Characterization of Pt/C obtained from synthesized $Pt(NH_4)_2Cl_6$ supported on carbon black with different treatments

J. Y. Verde-Gómez[1,2], V. H. Ramos-Sánchez[1], G. Alonso-Nuñez[1] and A. Keer-Rendón[1]

[1]Centro de Investigación en Materiales Avanzados S.C.
Miguel de Cervantes 120, 31109 Chihuahua, México

[2]Instituto Tecnológico de Cancún.
Kabah km 3, Cancún, Quintana Roo, México

INTRODUCTION

Polymer Electrolyte Membrane Fuel Cells (PMFC) are used in a wide variety of applications to convert chemical into electrical energy directly. To carry out this electrochemical process at low temperature (80º - 100º C), a noble metal catalyst must be used on both electrodes(1,2). Platinum is often used as it can stand the presence of acid electrolytes and it enhances the oxidizing reaction.

The catalytic layer of a PEMFC consists of highly dispersed Pt particles of 2 to 5 nm diameter supported on carbon black particles from 5 to10 nm diameter and has a thickness of 5 to 50 mm.

Carbon materials are preferred for PEMFC construction due their advantages satisfying the following demands(3): they are electrical conductors, catalyst supports, they help stabilizing the electrodes' phases and give a suitable morphology to the electrodes. Some authors(4,5) have reported that the surface chemical properties of the carbon support strongly influence the Pt impregnation process with a consequent effect on the catalyst activity.

In the majority of works, hexachloroplatinic acid (H_2PtCl_6) and tetrammineplatinum (II) chloride ($Pt(NH_3)_4Cl_2$) are used as precursors to perform the deposition of Pt on carbon. In this work, a different compound, ammonium platinum chloride ($Pt(NH_4)_2Cl_6$) synthesized in our laboratory, has been used and the Pt/C obtained compared with one prepared from commercial $Pt(NH_3)_4Cl_2$ from Alfa Aesar. Additionally, the carbon support was treated in two different forms.

EXPERIMENTAL

The carbon black used was VXC-72R (Cabot, Co.) as received and previously oxidized with H_2O_2. The impregnation procedure of Sepúlveda et al (5) was followed, after which, the resulting Pt/C was subjected to a reduction process.

The Pt load on the Pt/C obtained was evaluated by ICP-ES, whereas particle size and dispersion by TEM. TPR and cyclic voltammetry were used to obtain catalytic activity.

RESULTS AND CONCLUSIONS

Figure 1 is a TEM micrograph of the Pt/C obtained from $Pt(NH_4)_2Cl_6$. Pt is very well dispersed with particle size ranging from 1 to 1.5 nm. An effect was observed arising from the surface chemical properties of the carbon support. The new precursor synthesized in this work appears to be suitable for preparation of electrodes for PEMFC.

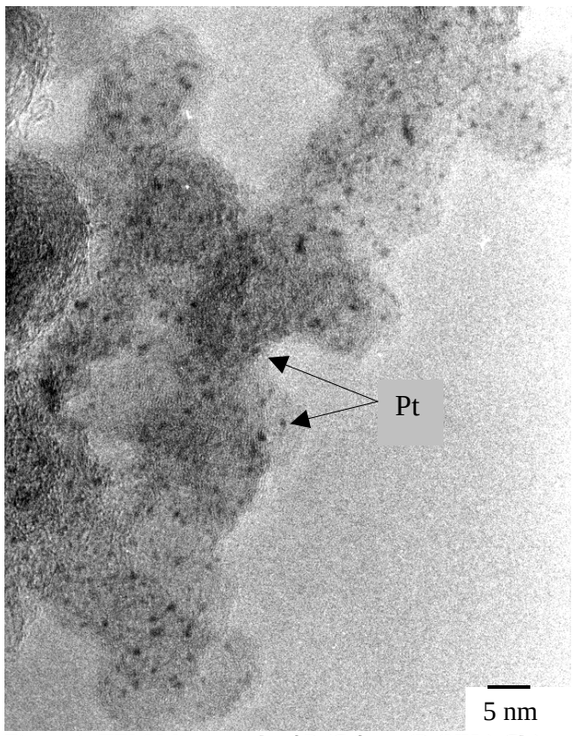

Figure 1. TEM Micrograph of Pt/C from ($Pt(NH_3)_4Cl_2$) at 200 000x.

ACKNOWLEDGMENTS

Support from Consejo Nacional de Ciencia y Tecnología CONACYT, México, under contract No. J31264 –U is gratefully acknowledged.

REFERENCES

1. Prater K.B., J. Power Sources **61,** 105-109 (1996).

2. Wilson M.S., Gottesfeld S., J. Appl. Electrochem. **22**, 1-7 (1992).

3. Auer E., Freund A., Pietsch, Tacke T., Appl. Catal. A: Gen. **173**, 259-271 (1998).

4. Amine K., Yasuda K., Takenaka H., Ann. Cim. Sci. Mat., **23**, 331-335 (1998).

5. Sepúlveda-Escribano A., Coloma F., Rodríguez Reinoso F., Appl. Catal. A: Gen. **173**, 247-257, (1998).