Kinetics and stability of PtGa/C catalysts in ethanol electrooxidation

Deise Menezes Santos[1,2] (IC), Giordano Toscano Paganoto[2] (PG), Josimar Ribeiro[2*] (PQ).

[1]Instituto Federal do Espírito Santo, [2]Universidade Federal do Espírito Santo

josimar.ribeiro@ufes.br

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Abstract

In order to evaluate the activity of PtGa/C catalyst in ethanol oxidation, activation energy was estimated and stability was evaluated by chronopotentiometry.

Introduction

Platinum catalysts are known as the best in the oxidative adsorption of small organic molecules such as ethanol, which has promising potential for use in fuel cells because it is a renewable fuel, easily storable and has low toxicity[1]. Pursuing the complete oxidation of ethanol and more stability, a lot of catalysts have been synthesized[2], however, PtGa/C catalysts were not studied for this purpose so far. In order to evaluate the catalytic activity for the electro oxidation of ethanol, five binaries catalysts of platinum and gallium were synthesized by thermal decomposition of the polymeric precursor method, supported on Vulcan XC-72 carbon of high surface area. Chronopotentiometry tests were made in ethanol in acidic medium and the activation energy for each catalyst was estimated by linear voltammetry at different temperatures.

Results and Discussion

Chronopotentiometry tests performed during 15 hours shows that the potential increases with time at constant current and the catalyst with greater gallium content was the most stable and also had the lowest potential for oxidation of ethanol.

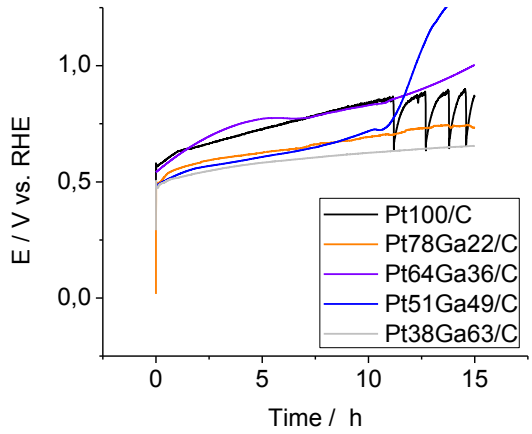

Figure 1. Chronopotentiometry of PtGa/C catalysts at ethanol 1 M, H_2SO_4 0,5 M and 3 mA/cm².

The effect of temperature on ethanol oxidation reaction was monitored by linear voltammetry analysis, varying the temperature of 25 to 65 °C. The activation energy is ranging from 5 to 35 kJ/mol as increases with the potential and all binary catalysts have lower activation energy value than pure platinum catalyst.

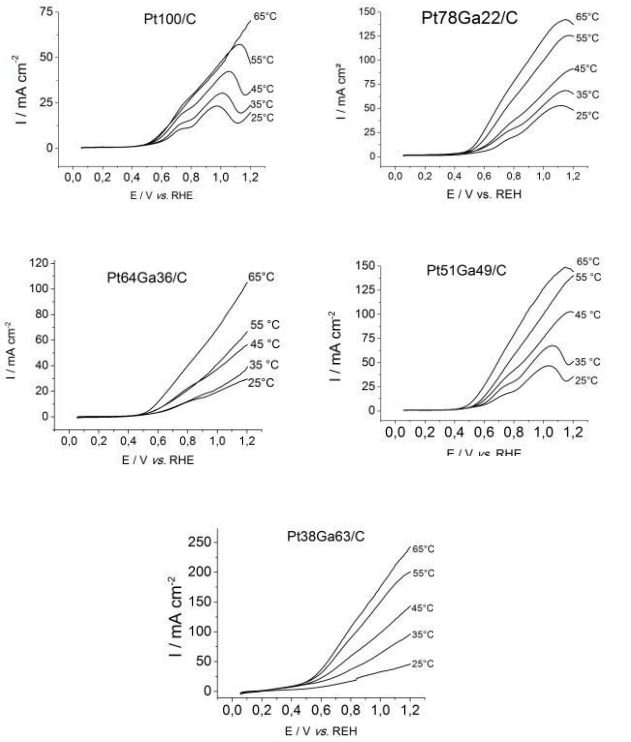

Figure 2. Linear voltammograms for ethanol oxidation 1M on H_2SO_4 0.5M at different temperatures of PtGa/C catalysts.

Conclusions

The PtGa/C catalysts showed greater stability and current towards ethanol oxidation than Pt100/C, as well lower activation energy values.

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