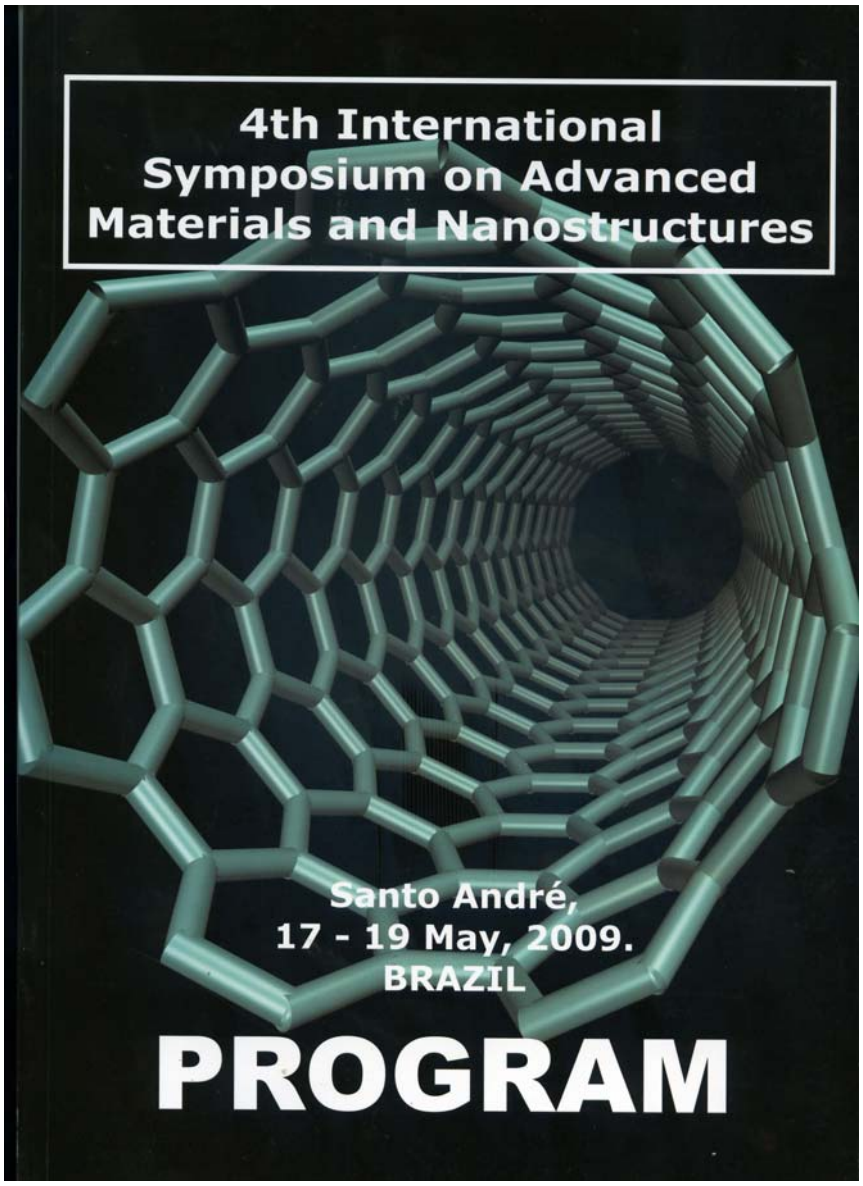
4th International
Symposium on Advanced
Materials and Nanostructures
Santo André,
17 - 19 May, 2009.
BRAZIL
PROGRAM

P46 - THE INFLUENCE OF CARBON SOURCE ON THE ACTIVITY OF PtRu/C ELECTROCATALYSTS PREPARED BY HYDROTHERMAL CARBONIZATION *PROCESS*

Marcelo M. Tusi, Gabriela G. Magalhães, Michele Brandalise, Olandir V. Correa, Ricardo M. Piasentin, Almir Oliveira Neto, Marcelo Linardi, Estevam V. Spinacé.

Instituto de Pesquisas Energéticas e Nucleares – IPEN/CNEN – SP, São Paulo, Brazil.

Direct Alcohol Fuel Cells (DAFC) are very attractive as energy source for portables, mobiles and stationary applications. The methanol is considered the most promising alcohol and carbon-supported PtRu nanoparticles (PtRu/C electrocatalyst) the best electrocatalyst [Spinacé, 2007 Research Materials 10 171-175]. Many studies have been shown that the use of carbon nanotubes and mesoporous carbons as support increase the performance of PtRu/C electrocatalysts, but the synthesis of these supports generally involves harsh conditions [Wilkinson, 2006 J. Power Sources 155 95-110]. Recently, the synthesis of metal/carbon nanoarchitectures by a one-step and mild hydrothermal carbonization process was reported using starch or glucose and noble metals salts [Cölfen, 2004 Advanced Materials 16 1636-1640]. In this work, we evaluated the influence of carbon source on the electroactivity of PtRu/C electrocatalysts prepared by hydrothermal carbonization.

PtRu/C electrocatalysts (5 wt% - metal loading) were prepared using glucose, starch or cellulose as carbon source and reducing agent, $H_2PtCl_6.6H_2O$ and $RuCl_3.xH_2O$ as metals source and catalysts of carbonization process. An aqueous solution of the carbon source was mixed with an amount of noble metal salts and then submitted to hydrothermal treatment in a Teflon lined autoclave at 200ºC for 6 h. The obtained solids were filtered, washed with ethanol and water and dried at 70 ºC. After this, the resulting material was thermally treated at 900°C under argon. The PtRu/C electrocatalysts were characterized by SEM, EDX, XRD and TGA and were tested for methanol electro-oxidation by cyclic voltammetry.

The PtRu/C electrocatalysts showed Pt:Ru atomic ratios obtained by EDX similar to the nominal ones. XRD analysis of the electrocatalysts showed a broad peak at about $2\theta = 20°$ associated to the carbon material and five peaks at about $2\theta = 40°$, 47°, 67°, 82° and 87°, that are associated to the (111), (200), (220), (311) and (222) planes, respectively, of the face cubic centered (fcc) structure of platinum and platinum alloys. A peak at about $2\theta = 43°$, which was associated to a metallic ruthenium phase, was also observed for all electrocatalysts. The average crystallite size of the fcc phase was calculated using Scherrer equation and the calculated values were in the range of 7-10 nm. The PtRu/C electrocatalysts prepared by hydrothermal carbonization process were tested for methanol oxidation and the electroactivity was strongly dependent of the carbon source.

The authors thank IPEN/CNEN-SP, MCT-FINEP Pro-H_2, CNPq, FAPESP and CAPES for financial support.