Friedrich-Alexander-Universität
Technische Fakultät

Department Chemie- und
Bioingenieurwesen (CBI)
Lehrstuhl für Energieverfahrenstechnik
Prof. Dr.-Ing. Jürgen Karl

Master's thesis

Particle-resolved computational fluid dynamic investigation of heat transfer inside a fixed-bed reactor considering the heat dissipation of the reactor bed

Content:

Heterogeneous catalytic methanation is the essential process of the Power-to-Gas technology. The critical problem of this process is how to keep the temperature below the catalyst limitation temperature to prevent the sintering of the catalysts due to a high reaction temperature. Heat dissipation treatment is usually applied to the reactor to avoid excessive temperature in the reaction bed. For example, using flowing nitrogen or thermal oil dissipates heat from the reaction bed. Therefore, investigating the detailed heat transfer inside a fixed-bed reactor considering the heat dissipation is essential for predicting the temperature distribution in this kind of reactor bed. However, there are still few studies on the heat transfer inside the reaction bed under the condition of heat dissipation through the particle-resolved CFD simulation.

For this research, the primary job is to make particle-resolved CFD simulations for a fixed-bed reactor with heat dissipation. As for the supposed working conditions: the high-temperature air flows through the reaction bed, and the cooling medium flows the outside the reactor to cool the fixed bed. This thesis aims to explore the influence of different tube-particle configurations and different effective thermal conductivities of the particle on the heat transfer in the cylindrical fixed bed reactor, considering the external heat dissipation.

Tasks:

- Literature research: heat transfer in fixed bed, particle-resolved simulation.
- Geometry sketching and grid meshing. (Supervisor can help you with this task)
- Setting boundary conditions for the CFD simulation.
- Post-processing of the CFD simulation.
- Written documentation of the thesis.

Your profile:

- Motivation and interest for computational fluid dynamic simulation.
- Basic knowledge of CFD-Simulation (favorable but not mandatory).
- Working independently.
- Teamwork with the supervisor.

Start: as soon as possible

Contact:

Xu Fang, M.Sc.
Phone: +49 9115302-99036 Email: xu.fang@fau.de