Fuel cell and electrochemical studies of the ethanol electro-oxidation in alkaline media using PtAuIr/C as anodes

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The use of fossil fuels has resulted in an increase of CO2 concentration in the atmosphere . It is well known that CO2 emission from fossil fuels is one of the principals responsible for the greenhouse effect. Taking these aspects into account,fuel cells might bean excelente alternative to the current energy generation as a clean and eficiente power source. In this context, alkaline fuel cells have attracted worldwide attention due to its promise to produce clean energy with high efficiency [1], thus direct etanol fuel cell could offer an alternative for electrical energy generation. In this work, ethanol electro-oxidation reaction was investigated considering conventional electrochemical experiments in alkaline media, direct ethanol fuel cell (DEFC), and in situ ATR-FTIR. The working electrode/anodes were composed of monometallic Pt/C, Au/C, Ir/C, and trimetallic PtAuIr/C nanoparticles with atomic Pt/Au/Ir ratios of 40:50:10, 50:40:10, 60:30:10, 70:20:10, and 80:10:10. X-ray diffraction (XRD) suggests PtAuIr/C alloy formation, and according to transmission electron micrographs, the mean particle sizes are from 4 to 6 nm for all catalyst compositions. PtAuIr/C 40:50:10 showed the highest catalyticactivityforethanolelectro-oxidationintheelectrochemical experiments; using this material, the peak current density from ethanol electro-oxidation on cyclic voltammetry experimente was 50 Ma per g of Pt, 3.5 times higher than that observed with Pt/C. The fuel cell performance was superior using all PtAuIr/C compositions than using Pt/C. Au/C and Ir/C presented very poor catalytic activity toward etanol electro-oxidation. The improved results obtained using PtAuIr/C might be related to the OHads species formed at low overpotential on Ir and to the decrease on adsorption energy of poisoning intermediates on Pt sites, promoted by Au.

References: 1. Sun C-L, Tang J-S, Brazeau N, Wu J-J, Ntais S, Yin C-W et al (2015). Electrochim Acta 162: 282–289