Oxidation of methanol on PtRuIn/C in alkaline medium: Effect of metals on the electrocatalytic activity

Monique Carolina L. Santos* and Almir Oliveira Neto

Instituto de Pesquisas Energéticas e Nucleares - IPEN/CNEN-SP, Av. Prof. Lineu Prestes, 2422 – Cidade Universitária – CEP: 05508-900, São Paulo, SP, Brazil.
*E-mail: moniquecarolinaa@gmail.com

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In this work the different electrocatalytic systems PtRu(50:50)/C, PtIn(50:50)/C, PtRuIn(50:10:40)/C and PtRuIn(50:40:10)/C were synthesized by the sodium borohydride reduction method, in order to be used as an anode in the alkaline fuel cell in the presence of methanol. The obtained materials were characterized by EDX, DRX and MET techniques. The reduction method applied in the synthesis was effective, since the particles showed good dispersion in the carbon support Vulcan XC72, according to the EDX and MET analyzes. The results obtained by XRD showed in all the diffractograms presented the FCC structure of platinum and a relative displacement of the equivalent peak to the plane (220) for values greater than and less than 2Θ. The mean crystallite size and the calculated net parameters indicated the insertion of Indium and Ruthenium atoms to the Platinum structure, assuming the formation of alloys. The electrochemical oxidation of methanol was studied by cyclic voltammetry, chronoamperometry and polarization curves. The PtRu(50:50)/C electrocatalyst in alkaline media showed the higher electrocatalytic activity fot the methanol electro-oxidation at room temperature compared to the others electrocatalysts prepared. The experiments in alkaline single direct methanol fuel cell (DMFC) also showed that PtRuIn(50:10:40)/C electrocatalyst exhibited higher performance for methanol oxidation at 80ºC, in comparison with the others electrocatalysts synthesized. These results indicated that the addition of Ru and In promote the methanol electrochemical oxidation, which could be attributed to the bifunctional mechanism (the presence of Ru and In oxides species) associated to the electronic effect (Pt-Ru-In alloys).