

December 2025

Bachelor/Master Thesis or HiWi – Numerical

Multiphase Modeling and Optimization of Distribution Zones of Electrochemical Systems

Background

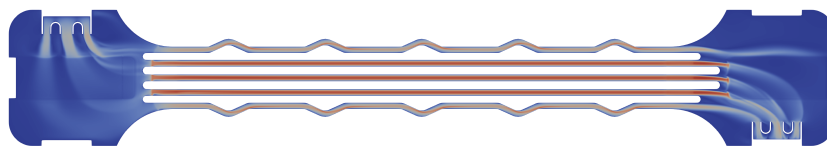
Hydrogen is considered one of the technologies for climate-neutral energy supply in the future. Efficiency and durability are important for the commercial success of PEM fuel cells and electrolyzers. Current research projects are focusing in particular on how to deal with multiphase effects. In fuel cells, gaseous hydrogen and oxygen react to form liquid water, while in electrolysis, gaseous hydrogen and oxygen are produced from liquid water. The new phase that is created must be effectively removed via the microchannels of the electrochemical converter. Inadequate removal can reduce efficiency and accelerate degradation.

An optimized design of the distribution zones is crucial for the efficient removal of the resulting phase, as they distribute the mass flow to the microchannels and bundle it again. There is currently no optimization strategy for the design of these distribution zones that takes the influence of two-phase effects into account.

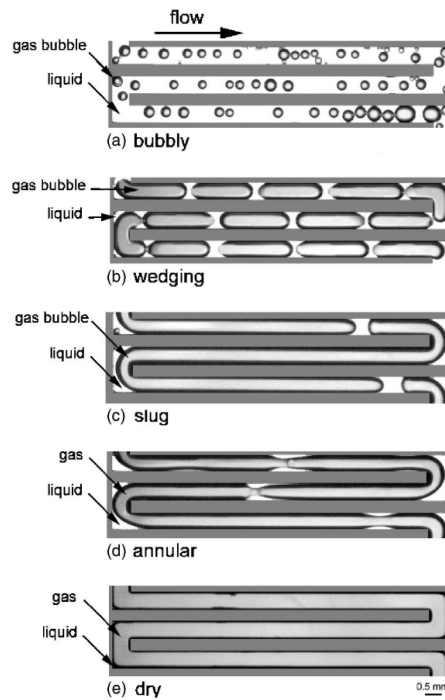
Content

Bachelor's or master's theses and student assistant positions can be carried out in this subject area. Tasks may include areas such as *optimization* or *multiphase flows*. Possible examples include the development of optimization tools, the validation of simulations with OpenFOAM, or model development for OpenFOAM in C++.

For further information, please get in touch with the contact person listed.



Velocity distribution



Cubaud, 2004



Simulation

Requirements

Basics of fluid mechanics,
OpenFOAM, Programming

Beneficial Skills

Multiphase flow, Python, C++

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