Int. J. Electrochem. Sci., 13 **(2018)** 10587 – 10600

International Journal of ELECTROCHEMICAL SCIENCE
www.electrochemsci.org

Electrocatalytic Performance of PtSn/C-In_2O_3.SnO_2 Nanoparticles Prepared by Sodium Borohydride Reduction Process for Ethanol Oxidation in Acidic and Alkaline Electrolytes

C.V. Pereira[1], *E.H. Fontes*[1], *J. Nandenha*[1], *M.H.M.T. Assumpção*[2] *and A.O. Neto*[1,*]

[1] Instituto de Pesquisas Energéticas e Nucleares, IPEN/CNEN-SP, Av. Prof. Lineu Prestes, 2242 Cidade Universitária, CEP 05508-000, São Paulo, SP, Brazil
[2] Universidade Federal de São Carlos, UFSCar Campus Lagoa do Sino, Rodovia Lauri Simões de Barros Km 12, CEP 18290–000 – Buri – São Paulo, SP (Brazil)
[*]E-mail: aolivei@ipen.br

doi: 10.20964/2018.11.49

Received: 23 June 2018 / *Accepted:* 20 August 2018 / *Published:* 1 October 2018

PtSn/C-In_2O_3.SnO_2 electrocatalysts were prepared by the borohydride reduction method in the single step using $H_2PtCl_6.6H_2O$ and $SnCl_2.2H_2O$ as metal sources, sodium borohydride as reducing agent and a physical mixture of 85% Vulcan Carbon XC72 and 15% In_2O_3.SnO_2 (indium tin oxide – ITO) as support. PtSn/C-In_2O_3.SnO_2 electrocatalysts were characterized by X–ray diffraction (XRD), energy dispersive analysis (EDX), transmission electron microscopy (TEM), cyclic voltammetry (CV), chronoamperommetry (CA) and polarization curves in alkaline and acidic electrolytes (single cell experiments). The diffractograms of PtSn/C-In_2O_3.SnO_2 electrocatalysts showed peaks associated to the face-centered cubic (fcc) structure of platinum, peaks which could be identified as a cassiterite SnO_2 phase or with Indium-doped SnO_2 (ITO) used as supports. TEM micrographs showed metal nanoparticles with average nanoparticle size between 2.4 and 2.7 nm. Ethanol oxidation in acidic and alkaline electrolytes was investigated at room temperature, by chronoamperommetry (CA), where PtSn/C-In_2O_3.SnO_2 (70:30) showed the highest activity among all electrocatalysts in study considering ethanol oxidation for acid electrolyte, while for alkaline electrolyte the highest activity was observed for PtSn/C-In_2O_3.SnO_2 (50:50). Polarization curves at 100°C showed PtSn/C-In_2O_3.SnO_2 (70:30) with superior performance for ethanol oxidation for acidic electrolyte and PtSn/C (70:30) for alkaline electrolyte, when compared to Pt/C for both electrolytes. The best performance obtained by PtSn/C-In_2O_3.SnO_2 (70:30) in real conditions could be associated with the occurrence simultaneously of the bifunctional mechanism and electronic effect resulting from the presence of PtSn alloy or a synergetic effect between PtSn and In_2O_3.

Keywords: Borohydride reduction process, PtSn/C-In_2O_3.SnO_2, ethanol oxidation, acidic and alkaline electrolytes, polarization curves

FULL TEXT