Friedrich-Alexander-Universität
Technische Fakultät

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

Master's thesis

CFD simulation for the catalytic methanation in a novel concept reactor

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. Through this way, the highest temperature in the reactor can also be limited and the high temperature zone can be extended, which is more conducive to the occurrence of methanation reaction.

For this research, the primary purpose is to explore the influence of the different conic reactor shapes on the reaction, especially its impact on the temperature distribution and the methane conversion in the reactor.

Tasks:

- Literature research: catalytic methanation, kinetic models, and relevant simulation.
- Geometry sketching and grid meshing.
- CFD simulation (2D and 3D) in ANSYS Fluent with suitable reaction kinetic models.
- Evaluation of the influence of the different conic reactor shapes and reactor configuration on the reaction according to the simulation results.
- Written documentation of the thesis.

Your profile:

- Basic knowledge of CAD and CFD-Simulation (favorable but not mandatory)
- Working independently
- Teamwork with the supervisor

Start: from now

Contact:

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