for hydrogen oxidation in acid media with ESA = 26 m<sup>2</sup>/g, a value higher than 23 m<sup>2</sup>/g obtained for commercial catalyst whit the same mass of Pt. The activity for methanol electro-oxidation for the Pt<sub>3</sub>Co<sub>1</sub>/C was similar to the commercial sample studied and, as the Co concentration increases, this activity exhibits a significant decrease. The CO tolerance was similar for all samples studied. The chronoamperometry studies showed higher performance for Pt<sub>3</sub>Co<sub>1</sub>/C sample, with  $j_{eq} = 2,6 \text{ mA/cm}^2$  after 15 min at the quasi-stationary state. The catalyst prepared by the microemulsion method presents lower activity for hydrogen and methanol electro-oxidation than the catalysts previously studied, obtained by TPR and NaBH<sub>4</sub> reduction.



**Figure 1.** XRD patterns of the sample series PtCo/C studied and commercial catalyst 10% Pt/C used for comparison.



**Figure 2.** Cyclic Voltammetry (20<sup>o</sup> cycle) using rotating disc electrode for the sample series PtCo/C. H<sub>2</sub>SO<sub>4</sub> 0,5 M (aq), scan rate 50 mV/s vs ECS.

### References

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