New materials and Electrochemical Analysis for Fuel Cell Electrical Vehicles without Platinum

R. Cornut, B. Jousselme

New materials and Electrochemical Analysis for Fuel Cell Electrical Vehicles without Platinum

R. Cornut and B. Jousselme,
Laboratoire d'Innovation en Chimie de Surface et Nanosciences
(LICSEN, NIMBE, CEA, CNRS, Université Paris-Saclay
CEA Saclay 91191Gif-sur-Yvette Cedex, France)

Fuel cells, as a highly efficient energy conversion technology, and hydrogen, as a clean energy carrier, have a great potential to reduce carbon dioxide emissions and to reduce Europe dependency on hydrocarbons. Proton exchange membrane fuel cell (PEMFC) is the fuel cell predilection technology for automotive applications with a large deployment horizon by 2025-2030. The performance and durability of fuel cell electrical vehicles (FCEV) have already been proved with car integrating high content of Pt based catalyst. However, the availability on earth of Pt is too low not to avoid future barriers for large scale development of the technology.

At LICSEN, we develop new materials for PEMFC using non-critical elements, with the aim of being competitive with Pt in terms of performance and durability, but with a much higher availability of the starting materials. This research also generates new needs in terms of electrochemical characterizations to address the complexity of the fonctionnal cores –namely the electrocatalytic layers. These have to operate not only the electrochemical reaction (oxygen reduction or hydrogen evolution) but to transport electrons, ions (H^+), molecules (H_2O), and gas (H_2 or O_2). At LICSEN, we use Electrochemical microscopy (SECM, Scanning Electrochemical Microscopy) to investigate the different processes occurring within these multifunctional materials and identify the limiting factors.