Alcohols electrooxidation on Ni nanodiscs modified with Pt supported on reduced graphene oxide (RGO)

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Abstract

Over the past years, there has been an increasing interest in the development of alternative power sources, both for environmental reasons and for the low availability of fossil fuels [1, 2]. In this context, direct alcohol fuel cells (DAFCs) have been regarded as one of the most appropriate choices. The versatility of DAFCs has been shown through the use of a variety of fuels, such as methanol and ethanol, as well as other small alcohols [3]. Recently, ethanol has been gaining considerable attention due to its greater availability and higher energy storage capacity (per volume) than methanol. However, the low reaction kinetics of ethanol oxidation and the high fabrication costs of these devices, limit the development of these technologies. Thus, it is necessary to use new type of electrocatalysts to improve the rates of methanol/ethanol oxidation decreasing the cost of the materials.

On the other hand, the main requirements of a suitable fuel cell catalyst support are: (i) high surface area, to obtain high metal dispersion; (ii) suitable porosity, to improve gas flow; (iii) high electrical conductivity; and (iv) high stability under fuel cell operational conditions [3,4]. Recent studies have shown that a graphene-based material meet many of these requirements and even enhances the catalytic activity of certain metals. In the present work, reduced graphene oxide (RGO) decorated with Ni nanodics as well as Pt@Ni nanodiscs supported on GO and RGO were synthesized. Physicochemical characterization of the catalysts was carried out by AFM, SEM, and several X-ray techniques, such as XRD and EDX. Electrochemical techniques showed higher conductivity and tolerance toward CO for Pt@Ni/RGO. Best activity was recorded from cyclic voltammetry for Pt@Ni/RGO although similar stationary currents were obtained for both Pt catalysts at 550 mV_{RHE}. Considering the lower Pt content of Pt@Ni/RGO, this material seems to be the most promising.

Acknowledgements

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References

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Figures

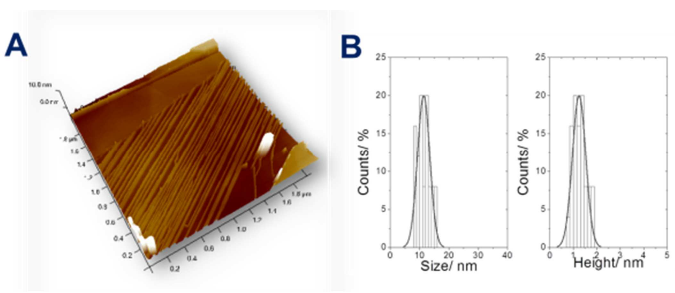

Figure 1. A. AFM image of the Ni nanodiscs supported on RGO nanosheets.
B. Histogram with nanodiscs size distribution.

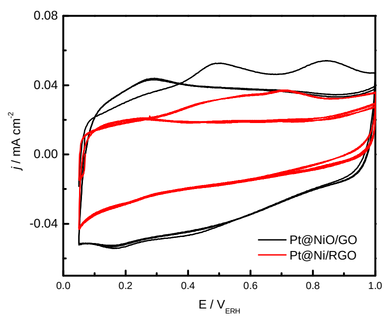

Figure 2. CO eletrooxidation on catalysts