



FDFC 2026

5-7 May 2026
Montpellier - France

Silica coating of PEM fuel cell Pt/carbon electrocatalysts to enhance durability upon operation

Lucas Elvira^{1,*}, Ali Haider^{1,2}, Loïc Noumbi², Nathalie Job², Sophie Hermans¹

¹IMCN Institute (MOST division), UCLouvain, 1 Place Louis Pasteur, B-1348 Louvain-la-Neuve, Belgium.

²University of Liège, Department of Chemical Engineering (B6a), Allée du 6 Août 11, 4000 Liège, Belgium

*lucas.elvira@uclouvain.be

Keywords: PEMFC, Catalysis, Carbon, Electrochemistry, Platinum, Silica-coating

Proton Exchange Membrane Fuel Cells (PEMFCs) are promising electrochemical devices to handle the challenges of the production of zero emission electricity. Platinum supported on carbon black (Pt/CB) is the primary catalyst used in practical PEMFC applications due to its high activity. However, the harsh operating conditions accelerate the catalyst degradation which compromises the catalyst stability and reduces the long-term efficiency of the fuel cell [1].

As a possible solution, the use of silica-coating method to increase the stability of the catalyst has been reported in the literature [2,3]. By covering the Pt/C material with a porous silica layer, one could prevent the particles from dissolution and sintering by forming a protective barrier, while the porosity of the layer ensure access to the underlying Pt particles for the reactants. As catalysts support, Carbon Xerogels (CXs) are promising candidates as it is possible to control their meso/macroporosity. This control enables optimization of the mass transport properties of the catalysts [4].

This project aims to develop silica-coating methods for Pt/CX catalysts, with a focus on achieving controlled layer thickness, uniform coatings and pores structure, thanks to statistical analysis and optimization of synthesis parameters. The catalysts are characterized for their electrochemical and surface properties using nitrogen physisorption, mercury porosimetry, electron microscopy (Fig. 1), and accelerated stress tests (ASTs) on Rotating Disk Electrode systems. Ultimately, the most promising catalysts will be integrated into a membrane-electrode assembly (MEA) for performance evaluation.

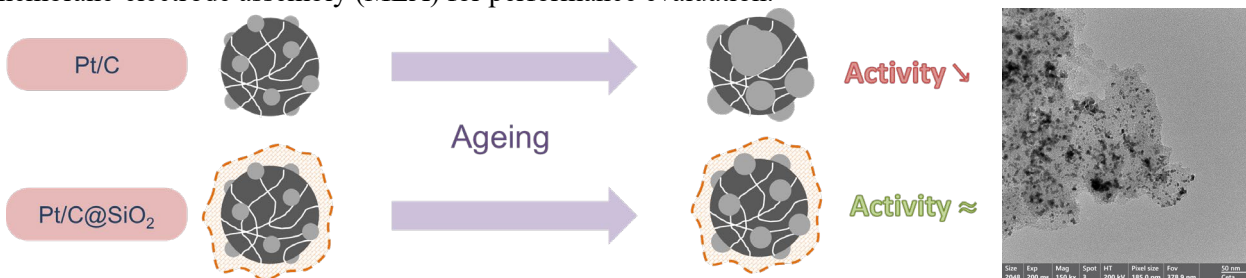


Figure 1: (left) Goal of the project and (right) TEM image of a Pt/CX sample covered by a silica layer.

Acknowledgements

The authors thank the F.R.S-FNRS for providing funding via a PDR project (Convention T.0166.24) and would like to acknowledge the financial support from the Walloon Region Win4Excellence project “TiNTHyN” under contract n°2310142, granted by SPW-Economie Emploi Recherche and supported by the Plan de Relance de la Wallonie.

REFERENCES

1. F. Maillard *et al.*, In *New and Future Developments in Catalysis: Catalysis by Nanoparticles* (pp. 401–423), Elsevier Inc. (2013)
2. S. Takenaka *et al.*, *International Journal of Hydrogen Energy* **43**(15), 7473–7482 (2018)
3. T. Haynes *et al.*, *Applied Catalysis B: Environmental*, **241**, 196–204 (2019)
4. N. Job *et al.*, *Carbon* **42**(3), 619–628 (2004)