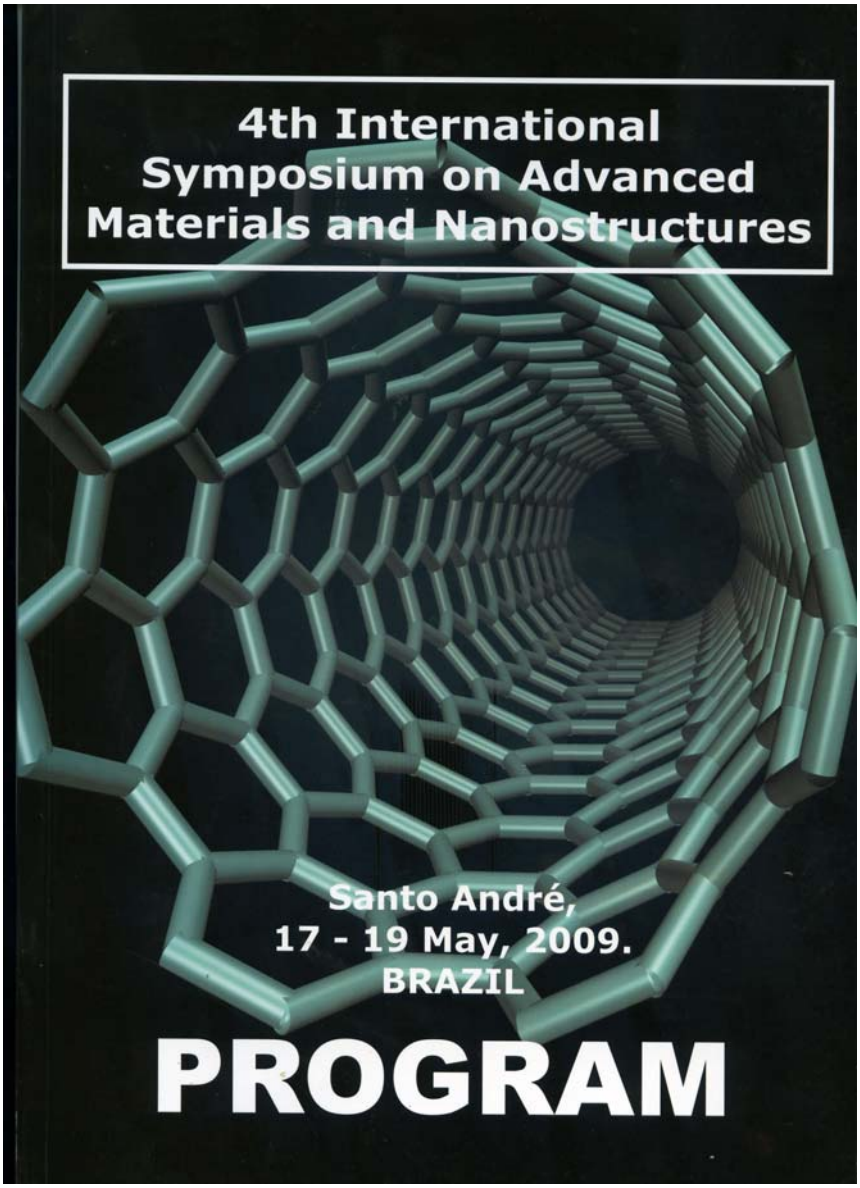
4th International Symposium on Advanced Materials and Nanostructures



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PROGRAM

P50 - ELECTRO-OXIDATION OF ETHANOL USING PtSnBi/C ELECTROCATALYSTS PREPARED BY A BOROHYDRIDE REDUCTION PROCESS

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Fuel cells employing alcohols directly (direct alcohol fuel cell, DAFC) are attractive as power sources for mobile, stationary and portable applications. Compared to hydrogen-fed fuel cells, which need a reforming system or have problems of hydrogen storage, DAFCs use a liquid fuel, thus simplifying the fuel delivery system [Neto, 2007 J.Power Sources 166 87-91]. Ethanol offers an attractive alternative as the direct fuel because it is produced in large quantities from biomass and it is much less toxic than others alcohols. Carbon supported platinum is commonly used as anode catalyst in low temperature fuel cells, however, pure Pt is not an efficient anodic catalyst for the direct ethanol fuel cell. Platinum itself is known to be rapidly poisoned on its surface by strongly adsorbed species coming from the dissociative adsorption of ethanol. Efforts to mitigate the poisoning of Pt have been concentrated on the addition of co-catalysts to platinum. In recent years, it is found that certain metal oxides as SnO_2 can enhance the catalytic activity for ethanol and methanol electro-oxidation through synergetic interaction with Pt [Neto, 2007 J.Power Sources 166 87-91].

In this aspect it is important to study new binary and ternary electrocatalysts for ethanol oxidation [Neto, 2007 J.Power Sources 166 87-91]. PtSn/C (50:50), PtBi/C (50:50), PtSnBi/C (50:40:10) and PtSnBi/C (50:10:40) electrocatalysts (20 wt% metal loading) were prepared by a borohydride reduction process using $H_2PtCl_6.6H_2O$, $SnCl_2.xH_2O$ and $Bi(NO_3)_3.5H_2O$ as metals sources and Vulcan XC 72 as support. The electrocatalysts were characterized by energy-dispersive X-ray analysis (EDAX) and X-ray diffraction (XRD). The electro-oxidation of ethanol was studied in acid medium by cyclic voltammetry and chronoamperometry using thin porous coating technique.

The Pt:Sn, Pt:Bi and Pt:Sn:Bi atomic ratios (EDAX) of the obtained electrocalysts were similar to the nominal atomic ratios and the average crystallite size were in the range of 3–7 nm. The X-ray diffractograms of Pt/C, PtSn/C, PtBi/C and PtSnBi/C electrocatalysts showed a broad peak at about $2\theta = 25°$ that was associated with the carbon support and four diffraction peaks at about $2\theta = 40°$, 47°, 67° and 82° characteristic of the face centered cubic structure (fcc) structure of platinum and platinum alloys. For PtBi/C (50:50) and PtSnBi/C (50:10:40) electrocatalyst was also observed the presence of the bismuth oxide phase (Bi_2O_3). The electrochemical studies showed that PtSnBi/C (50:10:40) electrocatalyst had superior performance for ethanol electro-oxidation at room temperature compared to PtSn/C (50:50) and PtBi/C (50:50) electrocatalysts.

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