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

Administrative

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Location: Sion or remotely (travel allowance offered)

Project description:

Anion exchange membrane water electrolyzers (AEMWE) are considered an emerging and promising technology for hydrogen production at relatively high efficiency and low cost. Currently, a 1 kW AEMWE square stack at atmospheric pressure is being operated in the lab (figure 1). The goal consists of upscaling AEMWE cell stacks to reach higher power (100 kW scale) at high pressures (100 bar) which facilitates hydrogen storage later. To achieve this milestone (100 kW at 100 bar), multi-physics simulations are needed to simulate two-phase flow in the flow channels, heat transfer in the stack and the effect of high pressure on the stack components.

Figure 1: 1 kW square stack of the lab

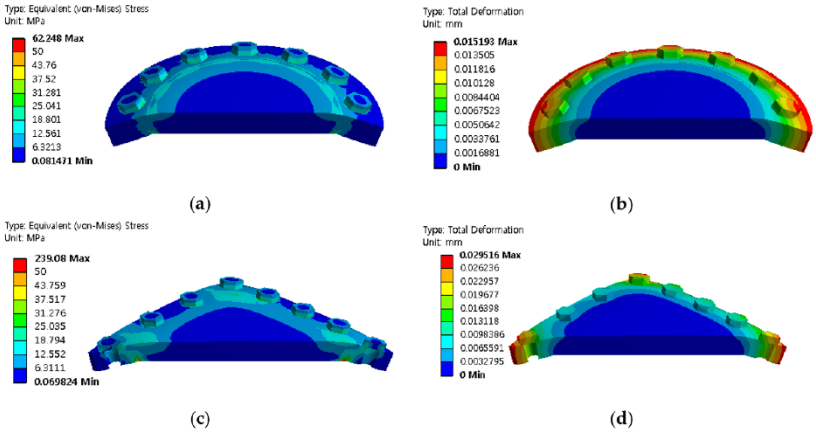

Figure 2: Comparison of the von-Mises equivalent stress and total deformation for squared and circular electrolyzer stacks [1]

Currently, the AEMWE stack operated in the lab is a 100 cm^2 square stack with a 1 kW operating power at atmospheric pressure. The goal is to upscale the current stack to higher power and pressure. Therefore, a circular design will be used to reduce stress and deformation (figure 2).

Your tasks:

A new 500 cm^2 circular flow channel design has been developed at the lab to study bubble evacuation. Your role is to:

1. Integrate the new flow channel design to the existing AEMWE model by adapting a circular geometry instead of the square one
2. Conduct a structural mechanics study for the new 500 cm^2 circular stack
3. Optimize the stack design for 100 bar pressure

References

[1] M. Jo, H.-S. Cho, and Youngseung Na, “Comparative Analysis of Circular and Square End Plates for a Highly Pressurized Proton Exchange Membrane Water Electrolysis Stack,” *Applied Sciences*, vol. 10, no. 18, p. 6315, Sep. 2020, doi: https://doi.org/10.3390/app10186315.