Sonochemical Synthesis of Pt/CNT/TiO_2 Anode Catalyst for Direct Methanol Fuel Cells

Z. I. Bedolla-Valdez[1,*], Y. Verde[2], Y. Gochi-Ponce[3], M. T. Oropeza-Guzman[4], G. Alonso-Núñez[1]

[1]Centro de Nanociencias y Nanotecnología-UNAM, Km. 107 carretera Tijuana-Ensenada, Ensenada, B. C., México, 22800.
[2]Instituto Tecnológico de Cancún, Av. Kábah Km. 3, Cancún, Q. Roo, México, 77500.
[3]Instituto Tecnológico de Oaxaca, Av. Ing. Víctor Bravo Ahuja 125, México, 68030.
[4]Centro de Investigaciones y Desarrollo Tecnológico en Electroquímica, Km. 126.4 carretera Tijuana-Tecate, Tijuana, B.C., México, 22253
[*]Tel: +526461750650 ext. 450; e-mail: zairabe@cnyn.unam.mx

ABSTRACT

Electrocatalytic materials are a major challenge for Direct Methanol Fuel Cells (DMFC) commercialization. To improve the properties of supported Pt anode catalysts several metal oxides are used to enhance the methanol oxidation performance [1-3]. Currently, titanium oxide is widely studied as electrocatalytic promoter due to its low cost and stability in acid media [1-3].

In this research, Pt/CNT/TiO_2 anode catalysts were prepared by a sonochemical method using a high-intensity probe during each synthesis step. In first instance, the system CNT/TiO_2 was synthesized at controlled temperature. Finally, 7 wt.% of Pt nanoparticles were incorporated to CNT/TiO_2 using $NaBH_4$ as a reducing agent . Pt/CNT and Pt/TiO_2 catalysts were prepared as reference samples.

The chemical composition of the systems was determined by ICP and EDS analysis. Structural properties and specific surface area of anode catalysts were examine by XRD and nitrogen adsorption by BET method, respectively. The electrochemical study was performed by cyclic voltammetry in a three-electrode half-cell at room temperature.

Pt/CNT/TiO_2 electrocatalysts were successfully synthesized by a short time synthesis method. The results of cyclic voltammetry test for methanol oxidation suggest that the incorporation of TiO_2 improves the catalyst tolerance to carbonaceous species. The Pt/CNT/TiO_2 anode catalyst exhibited better oxidation of methanol to carbon dioxide than Pt/CNT.

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Keywords: Carbon nanotubes; Titanium dioxide; Methanol oxidation

References

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