The desirable conditions for total oxidation of the ethanol to CO$_2$ were pursued. Different solutions in electrolysis of ethanol in different Pt-M electrodes as to the Pt sites there are strongly adsorbed carbon containing species, the Pt-M electrodes consisted of a Pt electrode and bimetallic alloys (MO) such as Ru, Rh, Sn, Re, Pd, Mo, Ti, Co, Ni, CoO$_2$, RuO$_2$, SnO$_2$, Pt-Ir electrodes present higher current density values in both alkaline and acid media. This suggests that different mechanisms of reaction may be taking place. Additional results and an analysis of the thermodynamics of the reaction will be presented.

**Results**

Figures 1 and 2 shows the steady cyclic voltammetry performance of a 1M ethanol solution in alkaline (KOH) and acidic media (H$_2$SO$_4$) at room temperature, with a 10mV/s scan rate. The results indicate that the media as well as the electrode strongly affects the electro-oxidation of ethanol. The first peak (which is related to the ethanol oxidation) starts at about -0.6 V vs Ag/AgCl, and at about 0.15 V vs Ag/AgCl, for the alkaline and acidic media, respectively. In addition, Pt-Ru and Pt-Ir electrodes present higher current density values in both alkaline and acid media.

**Introduction**

Ethanol is an attractive liquid fuel for polymer electrolyte fuel cell applications: it is convenient to store, it has less toxicity, it is the major renewable biofuel from fermentation of biomass, its partial oxidation products are less toxic than those of other alcohols, it possesses a high theoretical mass energy density of 8.1 kWh/kg, it has an electrochemical activity comparable to that of methanol, and its permeability through the polymer electrolyte membrane is low.[1-9]. Among the electrodes used to electro-oxidize ethanol, Platinum-based electrocatalysts are well-known for the electro-oxidation of organics molecules such as ethanol, but they are subject to poisoning due to the adsorbed CO molecules over the Pt which reduces drastically the catalyst activity.[1-11]. Therefore, addition of other metals (M) and metal oxides (MO) such as Ru, Rh, Sn, Re, Pd the ethanol electro-oxidation is improved.[7-9] Several studies has shown that the addition of Ru favors the adsorption of oxygen-containing species, while at the Pt sites there are strongly adsorbed carbon containing species, thus the oxidation of those carbon species can be achieved at lower potentials.[2,5,12].

**Methodology**

The objective of this work is to investigate the electrolysis of ethanol in different Pt-M electrodes to address these questions, leading to a better understanding of the electro-oxidation reaction of ethanol on Pt-M electrodes. Electrochemical techniques, combined with computational chemistry will be used to achieve the objectives. This work is important for the development of new alloys to improve the electro-oxidation of ethanol for fuel cell applications.

**Investigation of the Electro-oxidation of Ethanol on Different Alloys**

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