



## The effect of the temperature on the electro-oxidation of glycerol

Victor Y. Yukuhiro\*, Rafael A. Vicente, Cléo T. G. V. M. T. Pires, Pablo S. Fernández

### Abstract

The high demand for the biodiesel production has increased the glycerol (GIOH) generation, largely surpassing the industrial demand. In this context, the glycerol electro-oxidation reaction (GER) has become an interesting option for obtaining high value-added products. In this work, we studied the GER on polycrystalline Pt at different temperatures. We found that this variable strongly influence the electrochemical response. Our next step is to understand these changes in terms of the relative speed of the different reaction pathways.

### Key words:

Glycerol, Electrocatalysis, Temperature.

### Introduction

The incentive to research and produce alternative and renewable fuels to replace fossil fuels increased in the last years, for this reason there is a high demand on the biodiesel production. The biodiesel is produced through a reaction of vegetal (or animal) oil transesterification, and for every 1 ton of produced biodiesel, a 100 kg of raw glycerol are generated. Therefore studies on the GER are being conducted in order to selectively and efficiently obtain products with high value-added.

This work intends to study the effect of the temperature on the main pathways of the GER.

### Results and Discussion

Figure 1 shows the cyclic voltammograms (CVs) obtained with Pt in  $\text{H}_2\text{SO}_4$  0,5M. It is interesting to note how, while the hydrogen adsorption-desorption region (peaks at  $V < 0,4\text{V}$ ) is slightly affected, the Pt oxide formation-reduction diminishes with the temperature. As the  $\text{Pt-O}_x\text{H}_y$  species are necessary species for the oxidation of GIOH, this fact could affect the formation of oxygenated products of GIOH.

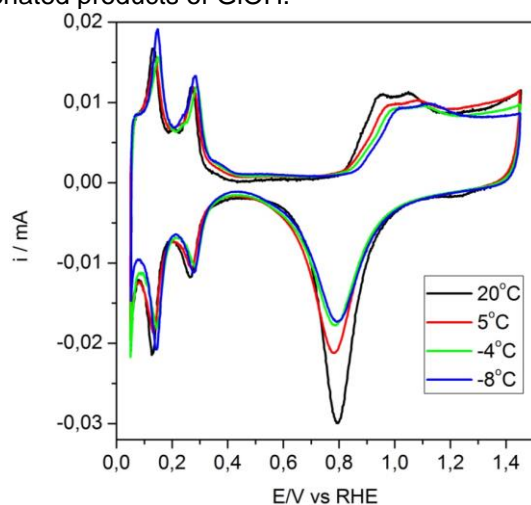


Figure 1. CV of Pt in  $\text{H}_2\text{SO}_4$  0,5M at several temperatures.

After obtaining the blank CV, glycerol 0,1 M was added to the system and the GER was studied by obtaining CV. Figure 2 shows the results obtained during the positive going sweep of the CV. The temperature

slowed down the overall kinetic of the reaction, but more importantly, it also change the CV profile suggesting that this parameter affect in a different way the kinetic of the reaction in domains of the electrode with different atoms arrangements. It is very likely that it will also severely affect the selectivity of the GER.

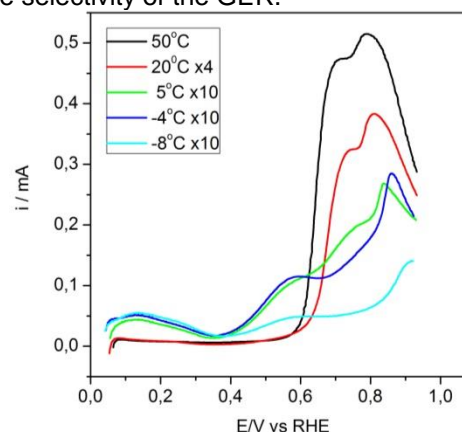


Figure 2. Positive going sweep of a CV obtained with Pt in  $\text{H}_2\text{SO}_4$  0,5M + 0,1M of GIOH at several temperatures. The currents of some CV's were multiplied to allow a better visualization.

### Conclusions

The temperature is an important parameter that severely affects the Pt oxides formation and reduction. It also modified the electrochemical response of the GER.

Based on these results we expect important changes in the selectivity of the GER with the temperature. To get a deeper understanding of these finding, we aim to interpret the results in terms of atoms arrangements at the surface of the electrode and the reaction selectivity. To do this, we plan to perform experiments using single crystals electrodes, fraction collection on line and FTIR in situ.

### Acknowledgement

We thank FAPESP (Process number 2016/01365-0), PRP-FAEPEX and CNPq-SAE.