TiO2:Nb aerogels, how sol-gel parameters can direct the synthesis route towards an optimization of catalyst support for PEMFC

Christian Beauger, Laetitia Testut, Guillaume Ozouf, Sandrine Berthon-Fabry, Arnaud Rigacci

TiO_2:Nb aerogels: how sol-gel parameters can direct the synthesis route towards an optimization of catalyst support for PEMFC

C. Beauger*, L. Testut, G. Ozouf , S. Berthon-Fabry and A. Rigacci

MINES ParisTech, PSL Research University PERSEE - Centre procédés, énergies renouvelables et systèmes énergétiques, CS 10207 rue Claude Daunesse 06904 Sophia-Antipolis Cedex, France

* corresponding author

Christian.beauger@mines-paristech.fr

Many energetic applications could benefit from the peculiar morphology of aerogel materials. Their large specific surface area combined with a tunable pore size distribution make them particularly appropriate for most catalytic processes. TiO_2 aerogels have thus advantageously been developed in our group respectively for hydrogen production by water splitting [1] and hydrogen conversion in fuel cells [2].

Proton exchange membrane fuel cells (PEMFC) still suffer from low durability resulting from carbon corrosion at the cathode side. Doped TiO_2 and SnO_2 have recently been proposed as alternatives to carbon blacks catalyst support. Stable in PEMFC operating conditions and electronic conductive after doping, their morphology have to be optimized to allow good platinum dispersion and utilization ratio as well as proper fluid management within the electrode (air admission and water elimination). Aerogels have proven here to be promising candidates [3, 4].

In order to optimize the morphology of Nb-doped TiO_2 aerogels developed in a previous study [1], sol-gel parameters were varied and their influence on both the specific surface area and the pore size distribution was analysed. Playing on the respective amounts of catalyst, water and solvent allowed modifying significantly the aerogel morphology (Figure 1).

Most significant results obtained in our group will be presented.

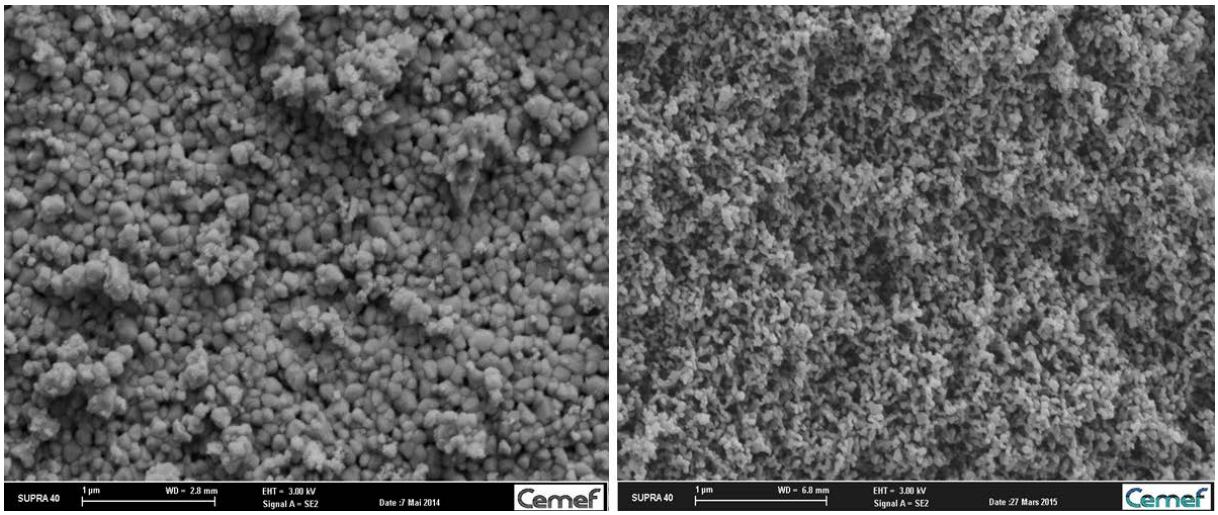

Fig.1 : SEM images of TiO_2 aerogels for different sol-gel parameters

REFERENCES

1. D'ELIA, Daniela, BEAUGER, Christian, HOCHEPIED, Jean-François, RIGACCI, Arnaud, BERGER, Marie-Hélène, KELLER, Nicolas Keller, KELLER-SPITZER, Valérie, SUZUKI, Yoshikazu, VALMALETTE, Jean-Christophe, BENABDESSELAM, Mourad and ACHARD, Patrick, Impact of three different TiO2 morphologies on hydrogen evolution by methanol assisted water splitting: Nanoparticles, nanotubes and aerogels, **International Journal of Hydrogen Energy** 36 (2011) 14360-14373
2. BEAUGER, Christian, TESTUT, Laetitia, BERTHON-FABRY, Sandrine, GEORGI, Frédéric, GUETAZ, Laure, Doped TiO2 aerogels as alternative catalyst supports for Proton Exchange Membrane Fuel Cells: a comparative study of Nb, V and Ta dopants, **Microporous and Mesoporous Materials**, 232 (2016) 109-118
3. OZOUF, Guillaume, BEAUGER, Christian, Niobium- and antimony-doped tin dioxide aerogels as new catalyst supports for PEM fuel cells, **Journal of Materials Science** 51(11) (2016) 5305-5320
4. OZOUF, Guillaume, COGNARD, Gwenn, MAILLARD, Frédéric, GUETAZ, Laure, HEITZMANN, Marie, BEAUGER, Christian, $Sn0_2$ Aerogels: Towards Performant And Stable PEMFC Catalyst Supports, **ECSTransaction 2015** 69(17): 1207-1220