Pd/C-ITO electrocatalysts for glycerol electro-oxidation

Carlos E.D. Ramos[1] Instituto de Pesquisas Energéticas e Nucleares (IC), Cristiane A. Ottoni[2] Universidade Estadual Paulista Júlio de Mesquita Filho - Câmpus Litoral Paulista (PQ), Sirlane G. da Silva[1] Instituto de Pesquisas Energéticas e Nucleares (PG), Rodrigo F.B. de Souza[3] Universidade Federal do Amazonas (PQ), Almir O. Neto[1*] Instituto de Pesquisas Energéticas e Nucleares (PQ).

***Corresponding Author: aolivei@pq.cnpq.br**

[1]*Instituto de Pesquisas Energéticas e Nucleares, IPEN/CNEN-SP, Av. Prof. Lineu Prestes, 2242 Cidade Universitária, CEP 05508-900 São Paulo, SP, Brasil.*

[2]*Biosciences Institute, São Paulo State University - UNESP, Coastal Campus, 11330-900 São Vicente, Brazil.*

[3]*Universidade Federal do Amazonas – UFAM, Av. General Rodrigo Octávio, 200, CEP: 69077-000, Manaus, AM, Brasil.*

Palavras Chave: *Pd/C-ITO electrocatalyst, Glycerol oxidation, Direct alkaline glycerol fuel cell*

Abstract

Pd/C-ITO electrocatalysts were synthesized by borohydride method in different ratios. These materials were characterized for X-ray diffraction (XRD), transmission electron microscopy (TEM), chronoamperometry and direct alkaline glycerol fuel cell (DAGFC). Presence of Pd, SnO_2 and indium phases was detected for XRD. TEM images for Pd/C-ITO electrocatalysts showed particle size range 6nm and agglomeration for all material synthetized. Pd/C-ITO (50:50) electrocatalyst presented best results for chronoamperommetry measurements, on the other hand, for DAGFC Pd/C-ITO (85:15) was the better, at open circuit potential of about 0.96 V and the maximum power density about 17 mW cm^{-2}.

Introdução

Among different types of fuel cells, direct alkaline alcohol fuel cells (DAAFCs) have the advantages of low operating temperature and ease of liquid fuel handling[1]. Recently, the electro-oxidation of glycerol have been receiving special attention due specific chemical characteristics. As well known, electrocatalytic material are the most important and expensive component in DAAFCs. Some works have been devoted to electro-oxidation of glycerol using Pd electrocatalytic as alternative to Pt in terms of cost and availability. In addition, conductive supports, which can replace the carbon black, in an attempt of improving the dispersion, activation and stability of the metal particles on the carbon surface for increasing the electroconductivity have been studied[2,3]. In this context, the purpose of this study was to characterize Pd electrocatalytic supported on a physical mixture carbon Vulcan XC72 and indium tin oxide (ITO) and, evaluate their catalytic activity in a direct alkaline glycerol fuel cell (DAGFC).

Resultados e Discussão

XRD presented Pd, SnO_2 e índium oxides phases (Fig. 1). TEM images for Pt/C-ITO electrocatalysts showed particle size ranging 6 nm (Fig.2). Pd had a great affinity for materials containing higher amounts of oxides.

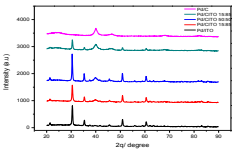

Figure 1. XRD pattern of Pt/C-ITO.

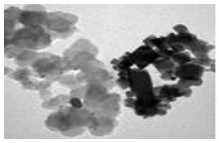

Figure 2. TEM images of Pd/C-ITO.

Electrochemical experiments shown Pd/C-ITO 50:50 was the most active material for glycerol oxidation (Fig.3a) while for DAGFC Pd/C-ITO 85:15 had largest activity (Fig 3b).

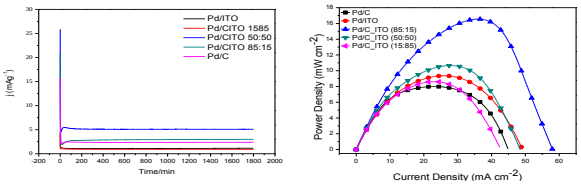

Figure 3. a) Chronoamperometry curves Pd/C-ITO in 1M KOH solution; b) Polarization curves of DAGFC.

Conclusões

Pd/C-ITO (50:50) was the most active material due the sinergic effect between support and electrocatalytic. However, in DAGFC Pt-ITO (85:15) shown major current density .

Agradecimentos

The authors thank CNPq (150111/2015-0) and CAPES for financial support and CCTM from IPEN/CNEN-SP for TEM measurements.

[1] Xie, A.; Zhou, X.; Zhou, W.; Cai, K.; Li, w.; Luo, S.; Yao, C. *Electrochim. Acta* **2016**, 189, 215.

[2]Geraldes, A.N.; da Silva, D.F.; Silva, L.G.A.; Spinacé, E. V.; Neto, A.O.; dos Santos, M.C. *J. Power Sources* **2015**, 293, 823.

[3]Ilieva M, Vessela Tsakova. *J. Solid State Electrochem.* **2015**, 19, 2811.