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

Administrative

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Location: Sion (travel allowance offered)

Project description:

Anion exchange membrane water electrolyzers (AEMWE) are novel electrolyzers used for water splitting to produce H_2 and O_2. They combine the advantages of previous electrolyzer technologies, such as proton exchange membrane (PEMWE) and alkaline (AWE) water electrolyzers, by having relatively higher efficiency and lower cost. Ohmic, activation and mass transport overpotentials contribute to the efficiency losses in AEMWE. In this project, the effect of bubbles produced on the different cell overpotentials is to be studied. More specifically, oxygen bubbles produced at the anode can get trapped in the porous transport layers (PTL) of the cell due to their large size. Trapped oxygen bubbles will reduce electrolyte conductivity (ohmic), electrochemically active surface area (activation) and rate of water diffusion in the cell (mass transport). Thus, trapped oxygen bubbles will reduce the overall cell efficiency, and need to be well managed to prevent such losses.

In this project, we want to use lock-in thermography for identifying hot-spots for bubble accumulation. The goal is to determine the location of such hot spots (usually at the land interface between the PTLs and bipolar plates (BiP)) to optimize cell design.

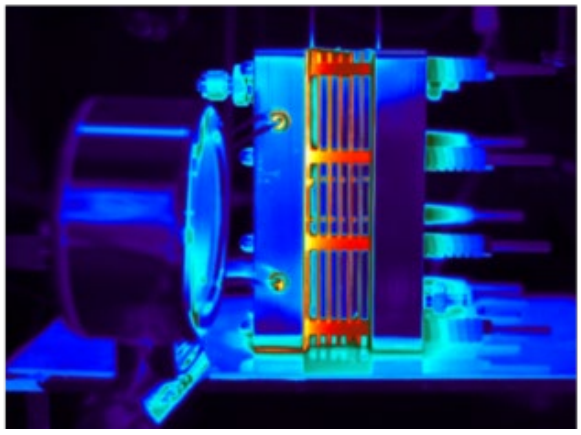

Figure 2: Thermographic image taken in the lab

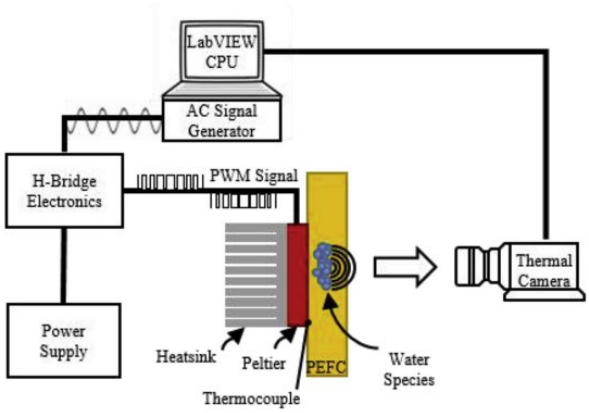

Figure 1: Lock-In thermography setup [1]

Your tasks:

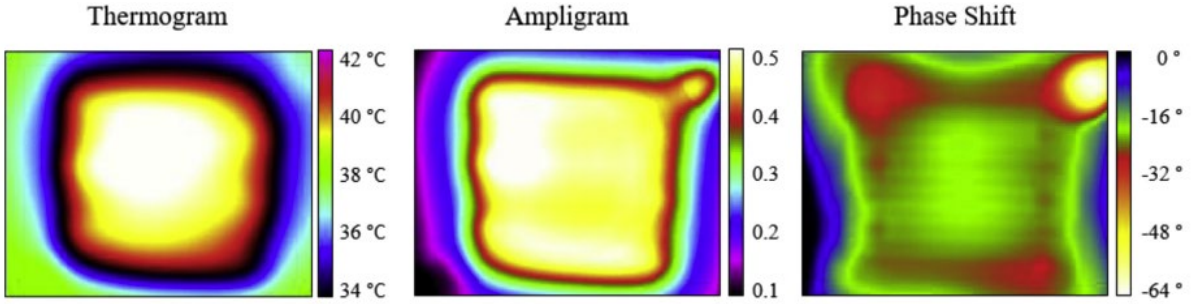

Figure 3: Lock-In thermography outputs a) Thermogram b) Ampligram c) phase shift [1]

1. Help in designing a lock-In thermography setup
2. Produce lock-in thermography outputs as in figure 3
3. Identify key hot-spot locations using different types of PTL for comparison
4. Provide insights into PTL design for hot spot reduction

References

[1] L. Rasha et al. 'Water distribution mapping in polymer electrolyte fuel cells using lock-in thermography'. In: Journal of Power Sources 440 (Nov. 2019), p. 227160. ISSN: 0378-7753. DOI: 10.1016/j.jpowsour.2019.227160. URL: https://www.sciencedirect.com/science/article/pii/S037877531931153X