# The Influence of Platinum Stepped Surface over Glycerol Electrooxidation Reaction

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## Abstract

Glycerol is a very attractive fuel to be used in direct glycerol fuel cell due to great abundance. The present work reports the influence of Platinum surface over glycerol electrooxidation, namely, stepped surfaces having (111) terraces and (110) steps. It has been shown that the steps play an important role in the oxidation of some organic molecules.[1]

## Introduction

Glycerol is abundantly produced as a co-product of the biodiesel fabrication and its use is restricted to pharmaceutical and cosmetics industries. As a result, the offer of this alcohol surpasses its actual demand and the accumulation of big volumes of glycerol can become an environmental problem in a short time scale. For this reason, there has been an effort in finding new applications for glycerol. One of the possibilities is the application of glycerol in direct glycerol fuel cells for electric energy generation and co-generation of commercially interesting chemicals.[2]

## Results and Discussion

All electrodes were cut and polished from small single crystal platinum beads following the procedure described by Clavilier and co-workers. The stepped surfaces belong to the series of Pt(S)[n(111)x(111)] having Miller indices Pt(n,n,n-2). As usual, n represents the number of terrace atoms, which implies that these surfaces have well defined atoms on the terraces. Since the intersection of a (111) terrace and a (111) step also defines a (110). The Fig. 1 shows the CV profile and its peculiar regions that comprises the hydrogen process. The electroactivity of these electrodes for glycerol electrooxidation were studied by CV (Fig. 2). Then, as can be observed, the glycerol oxidizes on different ways. The oxidation reaction onto Pt(111) surface showed a mean peak at 0.55 V and a higher and reverse peak at 0.56 V due to hysteresis effect. For the others surfaces, namely, the stepped, the oxidation peak diminishes as the 111 terraces contribution decrease and the 110 steps sites increases until to reach the Pt(110) surface. For Pt(100), the onset potential starts at 0.66 V and the backward sweep showed lower current than anodic peak at 0.74 V

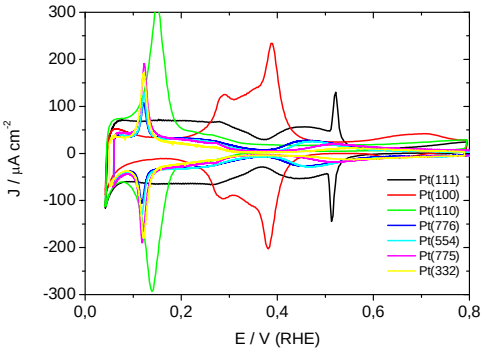


**Figure 1.** CV of Pt(111), Pt(554), Pt(775), Pt(332), Pt(110) and Pt(100). ($H_2SO_4$ 0.1 M, 100 mV $s^{-1}$).

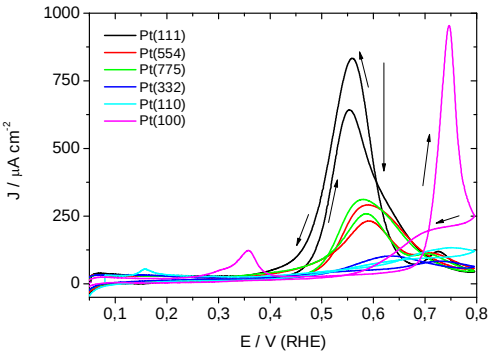


**Figure 2.** Electrooxidation of Glycerol (0.1 M + $H_2SO_4$ 0.1 M, 20 mV $s^{-1}$)onto: Pt(111), Pt(554), Pt(775), Pt(332), Pt(110) and Pt(100).

## Conclusions

According to results obtained, the Pt(111) surface presented the best performance for glycerol electrooxidation. The 110 monoatomic steps sites does not contributes to improve the oxidation reaction, once the peak decreases gradually as the 111 terraces diminishes.

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