Sol-Gel Syntheses of Durable Metal-Oxide Hybrid Platinum Catalysts for PEFC

Tyler Trefz, Natalia Kremliakova, Darija Susac, Jasna Jankovic

AFCC Automotive Fuel Cell Cooperation Corp.
9000 Glenlyon Parkway, Burnaby BC, Canada

Two major challenges in the development of polymer electrolyte fuel cells (PEFCs) with respect to the automotive industry are the cost and durability of the cathode catalyst. As such, there has been much research aimed at reducing the amount of Pt used in the catalyst and also increasing the catalysts durability.[1,2] Despite progress in the development of more active catalysts, Pt and its alloys suffer from poor durability as a consequence of dissolution or degradation of the catalyst.[3] When platinum is deposited on some early transition metal oxides, for example NbO_x, catalyst durability and ORR activity is enhanced due to strong metal support interaction (SMSI)[4] or partial alloying.[5,6]

Several versions of sol-gel syntheses of durable platinum catalysts with niobium oxide and carbon have been developed at AFCC. The structure and morphology of these catalysts have been evaluated by microscopic and spectroscopic techniques giving indications that Pt alloying with Nb takes place during the thermolysis step of the synthesis. Moreover, SMSI between Pt and NbO_x is expected to enhance the specific activity of the catalyst and durability in terms of Pt dissolution. Electrochemical evaluations of these hybrid catalysts have demonstrated 2-3 times higher ORR activity along with increased durability in comparison to carbon supported Pt catalysts.

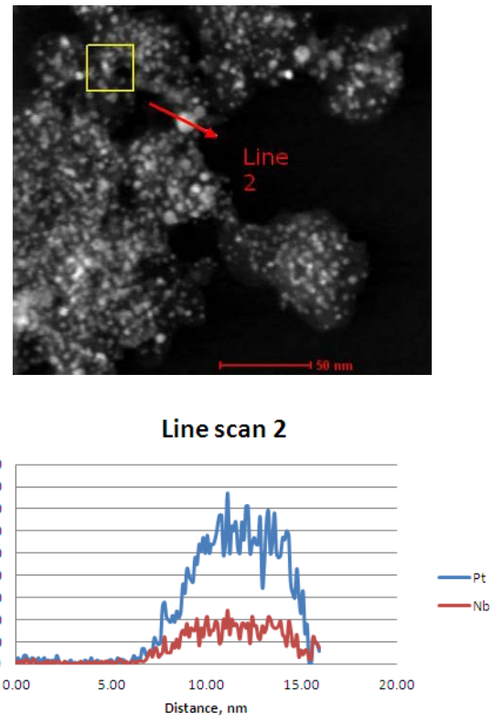

Figure 1), STEM image of NbO_x/Pt hybrid catalyst and EDX line scan.

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