XIV International Congress of the Mexican Hydrogen Society
Cancun, Mexico, 2014

Sulfur Doped Carbon Nanotubes as Electrocatalyst in PEM Fuel Cells

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ABSTRACT

Fuel cells are attractive devices for the generation of clean energy. However, the main obstacle found for large-scale commercialization is the high cost of platinum, which is used as electrocatalyst for high performance and activity. Recently there have been studies on free-platinum electrocatalysts based on carbon materials doped with heteroatoms (N, S, P, B, etc.), which exhibit electrocatalytic activity similar to platinum but with a significantly lower cost. Furthermore, carbon nanotubes have unique properties such as high resistance to corrosive atmospheres and good electrical conductivity, making these excellent candidates for use in the hostile operation environment of the fuel cell. In this study sulfur doped carbon nanotubes were synthetized by chemical vapor deposition technique. Sulfur was incorporated from the carbon nanotubes synthesis using as precursor thiophene. Influences of parameters as temperature and carrier flow gas were studied in order to find the optimal synthesis conditions. The morphology was analyzed by Scanning Electron Microscopy and High Resolution Transmission Electron Microscopy. Morphology results show that carbon nanotubes with several diameters were obtained (between 70 to 500 nm). Elemental mapping show a homogenous distribution of sulfur on the carbon nanotube surface. However the formation of FeS in the core of nanotubes was corroborated by elemental mapping and X-Ray diffraction analysis. The electrocatalytic activity of these novel platinum-free electrocatalysts will be evaluated by the rotating disk electrode technique to determine its feasibility for use in this application.

Keywords: Carbon nanotubes, electrocatalyst, heteroatom