

# Design and Optimization of a Test-Bench for the Experimental Investigation of Interfacial Contact Resistance in AEM Electrolysis Materials

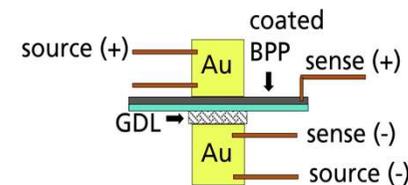
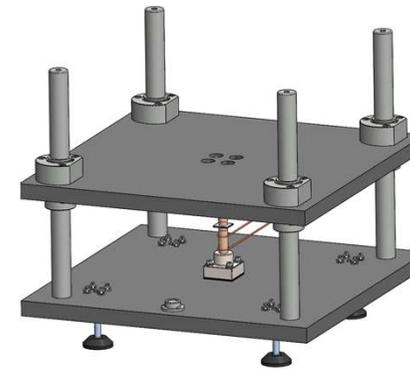
## Task description

In order to produce renewable hydrogen efficiently and cost-effectively, the anion exchange membrane water electrolysis (AEMWE) technology is emerging as a promising alternative to conventional PEM and alkaline electrolysis systems. AEM electrolysis combines the advantages of both technologies, such as high current density operation, low-cost materials, and the potential use of PFAS-free and PGM-free components. However, for the large-scale implementation of AEM electrolysis, long-term stability and durability of cell components remain critical challenges. One major factor influencing the performance and durability of AEM-cells is the interfacial contact resistance (ICR). The ICR occurs at the interfaces between electrodes, membranes, and current collector, and is influenced by the contact pressure. Reducing the ICR ensures uniform current distribution, minimizes voltage losses, and improves long-term durability of the cells.

To investigate and quantify the interfacial contact resistance in AEM electrolysis materials, a dedicated test bench is required. In the present thesis, an existing test bench will be optimized and modified to enable high-precision resistance measurements under different loading conditions. As part of this international research project, the upgraded test bench will enable both the characterization of the materials and the performance of reference measurements, providing a consistent baseline for evaluating results.

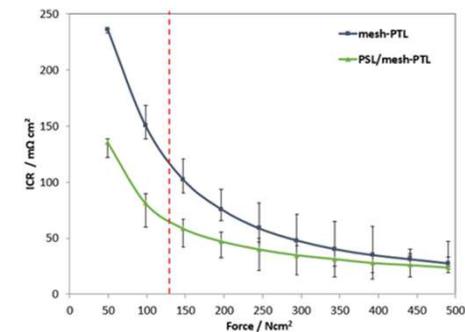
## Assignments

- Literature research: Introduction to AEM technology and review of existing test bench system (3 weeks)
- Concept Development and System Design: Define requirements, system architecture and selection of hardware (3 weeks)
- Test Setup Implementation and Testing: Integration of hardware and software, implementation of data acquisition. Measurements and functional testing on the optimized ICR test bench (3 weeks)
- Results presentation and thesis report writing (3 weeks)



Schematic measurement setup

Source: Georg, A.; Groos, U., Characterization of metallic bipolar plates, Fraunhofer Institute for Solar Energy Systems ISE, Freiburg



Interfacial contact resistance (ICR) with respect to compaction force of PEM material.  
Source: Stiber et al. 2021, *Porous Transport Layers for Proton Exchange Membrane Electrolysis Under Extreme Conditions of Current Density, Temperature, and Pressure*, *Advanced Energy Materials*, 11(33), 2100630.

**Start:** As of now

**Duration:** ca. 3 months

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