

Electrochemical Performance of Nitrogen Doped Carbon Nanotubes

Daniel Lardizábal G.¹, Alfredo Aguilar Elguezabal.²,
A.M. Valenzuela-Muñiz¹ and Y. Verde-Gomez¹

¹Instituto Tecnológico de Cancún,
Kabah Km 3, Cancún, Quintana Roo, 77500, México
²Centro de Investigación en Materiales Avanzados,
Miguel de Cervantes 120, Complejo Industrial
Chihuahua, Chihuahua, Chihuahua, 31109, México

The discovery of fuel cells originates a new generation of high-efficiency devices for production of clean energy. Nowadays, in order to achieve the implementation of this technology at large-scale, it is necessary the development of new catalysts to replace platinum which is rare and therefore expensive. Carbon allotropes as carbon nanotubes (CNT) and graphene doped with nitrogen, have a great potential for electrocatalytic applications in fuel cells, especially in the cathode where oxygen reduction reaction (ORR) takes place. In this work modified chemical vapor deposition (MCVD) technique was used to synthesize CNT doped with nitrogen. Nitrogen precursors as ammonia and acrylonitrile were employed.

The nitrogen precursors were dissolved in toluene, preheated at 240°C and then pyrolysis reaction was carried out at 800°C. In order to determine the nitrogen content, thermogravimetric analysis (TGA) was carried out. The results indicate a nitrogen content of 2 to 4% (wt. %). In addition, the graphitization degree of the samples was determined using Raman spectrometry where the relationship between intensity of the D and G bands (ID/IG) was evaluated. Also, Raman studies indicated that NTC structure was modified and probably doped.

Scanning electron microscopy results show doped-CNT with lengths of some microns (Figure 1). Transmission electron microscopy (TEM) studies show carbon nanotubes multiwalled type. The electrocatalytic activity towards the ORR was evaluated. The electrochemical performance will be discussed.

REFERENCES

1. Can Wang et a (2011). "Nitrogen-doped carbon nanotubes synthesized with carbon nanotubes as catalyst" Diamond and Related Materials 20:1353-1356
2. Edward N. Nxumalo et al.(2008) "CVD synthesis of nitrogen doped carbon nanotubes using ferrocene/aniline mixtures" Journal Organometallic Chemistry, 693:2942-2948
3. Shankhamala Kundu et al. (2009) "Electrocatalytic activity and stability of nitrogen-containing carbon nanotubes in the oxygen reduction reaction" J. Phys Chem. 113: 14302-14310

ACKNOWLEDGMENTS

Authors recognize the support to CONACYT-CNPq (Brasil) under grant No. 174689

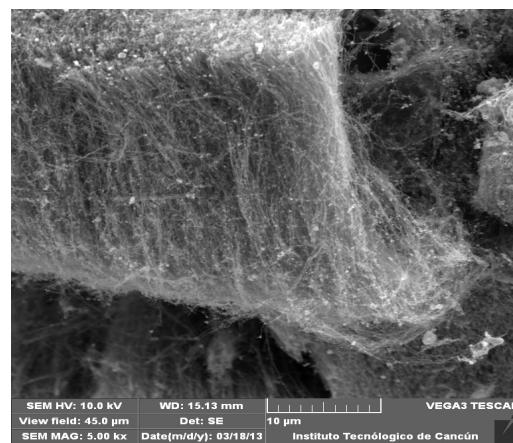


Figure 1. SEM micrograph of Doped-CNT.