offered master thesis to the following topic:

Development of a Detailed Particle Model for Biomass Pyrolysis

Goals:

- Literature study regarding the thermo-chemical conversion of biomass
- Implementing pyrolysis reactions into an existing single particle model
- Validation of the new model

Results:

- A validated detailed particle model for thermo-chemical biomass conversion

Description:

Computational fluid dynamics (CFD) is a versatile tool. Not only large scale processes can be investigated, but it is also possible to depict processes on the single-particle scale. In cooperation with K1-MET GmbH we explore the conversion behaviour of individual char particles. The scales for these particles are in the range of multiple micrometers up to a few centimeters. This investigation is based on a detailed particle model, which resolves not only the flow field around the particle, but also the processes inside the particle. This detailed particle model was implemented in the CFD toolbox OpenFOAM.

The goal of this thesis is to extend the existing model for char conversion in such a way, that it is applicable to the thermo-chemical conversion of biomass. Therefore, in the first step an extensive literature research should be performed about existing biomass conversion modells and the reaction mechanisms used therein. This knowledge should then be applied in order to implement the gas-solid reactions needed for biomass pyrolysis into OpenFOAM and to extend the existing model where necessary.

After the development and implementation of the new biomass particle model experimental data is available for validation of the new model. At the end of this thesis a validated detailed particle model for the thermo-chemical conversion of biomass particles should be implemented in OpenFOAM.

Prerequisites:

- Basic knowledge in CFD
- Basic knowledge in OpenFOAM (CFD-Software)
- Basic knowledge about thermo-chemical gas-solid reactions in biomass
- Basic knowledge in C++ and Python are of advantage
- Sufficient knowledge of the german language or english language

Start:

This thesis has no experimental part and can therefore be done without presence at the university, as long as the Covid-situation does not allow it.

Regular meetings with the supervisors will be held online.

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