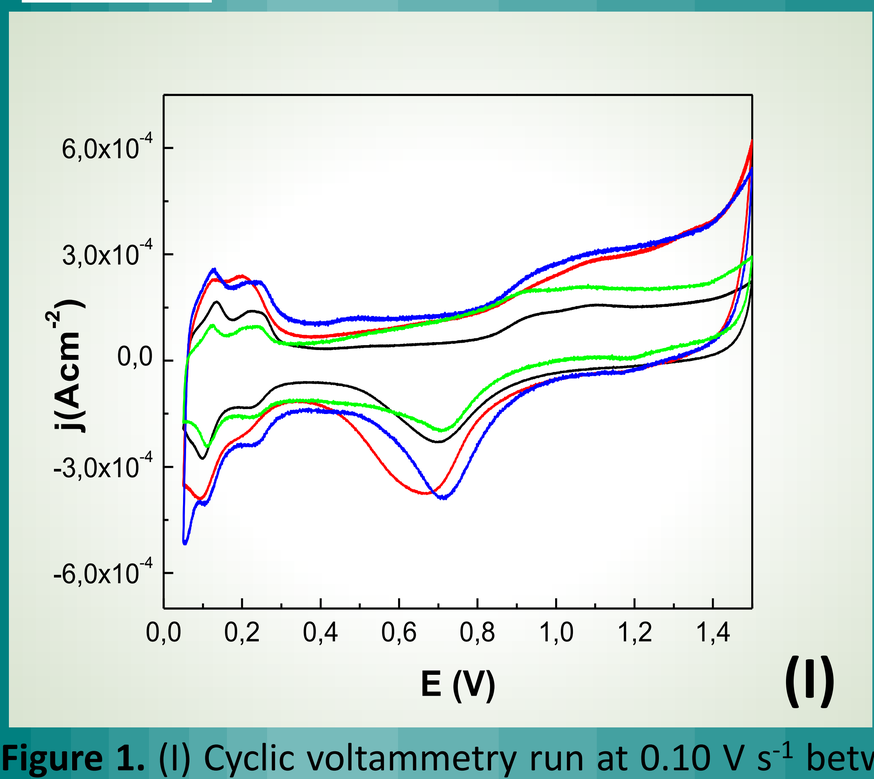
CARBON SUPPORTED Pt, Ru AND Mo CATALYSTS FOR METHANOL ELECTROOXIDATION

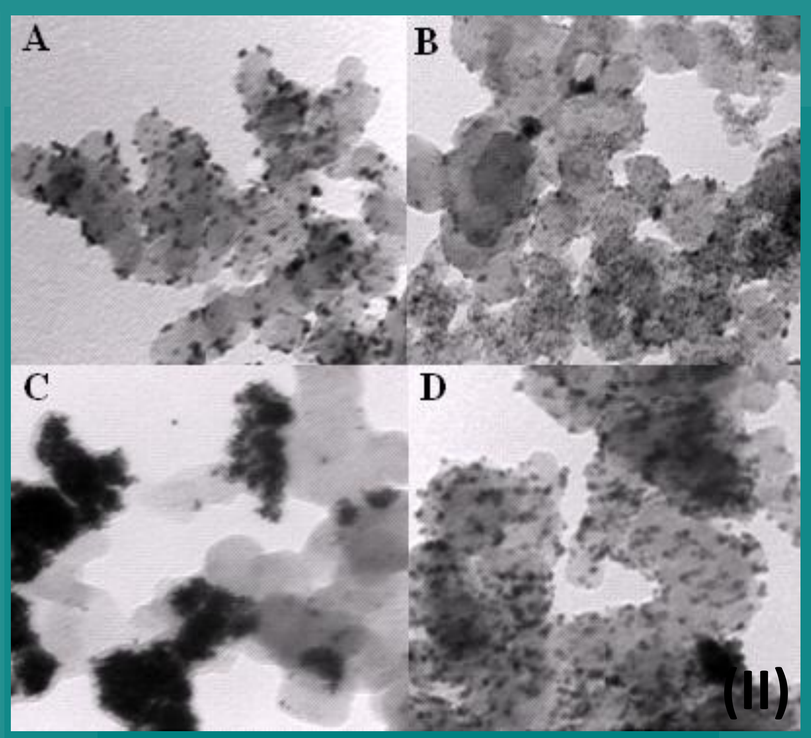
Pérez I.[(1)], Díaz V. [(1)], Teliz E. [(1)], Corengia M. [(1)], Zinola C.F[(1)]

[(1)] Núcleo Interdisciplinario Ingeniería Electroquímica, J. E. Rodó, 1843, 11200, Montevideo, Uruguay

Methanol electrochemical oxidation on carbon supported electrocatalysts was studied on platinum, ruthenium and molybdenum as active phases. Pt/C, PtRu/C, PtMo/C and PtRuMo/C catalysts were synthesized with 20% metal loading by chemical reduction. These catalysts were physical and electrochemical characterized by Transmission Electron Microscope (TEM), cyclic voltammetry and CO anodic stripping voltammetry, respectively. Chronoamperometry was used to analyze and compare the catalysts activities after an electrochemical surface activation. The platinum active area was determined by anodic stripping CO voltammetry, exhibiting a different electrochemical profile for each catalyst.

