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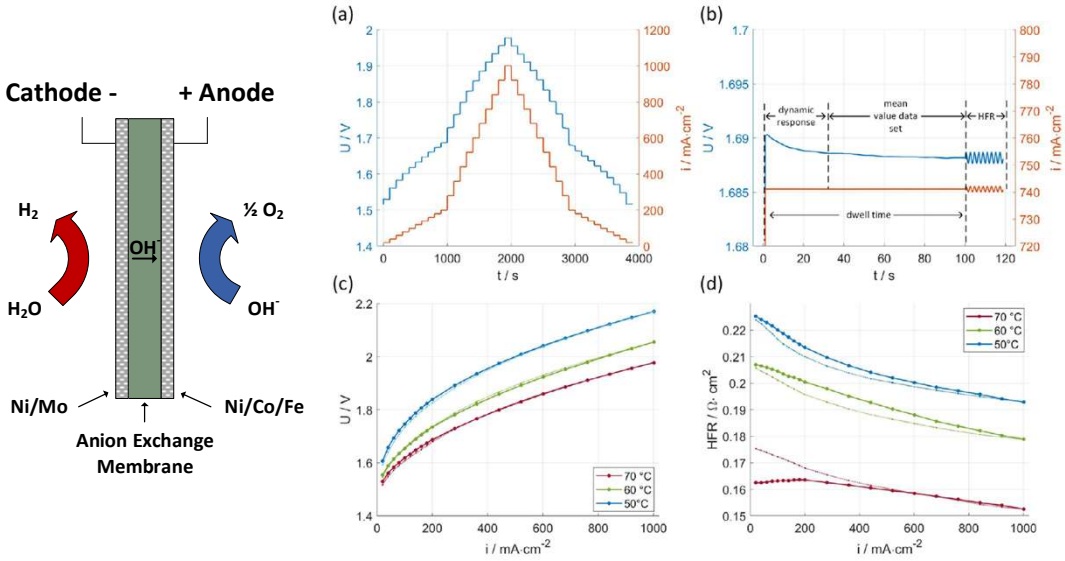
Study on ex-situ and in-situ activity and durability of PGM-free AEMWE catalysts

Description:

Hydrogen production represents a crucial step in the complete transition of the energy system towards renewable sources. One promising method for hydrogen production is anion exchange membrane (AEM) water electrolysis, which is a relatively novel technology still under research. To evaluate catalysts for their performance in electrochemical cells, various standardized ex-situ test setups are available. However, the performance and durability of catalysts within the electrode of a stack strongly depend on the electrode fabrication method and the selection of materials.

The objective of this thesis is to investigate various platinum-group metal-free (PGM-free), nickel-based catalysts using standardized ex-situ test setups, specifically rotating disk electrode (RDE) and half-cell measurements, and to compare these results with performance data obtained from in-situ cell tests. Potential variables to be adjusted and screened during the test series include substrate type (Fe- and Ni-felt or –mesh), ionomer type, ionomer content, catalyst type, catalyst loading, operating temperature, and electrolyte concentration. To efficiently study the effects and interdependencies of these variables and to maximize knowledge gain from the tests, the application of a Design of Experiments (DoE) approach is recommended. The results from the ex-situ measurements will be compared to in-situ performance data of selected electrodes. The overarching aim is to identify the key factors driving high-performance operation.



Schematic illustration of AEM water electrolysis (left) and measurement data from in-situ characterization of electrodes (right); Source: HyCentA

Content / Time table:

- Literature research on testing protocols for AEMWE catalysts and familiarization with testing equipment (1 month)
- Development of strategic test plan to evaluate effect of parameter variation and conduct tests incl. data evaluation (3 months)
- In-situ testing of selected electrodes in electrolysis cells (1 month)
- Evaluation of results and thesis writing (1 month)

Start: as of now

Duration: approx. 6 months

Paid Master Thesis

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