Magnetite-Platinum Core-shell Nanoparticles Using a Two-step Method for the Oxygen Reduction Reaction

N.M. Sánchez-Padilla[1], S.M. Montemayor[2],F.J. Rodríguez Varela[1,3*]

[1] Programa de Sustentabilidad de los Recursos Naturales y Energía, Cinvestav Unidad Saltillo, Av. Industria Metalúrgica 1062, Parque Industrial Ramos Arizpe. Ramos Arizpe, Coahuila. C.P 25900, México.
[2]Facultad de Ciencias Químicas, Universidad Autónoma de Coahuila. Blvd. V. Carranza s/n, República Oriente, Saltillo, Coahuila. C.P. 25280, México.
[3]Programa de Nanociencias y Nanotecnología, CinvestavUnidad Saltillo, Av. Industria Metalúrgica 1062, Parque Industrial Ramos Arizpe. Ramos Arizpe, Coahuila. C.P 25900, México.
[*]E-mail: javier.varela@cinvestav.edu.mx

ABSTRACT

Direct Alcohol Fuel Cells (DAFCs) are a promising alternative to replace energy devices that use fossil fuels. To reach this objective, it is necessary to enhance the catalytic activityand reduce the cost of cathode catalysts. Decreasing the Pt loadingon the electrode is a viable approximation to achieve lower catalyst costs. Also, the use of cheap co-catalysts helps to accomplish this goal. This is the reason for the research carried out in this work, on new nanostructures and materials as cathodes for DAFCs. It has been proved that iron oxides have a synergetic interaction with Pt to form highly active and stable anode and cathode materials. In this study, wehave synthesizedFe_3O_4@Pt and Fe_3O_4@Pd core-shell cathode catalysts supported on Ordered Mesoporous Carbon (OMC),a novel material applied as a support on fuel cells. The synthesis has been performed in a two step procedure.First, the formation of the ferric-ferrous oxide as core material via the reduction of the Fe precursor, using$NaBH_4$ as reducing agent. Second, the deposition of the Pt (or Pd) shell, followed by the dispersion of the core-shell nanoparticles on OMC, using the polyolmethod. The Fe_3O_4@Pt/OMC and Fe_3O_4@Pd/OMCcatalytshave been characterized by XRD, SEM-EDS andtested as cathode materials for Oxygen Reduction Reaction (ORR) in acid medium.

Keywords:two step synthesis, core-shell nanocatalyst,Oxygen Reduction Reaction.