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Characterization of PtSnNi/C nanocatalysts obtained using alcohol reduction process

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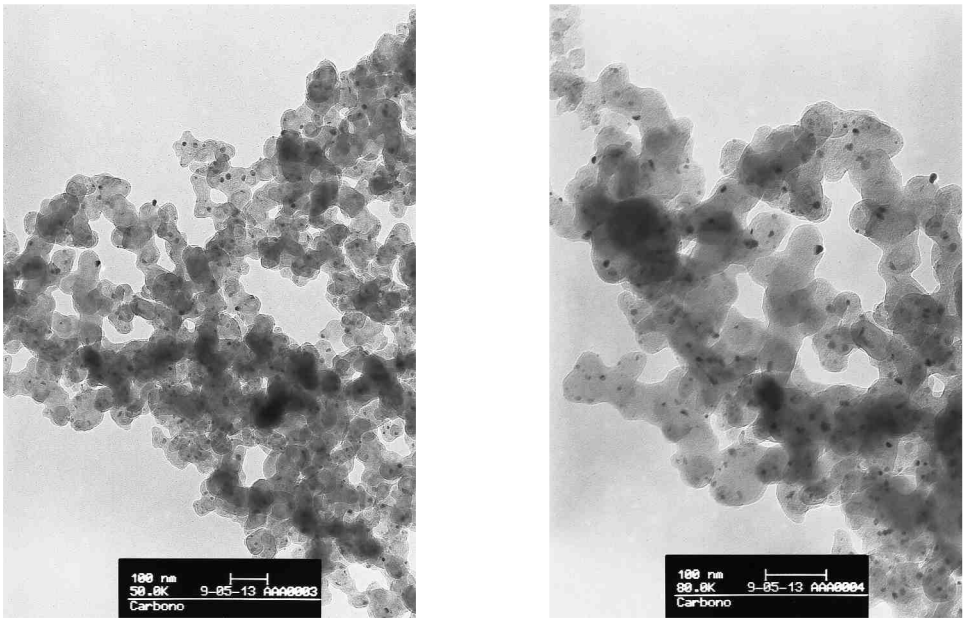
Abstract – PtSnNi/C nanocatalysts for ethanol oxidation with different molar ratios were prepared. It was used alcohol reduction process with ethylene glycol as reducing agent and Vulcan Carbon XC-72 as support. With X-ray diffractometer (XRD) and transmission electron microscope (TEM) it was possible to characterize the nanoparticles in terms of composition, distribution and size.

The use of ethanol has some advantages in Direct Alcohol Fuel Cells, where it can be converted directly into electrical energy. It is a non-toxic renewable fuel with high energy density, easy to transport and store. However anode kinetic is very slow and the oxidation has low efficiency. Some authors have studied carbon-supported platinum-based nanocatalysts like PtRuSn/C, PtRuNi/C and PtSnNi/C for ethanol oxidation achieving different performance[1,2]. In this study we synthesized PtSnNi/C with Pt:Sn:Ni (75:10:15, 75:15:10, 60:16:24 and 60:24:16) atomic ratios in order to observe composition, distribution and size.

The nanocatalysts were prepared using $H_2PtCl_6 \cdot H_2O$ (Aldrich), $NiCl_2 \cdot 6H_2O$ (Aldrich) and $SnCl_2 \cdot 2H_2O$ (Aldrich) with 20 wt.% as metal sources, ethylene glycol (EG) (Aldrich) as reducing agent and solvent and carbon Vulcan XC-72 as support. The carbon was added to EG/water (75/25, v/v) and treated in a ultrasound bath for 1h. Then the metals sources dissolved also in EG/water (75/25, v/v) were added to the carbon and the pH was adjusted to 12. The mixture was heated to 130°C and kept in this temperature for 3h. Finally the mixture was filtered, washed and dried.

The Pt:Sn:Ni atomic ratios of the nanocatalysts were very similar to the atomic ratio used in the preparation. Using alcohol reduction process it was able to obtain the nanocatalysts in one step, with good distribution and similar size range.



Figures: TEM images of a PtSnNi/C with Pt:Sn:Ni (75:10:15) atomic ratio

References

[1] A. O. Neto et al. / Journal of Power Sources 166 (2007) 87-91
[2] E. Ribadeneira, B.A. Hoyos / Journal of Power Sources 180 (2008) 238-242