Development of a fuel cell system for operation in extreme environments

The goal of this project is to develop a cabinet to protect a miniaturized fuel cell system system and keep it operative in extreme environments

Laboratory:	EERL / INERGIO
Number of students:	1 (Master thesis preferred)
Section:	GC, SIE, GM, EL, MX, PH, CGC
Status:	Available (Fall 2021)

Description of the project

Fuel cells are direct electrochemical devices that convert the chemical energy of fuel to electricity. INERGIO, an EPFL spin-off, has taken a unique approach to miniaturize Solid Oxide Fuel Cell (SOFC), a fuel flexible technology to deliver eco-friendly and reliable power. This is to develop a technology that allows the use of high energy density and commercially accessible liquid butane (camping gas) to deliver clean energy. SOFCs are a promising technology to supply power for off-grid and remote applications (e.g. space missions, environmental stations, Polar studies) because it can potentially overcome drawbacks of solar panel installations, remove the harmful emission of diesel generators and avoid the issue of battery replacement.

This project will be conducted at INERGIO under the supervision of the Extreme Environment Research Laboratory (EERL). It will focus on the development of a cabinet to protect the SOFC system and keep it operative in extreme environments (especially low temperatures). The final goal is to have a system ready to be deployed during the Asclepios II analogue mission in Summer 2022 and various field campaigns in extreme environments organized by the EERL. A proof of concept for the cabinet has been realized during a previous project, now the objective is to improve it further. In particular, there are three specific goals:

- Improve the actual design of the cabinet for operation under temperature conditions from -40 to 30°C while maintaining the temperature inside the cabinet between 0 to 35°C .
- Develop a system for the fuel cell exhaust to avoid water condensation in or around the cabinet.
- Craft the cabinet and test it in a climatic chamber and/or in natural environments.

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