ABSTRACT

In this work, it was investigated the electrocatalytic properties of oxides electrodes denominated dimensionally stable anodes, DSA®, in NaCl medium, applying them for ethanol oxidation. For this propose, many experimental parameters nave been investigated: the modulator oxide, changes in the preparation method of the electrode and pH changes of the solution.

Electrodes with nominal composition $Ti/M_xS_{(1-x)}0_2$ (where M = Ru and Ir, S = Ti and Sn, x = 0.3; 0.5 and 0.7) were prepared by thermal decomposition changing the precursors solution; (i) polymeric precursors (DPP) and (ii) inorganic precursors (Chloride) dissolved in isopropanol (DPI/ISO). The support electrolytes were 3.0 mol dm^{-3} NaCl and 3.0 mol $dm.^{3}$ NaCl acidified with 0.01 mol dm^{-3} HCl.

There is a problem when one prepares oxides electrodes using tin chloride. The tin chloride, in acid medium, suffers oxidation from Sn (II) to Sn (IV), the latter one volatilize at the higher temperatures used to prepare the electrode (450° C). SEM and EDX analyses were used to evaluate if the changes introduced in the preparation method contributed to inhibit the tin volatilization. The results obtained for all electrodes showed a good agreement of nominal and experimental compositions, proving that both preparation methods are efficient to fix tin in the coating.

It was performed electrochemical investigation in the presence and absence of ethanol, the experimental results for DPP electrodes containing $Sn0_2$ show better catalytic properties for oxidation species production and also for ethanol oxidation.

Electrolyses at constant current were performed with four nominal electrode compositions: $Ti/Ru_{0.5}Ti_{0.5}O_2$, $Ti/Ru_{0.7}Sn_{0.3}O_2$, $Ti/Ir_{0.5}Ti_{0.5}O_2$ e $Ti/Ir_{0.3}Sn_{0.7}O_2$, all of them was prepared through DPP method. It has been applied two different current densities: 25 mA cm^{-2} and 75 mA cm^{-2}. Both current densities showed acetic acid as main oxidation product, it was also observed the C-C bond break forming $C0_2$, this has not been reported before for ethanol oxidation using DSA®. However, at 25 mA cm^{-2} acetaldehyde is formed, whereas, it was not observed at 75 mA cm^{-2}. In this case, the high current density might favor the oxidation of intermediate products formed during the electrolysis.

Experiments performed in the absence of chloride did not show the formation of CO_2, Therefore, the presence of oxidizing species (chlorine and hypochlorite) favors the cleavage of C-C and formation of $C0_2$ as oxidation product of ethanol.