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COMPARISON OF CO TOLERANCE OF Pt-Ru AND Pt-Mo ANODES IN PEFCs

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Polymer Electrolyte Fuel Cells, PEFCs, could provide in a near future a primary power source for terrestrial electrical vehicles fed with reformed hydrogen-rich gas. A problem with this fuel is the presence of CO, which even at ppm levels, drastically affects cell performances, poisoning the electroactive sites of Pt/C anode. To solve this problem a typical approach is to use electrocatalysts more tolerant to CO than pure Pt/C, such as Pt-Ru/C and Pt-Mo/C alloys.

We report here comparative studies of the hydrogen oxidation reaction (HOR) of Pt/C, Pt-Ru/C and Pt-Mo/C electrodes. It was studied the effect of Mo content in the catalytic layer of Pt-Mo/C anodes (Mo 17-25 at %) with regard to hydrogen and carbon monoxide oxidation. Electrochemical impedance spectroscopy (EIS) and galvanostatic polarisation were used to characterise the electrochemical behaviour of the gas diffusion anodes in a half-cell configuration with H_2SO_4 1M at 25°C as the electrolyte. With regard to hydrogen oxidation, the catalytic performances were Pt/C>Pt-Ru/C≥Pt-Mo/C and within the Pt-Mo alloys, Pt:Mo 5:1 atomic ratio showed the best performance (fig.1). The addition of 100 ppm of CO to the hydrogen gas stream, decreased the catalytic performance of Pt-Ru/C and Pt-Mo/C about 10÷20 times and 700 times that of Pt/C (catalytic performances Pt-Ru/C≥Pt-Mo/C>>Pt/C).

Pt-Metal alloys showed same trend in performances in presence or in absence of CO, so indicating the existence of a different mecchanism in the HOR resepct to Pt/C electrode. EIS measurements on all Pt-Metal catalysts showed the presence and the influence of oxygenated species. In particular it seems to be a determining factor the oxidation state and/or hydratation of the second metal (Ru or Mo), both on HOR and carbon monoxide oxidation.

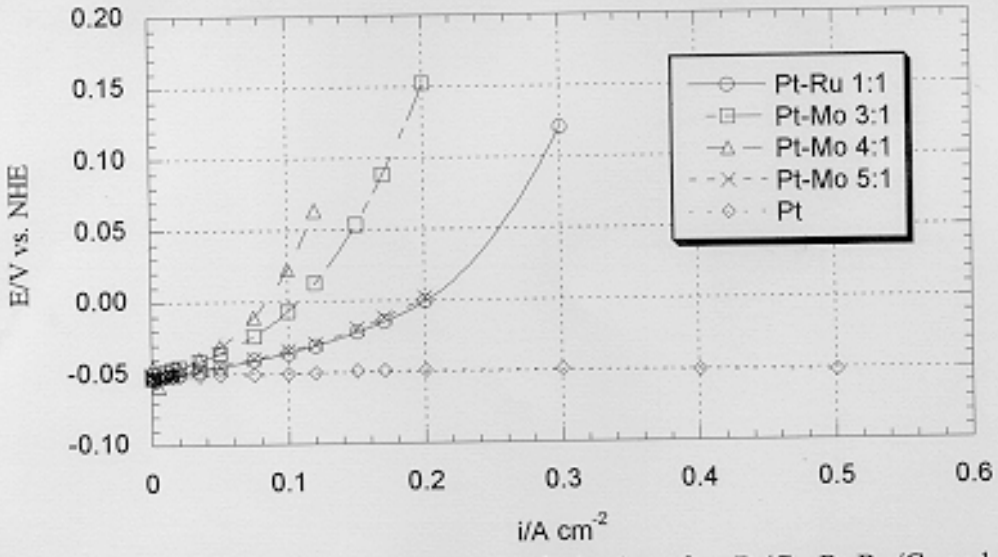

Fig. 1 – IR-free galvanostatic steady-state polarisation for Pt/C, Pt-Ru/C and Pt-Mo/C electrodes in H_2SO_4 1 M at 25°C in H_2 at 50 mL min^{-1}.