TUHH Hamburg University of Technology

Master Thesis

Call for Application

TUHH ims Institute of Multiphase Flows
Prof. Dr.-Ing. habil. Michael Schlüter

Fluid Dynamic Characterization of a Double Jet Loop Reactor for Bioelectrochemical Processes

Problem:

Bioelectrochemical systems (BES) show great potential for sustainable production of hydrogen and platform chemicals. However, they require a delicate balance between high mass transfer and low shear stress to support biofilm-based microbial activity. To address these conflicting demands, we developed a new reactor concept—the Double Jet Loop Reactor (DJLR)—a system with two fluidic loops that spatially separate mixing and biofilm zones.

However, to fully exploit the reactor's potential, a detailed characterization of fluid dynamics and mass transfer is essential. TUHHs worldwide unique large-bore vertical MRI scanner enables non-invasive, high-resolution flow measurements in vertical reactors—making it ideal for characterizing the DJLR's internal circulation.

Objective and Scope of Work

The aim of this thesis is to characterize the DJLR's fluid dynamics and gas–liquid mass transfer performance. Central aspects include determining recirculation rates in both loops depending on power input, alongside assessing gas–liquid mass transfer ($k_L a$) and evaluating energy dissipation (ε) to quantify local turbulence and mixing intensity. Using vertical MRT, internal velocity fields will be visualized and quantitatively analyzed, providing detailed insight into circulation patterns and fluidic regimes.

This thesis will contribute essential insights into the performance of the DJLR, helping bridge the gap between fundamental design and application in sensitive bioprocesses.

The guidelines available at the Institute for Multiphase Flows for the preparation of theses must be observed.

Hamburg, 19.06.2025

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Focus: **Experimental**
Start: **from 07/2025**

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