

## PhD thesis proposal

### “Developing accelerated stress test protocols for PEM electrolyzers.”

#### Description of the PhD Project:

Polymer Electrolyte Membrane Water Electrolysis (PEMWE) is widely regarded as the most promising technology for hydrogen production from renewable sources. However, evaluating the durability of PEMWE systems remains a significant challenge, despite being extremely valuable for both developers and operators.

Accelerated Stress Tests (ASTs) are considered effective tools to investigate degradation mechanisms, reduce testing time and development cycles, and provide guidance for both electrolyzer design and system operation.

That said, designing reliable AST protocols is far from trivial, as performance degradation in PEMWE systems involves multiple components and complex multi-physical and physicochemical processes.

The ANR PEPR project “ASTERHYX” brings together the expertise of leading laboratories specialized in PEMWE testing and analysis, with the objective of developing AST protocols through a combination of targeted multiscale experiments and advanced modelling approaches.

The doctoral position will take place within the framework of the ASTERHYX project and contribute to the entire AST development cycle—from initial long-term PEMWE testing, through AST protocol design, to data analysis and degradation modelling.

Specifically, the PhD work will involve the following tasks:

- Task 1: In-situ, in-operando characterization tool development and realization for PEMWE degradation characterization.
- Task 2: Development of AST protocols by conducting dedicated experiments and simulations as well as synthesizing experimental results.
- Task 3: Conducting multiscale in-situ and ex-situ characterizations in multiple long-term degradation tests.
- Task 4: Development of degradation models and lifetime prediction models using both physical and data-driven modelling approaches.

#### Host institute:

The Institute FEMTO-ST which is one of the largest CNRS-labeled lab in engineering in France. European leading experimental facilities are provided partially by CNRS FCLAB (<https://www.fclab.fr/>). The supervision of the PhD will be in collaboration with the CEA-LITEN, so periods of exchanges between these two laboratories must be considered.

#### Working Conditions:

The experimental infrastructure is mainly supported by the ANR PEPR project “Equipex+ DurabilitHy” ([Project Link](#)) and the above-mentioned ANR PEPR project “ASTERHYX”. The PhD position is also fully funded by an ANR grant. The net salary is approximately 2000 €/month.

**Applicants' Profile:**

Candidates must own a Master Degree. Candidates should possess expertise in the characterization, modeling, and analysis of physical devices, preferably electrochemical devices (such as fuel cells, batteries, and electrolyzers). Experience in hydrogen fuel cell or electrolyzer system design, automation, and testing will be a significant advantage. A strong background in data analysis and modeling (e.g. numerical analysis, machine learning techniques) would be appreciated. An ability to work collaboratively in a team setting is essential. A very good English level is mandatory.

**Contacts:**

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**Period:** The PhD is for three years (36 months) and supposed to start from 10/2025.

**Workplace:** mostly in Belfort (France), but also in Grenoble (France)