Design and modelling of a catalytic burner for oxy-combustion in a 10 kW hybrid SOFC + mGT system

Master Project (30 ECTS)/Semester Project (10 ECTS)

Administrative

Supervision: Martin Gay, Prof. J. Van Herle
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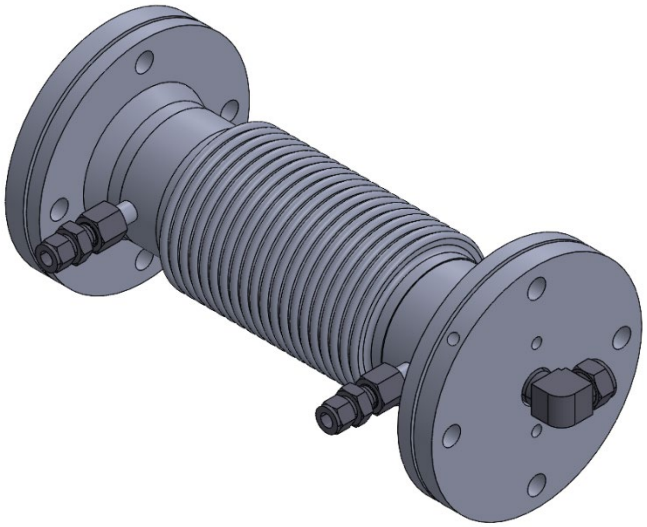
Location: Sion or remotely (travel allowance offered)

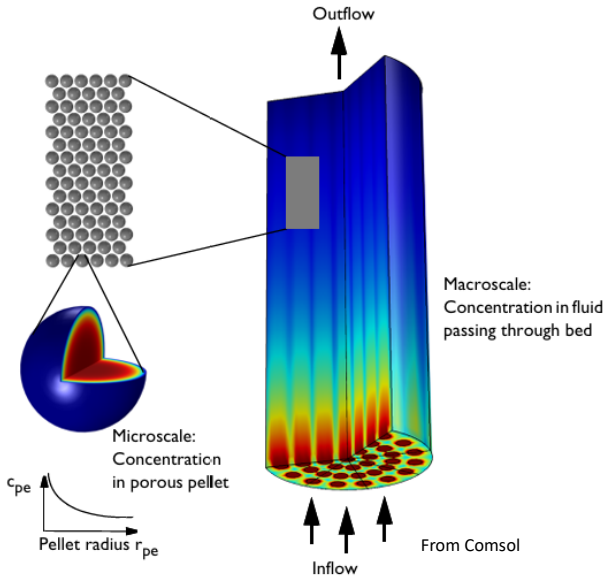
Remarks: If interested, please send your CV, with a short motivation letter, to Martin.

Project description:

An 8 kW SOFC is coupled to a micro gas turbine (mGT) to maximize the conversion of methane into electricity. Coupling these two technologies has never been done before and requires a complex Balance of Plant (BOP) to maximize the heat exchanges and thus maximize efficiency. A key component part of the BOP is a catalytic burner for oxy-combustion of the remaining fuel at the anode off gas of the SOFC. Due to its size, the mGT limits its inlet temperature between 400 °C and 500°C (mainly because of the magnets fixed on the rotor for the electricity production). This requires injection of steam to reduce the stream temperature while increasing the mass flow. However, not enough steam is available inside the system and the burner must be cooled down in another way. A heat exchange with water through tubes inside the burning chamber will be modeled. The produced steam will then be injected at the inlet of the burner (example of a solution below).

The goal of this project is to model the burner according to the complex requirements of a 10 kW hybrid SOFC + mGT system. With the model, perform a sensitivity analysis depending on the working conditions. Different design will also be investigated.





Your tasks:

1. Assess an existing design in terms of reaction rates, steam production, heat distribution inside the catalytic bed
2. Investigate new designs to improve efficiency and safety
3. If possible, validate the results on a test rig (inside the lab in Sion)

Skills: familiar with simulation software (COMSOL), strong motivation and ability to work in an autonomous environment.