

Synthesis and characterization of Ni/C and NiFe/C as electro-catalysts for glycerol oxidation in alkaline media

V.L.Oliveira¹, G. Tremiliosi-Filho¹

¹*Universidade de São Paulo, São Carlos, SP, Brazil
Instituto de Química de São Carlos- IQSC*

The Ni-based electrocatalysts have been shown promising due to their high catalytic activity and its competitive price. Ni-based alloys show an improvement in the ability of Ni catalyst due to the synergistic electronic effect between the alloying elements[1]. Moreover, in recent years has been of great interest to the synthesis of materials with nanometric sizes for application in electrocatalysis because their properties dependent on their dimensions. The multi-metallic nanoparticles for carrying out catalytic effect desired settings should be prepared in binary or ternary and must be supported in carbon particles [2]. In this study was developed Ni and NiFe nanoparticles supported on carbon Vulcan XC-72. The route used for the catalysts synthesis was the impregnation method followed by heat treatment in a reducing atmosphere of H₂ for 2 hours (300 °C, 500 °C, 700 °C). The samples were characterized by: energy dispersive X-ray (EDX), X-ray diffraction (XRD), Transmission Electron Microscopy (TEM) and some electrochemical studies using electrodes in ultra thin layer were performed. Through EDX is possible to verify that below 700 °C is obtained a mixture of oxides and hydroxides of the base metals. From the X-ray diffractograms was possible to identify some characteristic peaks for these samples (NiC, NiFe). To determine the average particle size, were used Scherrer equations[3]. The crystallite size found from the XRD pattern was approximately 20 nm, indicating particles with satisfactory sizes for oxidative catalytic activity. This size was also verified by TEM. Cyclic voltammetric studies, evaluated the activity of these materials for the electro-oxidation of glycerol in alkaline solution. It was verified that the most active materials, NiFe/C was obtained at 700 °C and Ni/C at 300 °C. The results of the chronoamperometric curves at - 200 mV vs Hg/HgO shows that the materials obtained take short time to stabilize. However, we can say that for the route of synthesis employed, NiFe/C catalysts presented the higher activity towards oxidation of glycerol.

Keywords: glycerol, nickel, iron, electrocatalysts, alkaline medium

Work supported by FAPESP.

- [1] Jiang, N.; Meng, H. M.; Song, L. J.; Yu, H. Y. *Int. J. Hydrogen Energy*. 35, 8056, (2010).
[2] M Yu, A. H.; Cui, X.; Li, L.; Li, K.; Yu, B.; Antonietti, M.; Colfen, H. *Adv. Mat.* 16, 1636, (2004).
[3] Salgado, J. R. C.; Gonzalez, E. R.; *Eclética Química*. 28, 2-77, (2003).

vanessaoliveira@iqsc.usp.br