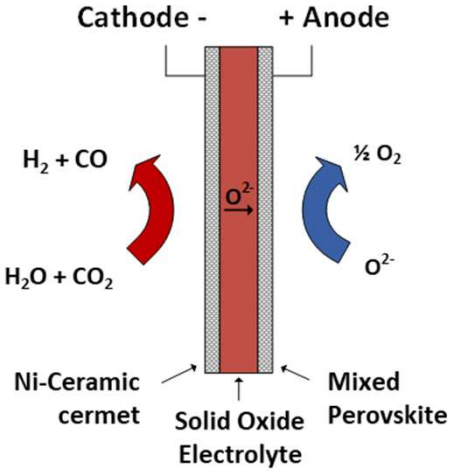
Development of Degradation Models for High-Temperature Co-Electrolysers

Task description

High-temperature SOE (Solid Oxide Electrolysis) technology enables highly efficient green hydrogen production, achieving efficiencies over 80 % due to its operating temperature of 700-850 °C, the highest among current electrolysis technologies. In co-electrolysis mode, SOE can also convert H_2O and CO_2 into syngas, an important feedstock for chemical and e-fuel production. Despite these advantages, degradation remains a critical barrier to long-term performance, particularly when operating conditions are not optimally controlled.

This work builds on a literature review of SOE degradation mechanisms and an existing SOEC simulation framework in Matlab-Simulink®. The objective is to develop and implement degradation models for cell-component-specific degradation mechanisms and integrate them into the current simulation environment. The tasks include a targeted review on degradation modelling approaches, development and implementation of selected degradation models, and verification and evaluation through model testing. The final SOEC simulation framework should enable prediction of long-term performance decline under relevant operating conditions.



Assignments

- Literature research: Introduction to SOE technology and review of existing electrochemical SOEC model and degradation modelling (1 month)
- Model development and implementation: Definition of modelling approach and implementation into the electrochemical SOEC simulation framework (3 months)
- Model validation and testing: Validation and testing of degradation model with literature data and experimental results (1 month)
- Results presentation and thesis writing (1 month)

Start: 01.05.2026

Duration: approx. 6 months

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