Karlsruhe Institute of Technology

Institute of Fluid Mechanics

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http://www.istm.kit.edu

22nd February 2018

bachelor or master thesis – numerical

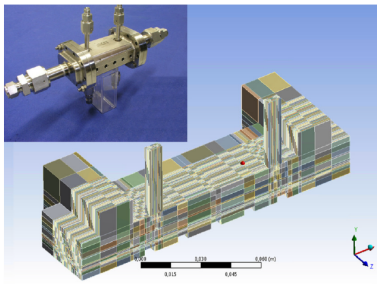
CFD analysis of evaporation cooling in a microstructured reactor

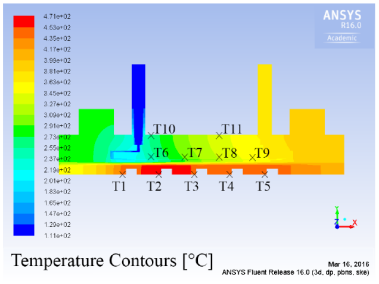
Background

In order to achieve the Federal Government's high CO2 avoidance targets by 2050, increased efforts to introduce renewable energy sources are also needed in the transport sector, which currently accounts for 20% of direct CO2 emissions. At the Institute for Micro Process Engineering (IMVT-KIT) a novel and compact microstructured packed bed reactor for catalytic methanation of pure CO2 for syngas throughputs of up to 2 Nm3/h has been developed and experimentally verified. Hereby, heat is extracted by evaporation of water, so that the steam can be used to supply a highly efficient steam electrolyzer. To predict the reactor behavior in different modes of operation, detailed modeling of the reactor including the cooling is required. Thus IMVT and ISTM are cooperating with regard to this task.

Content of the Thesis

The aim of this thesis would be to apply different available models in Fluent® to model the evaporation and thus the internal heat transport and fluid flow phenomena in the existing reactor device. The simulation results can be compared with experimental data of conversion and temperature from the lab. The insights into the evaporation performance should allow further development of the micro reactor prototype and lead to a clearer view on the behavior of the recently applied reactor device. For the simulation a meshed model of the reactor is available together with two options of linked reactions kinetics. The model has been recently applied to simulate the reaction under cooling with air and can be easily adapted to the required task. The thesis can be submitted to the Mechanical Engineering faculty or Chemical Engineering faculty, depending on the student.





Requirements
basic knowledge in heat & mass transfer

Beneficial skills
CFD, Matlab, Ansys Fluent

You will learn
methods of scientific research, applied CFD

Start: immediately

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