RESULTS





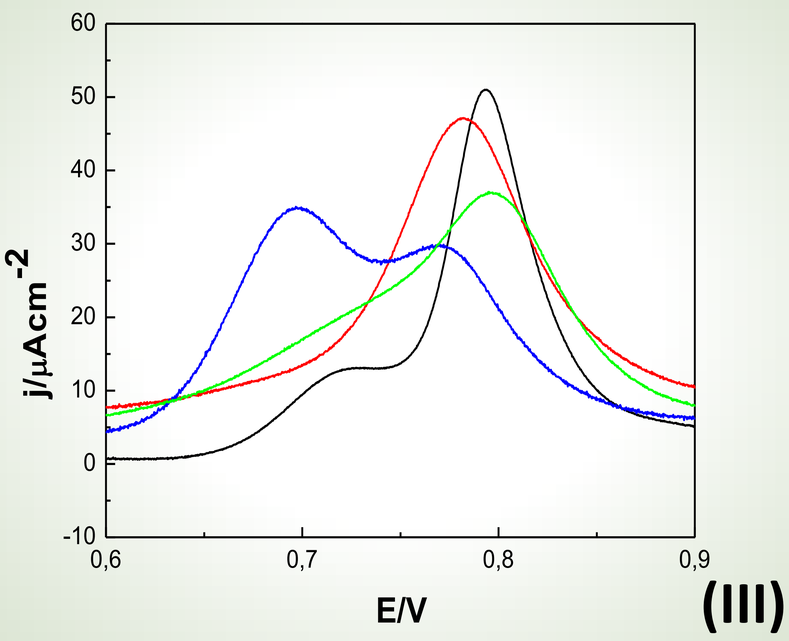
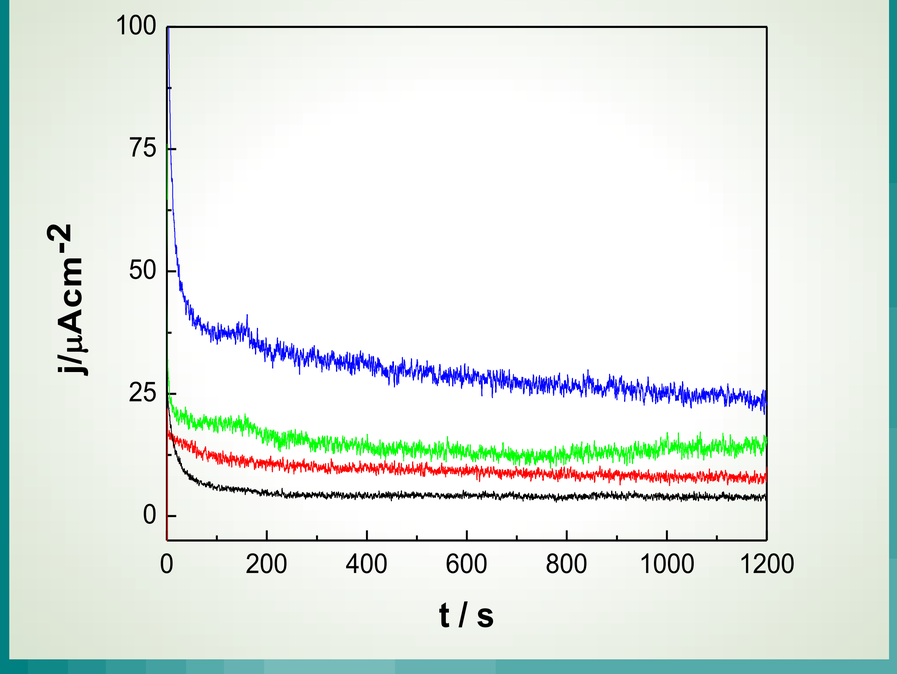


Figure 1. (I) Cyclic voltammetry run at 0.10 V s^{-1} between 0.05 to 1.45 V in 1 M sulfuric acid solution at room temperature of carbon-supported electrodes activated by cathodization at -0.10 V for 3 min. (II) TEM images of carbon supported catalysts; (A) Pt/C, (B) PtRu/C, (C) PtMo/C, (D) PtRuMo/C. (III) CO anodic stripping profile after 20min of adsorption at 0.05V in CO saturated supporting electrolyte. Pt/C (black line), PtRu/C (red line), PtMo/C (blue line), PtRuMo/C (green line).



Charge density values (mC cm^{-2})				
E/mV	**Pt/C**	**PtRu/C**	**PtMo/C**	**PtRuMo/C**
450	0.00	3.82	13.59	3.67
500	5.57	5.31	29.36	3.51
550	20.25	30.48	52.42	17.55
600	74.34	91.23	107.86	54.48

Table 1. Methanol oxidation charge densities values for Pt/C, PtRu/C, PtMo/C and PtRuMo/C after 20 minutes at different potentials.

Figure 2. Current densities transients in methanol 0.1M + sulfuric acid 1M for Pt/C (black line), PtRu/C (red line), PtMo/C (blue line), PtRuMo/C (green line) at 0.50 V.

CONCLUSIONS

The electrochemical methods revealed an enhanced performance of PtMo/C catalysts for methanol oxidation in comparison with the others catalysts studied. After the integration of chronoamperometric plots over 20 min in methanol acid media at 450mV, this catalyst presented charge densities values three times greater than PtRu/C and PtRuMo/C. It was not found any catalytic activity for the Pt/C at this potential value. PtMo CO profile exhibited two peaks and clearly depicted the lowest onset potential value. According with our results, PtMo/C can be considered more tolerant to the formation of catalytic poisons.

ACKNOWLEDGEMENTS

The authors are greatly acknowledged to the CSIC Projects of the UdelaR. *V. Díaz and C. Zinola* are researchers at the Chemistry Area of PEDECIBA United Nations.