Development of an AEM Water Electrolyser for Hydrogen-Filled Meteorological Balloons in Polar Environments

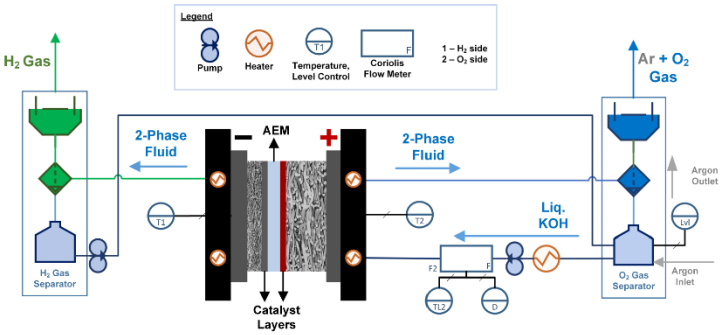
Semester Project (10 ECTS)

Administrative

Supervision: Simon Dorthe, Stéphane Weissbaum, Prof. J. Van Herle
Contact: simon.dorthe@epfl.ch, stephane.weissbaum@epfl.ch
Location: Sion or remotely (travel allowance offered)
Remarks: If interested, please send your CV, with a short motivation letter, to Simon or Stéphane.

Project description:

As part of its research on the polar environment, the Extreme Environments Research Laboratory (EERL) at EPFL performs meteorological soundings using radiosonde balloons filled with helium. One major limitation of this method is the logistics of helium supply: the gas must be shipped in pressurised cylinders by boat during resupply missions that occur only every six months, which severely restricts the number of launches they can perform. In addition, helium is a non-renewable gas mainly obtained as a by-product of fossil fuel extraction and cannot be produced synthetically at scale. The aim of this project is to investigate the feasibility of replacing helium with hydrogen generated on site by a compact anion exchange membrane (AEM) water electrolyser, and to design and develop such a system. The student will assess the specific requirements for balloon filling (pressure, flow rate, purity and safety), propose a suitable electrolyser and balance-of-plant concept adapted to polar conditions, and produce a preliminary prototype or detailed design for future deployment.



Your tasks:

- Develop a comprehensive understanding of the overall problem and associated constraints (resources available on site, required gas volume and filling frequency, hydrogen safety aspects, and operation under extreme temperatures and remote logistics).
- Evaluate the technical, operational, and safety feasibility of replacing helium with on-site hydrogen production.
- Dimension and design an AEM water electrolyser system, including balance of plant (BoP) and hydrogen storage, to reliably supply the required gas for balloon filling.
- Assess the cost of the proposed solution based on existing and commercially available components.