4th International Symposium on
Energy Challenges & Mechanics
- working on small scales

11-13 August 2015
Aberdeen, Scotland, UK

Electrocatalysts for high temperature PEMFC

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Accepted for publication on 11th June 2015

Greenhouse gas emission and high energy demand in the world are main reasons for the increased interest in polymer electrolyte membrane fuel cells (PEMFCs) as energy conversion systems for automobiles, portable applications and power generation. In this sense, high temperature PEMFCs (HT-PEMFCs) operating in between 160 °C to 200 °C, have animated the use of reformate and alcohol as fuels for different applications. These types of electrochemical devices operate better with high purity hydrogen, which actually due to technical and economic considerations is unlikely to be the fuel source. Alternatively, hydrogen from reformed fuels (natural gas, gasoline or alcohols) and alcohols like ethanol are considered suitable fuels to HT-PEMFCs.

In HT-PEMFCs coexist advantages of low-temperature and high-temperature fuel cells like: increasing contaminate (CO and C-species) tolerance and also facilitating the oxidative cleavage of C-C bonds in alcoholic fuels. In this sense, a higher CO tolerance allows the use of hydrogen directly from a hydrocarbon-based fuel reformer. Likewise, a higher rate of C-C bond cleavage makes this technology suitable to work on ehtanol.

The improvement of the performance of HT-PEMFCs is directly related to the development of advanced electrocatalytic materials. In this respect, innovative electrode materials for HT-PEMFC anodes have being researched during the last years at the Fuel Cell Group of the Fraunhofer Institute for Chemical Technology. The new materials are synthesized according to specified requirements. Later the materials are tested in an especial three electrode cell, which enables the evaluation of the electrocatalytic reactivity in similar HT-PEMFC conditions and the electrochemical selectivity by combined detection using a potentiostat and a mass spectrometer. After that the synthesized materials are ready to be evaluated in real conditions using a conventional single cell test system. In this conference will be presented improved electrodic materials developed according to specified requisites for HT-PEMFCs working on reformate and ethanol.

Keywords: electrocatalyst; HT-PEMCF, hydrogen, ethanol, reformate