Friedrich-Alexander-Universität
Technische Fakultät

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

Master's thesis

CFD simulation of catalytic methanation with a conic shape 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. The widely used conventional reactor for this reaction is a fixed bed with a cylindrical reactor shape containing many particles loaded with catalyst. To improve the performance of the conventional fixed bed, the Chair of Energy Process Engineering has developed an innovative reactor concept with a conic shape of the reactor bed. With the variable reactor diameter of the conic shape of the reactor bed, the dwell time of the gas at the different parts of the reactor can be controlled so that the temperature can also be limited.

For this research, the primary purpose is to explore the influence of the different conic reactor shapes on the reaction, especially the impact on the reaction temperature and the methane conversion. Besides that, the simulations of the conventional cylindrical reactor shape and different conic reactor shapes under the condition of the same reactor volume shall be compared.

Tasks:

- Literature research: catalytic methanation, kinetic models, and relevant simulation.
- Selecting a kinetic model from the literature and writing a code script for it.
- Geometry sketching and grid meshing.
- CFD simulation (2D and 3D) in ANSYS Fluent with selected reaction kinetic models.
- Evaluation of the influence of the different conic reactor shapes on the reaction.
- Written documentation of the thesis.

Your profile:

- Basic knowledge of CAD and CFD-Simulation (favorable but not mandatory)
- Basic knowledge of C/C++ programming language (favorable but not mandatory)
- Working independently
- Teamwork with the supervisor (Supervisor can teach you code programming and grid meshing)

Start: from now

Contact:

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