Lehrstuhl für Energiesysteme
TUM School of Engineering and Design
Technische Universität München

Master's Thesis

(Experimentell)

Application of predictive modeling methods to model volatile release under entrained flow conditions

Description:

In view of the climate-related shift in resources and energy, as well as the high dependence on imports of fossil raw materials, the development of new raw materials, such as biogenic residues or plastic waste, is of utmost importance. Closing the carbon cycle is also a crucial aspect of making the chemical industry more sustainable. A promising approach in this context is entrained flow gasification to convert residues or bio-mass into high-quality synthesis gas (H2 & CO), which can then be used, for example, in IGCC power plants for electricity generation or in catalytic syntheses to produce basic chemicals such as methanol or FT-products.

The first step in thermochemical conversion processes is devolatilization, which plays a decisive role in determining the fuel's conversion behavior in the gasifier/combustor. Therefore, the release of volatiles is being studied independently of the gasification/burnout reaction at the Chair of Energy Systems (CES) using a wired mesh reactor (WMR). This setup allows for the experimental determination of various influences, such as temperature, pressure, and heating rate. To enhance resource efficiency in the future – both financially and in terms of working time – a predictive model for the release of volatiles is developed.

The aim of this work is to improve an existing predictive model that can forecast the release of volatiles from residues and biomass. As an initial step, the current model status needs to be analyzed. Therefore, data from the literature and previous experimental work at the chair will be reviewed to identify potentially useful correlations and to re-examine the used correlations. Additionally, a literature review on predictive modeling methods will be conducted. Following this, the predictive model for volatile release will be further developed. In the final step, carefully selected experiments will be conducted in the WMR to validate the developed model. The results will then be compared with existing literature and documented in writing.

Requirements:

- Independent way of working
- Reliability and personal responsibility
- Programming skills desirable

Work Packages:

- Familiarization with predictive modeling methods and the basics of entrained flow gasification
- Development of a predictive model and experimental validation of the model
- Documentation of the work and regular meetings with the supervisor

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Contact: M. Sc. Lukas Springmann / M.Sc. Johannes Haimerl

Room: MW 3711 / MW 3708

Tel.: 089 289 16292 / 089 289 16284

Email: lukas.springmann@tum.de / Johannes.haimerl@tum.de