

## PhD Offer (3 years) - October 2023

### Fuel cell membranes with active nanofiber reinforcement

**Supervisors** Sara Cavaliere and Deborah Jones (ICGM), Guillaume Pibre (Michelin)

#### Context and activities:

The core of the proton exchange membrane cell (PEMFC) is the membrane-electrode assembly (MEA), consisting of a proton-conducting membrane between two electrodes. In order to increase the performance and durability of PEMFC, new materials and morphologies are required for MEA components. This PhD work focuses on the preparation of proton exchange membranes reinforced by active reinforcements, in ionic or covalent interaction with the ionomer matrix to improve their mechanical properties and durability. It will focus on the preparation of polymer nanofibers and their chemical functionalization and final incorporation in non-fluorinated ionomers. The fiber-based composite membranes as well as the corresponding MEAs will be characterized by physico-chemical and electrochemical techniques.

The proposal is strongly in line with the policy of hydrogen materials and mobility development of the industrial partner and its ambitions: for more information <https://www.michelin.com/hydrogene/>

Activities performed by the student will comprise the fabrication of polymer fibers by electrospinning and their incorporation in membranes prepared by casting. Selected samples will be characterized within the laboratory using state-of-the-art techniques (proton conductivity measurements, tensile stress-stress tests, dimensional stability...), also including morphological analysis (SEM/TEM microscopy) and electrochemical characterization.

#### Expected skills:

- Master's degree or equivalent in chemistry, materials science, polymer science, electrochemistry, with good knowledge in lab science
- Cautious experimental work
- Autonomy, anticipation, proactive spirit, being a source of proposals, teamwork skills
- Knowledge of polymer and membrane characterisation would be appreciated

The candidate will have the opportunity to develop a range of skills and techniques:

- Deposition techniques (electrospinning, casting, spray coating)
- Materials characterisation (mechanical tests, ionic conductivity and gas permeability measurements, *etc*)

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- Electrochemical characterisation of membranes and MEAs, and accelerated degradation processes

**Application:** The applicant should provide a cover letter, a full CV (including the scientific production). Contract would be established with MICHELIN.

Applications should be sent by email before April 30th, 2023, to:

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