

Master Thesis: Analysis of system and operating parameters with respect to the water management of the anode loop with help of system simulation

Duration: min 6 month

Start: 01/09/2022 or later

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Thesis outline:

Sufficient humidification of the anode side of a hydrogen fuel cell is an important factor for stable operation and to reduce long term degradation. As the incoming hydrogen gas in normal cases is dry, the humidification of the anode side is driven by the water cross over from the cathode through the membrane. Both, the internal mass transport processes and the operation and system design of the complete anode loop have a huge impact on sufficient and evenly distributed humidification. Systema and stack simulation can help to understand the relevant factors and support the design of the anode loop as well as the development and optimization of control strategies.

The purpose of this master thesis is to model and analyse an existing anode concept with a commercial system simulation software (GT-Suite). This will help to understand the impact of the operation conditions on the water management and generate a better understanding of the current concept.

In a second step, the operating conditions should be optimized to further improve humidification, starting with operating in standard conditions and steady state and further investigating cold, hot and (thermal and load) transient operation. The applied strategies will then be validated in physical test.

Finally, a simulation study should be carried out to develop proposals for further improvement of the anode loop design and dimensioning of key components. Different concepts shall be investigated and evaluated.