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

Master's Thesis

(Experimentell)

Development and evaluation of an enhanced predictive machine learning model for volatile release from biomass and residues

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 biomass 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 enables experimental determination of various factors, including 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 enhance and expand an existing predictive machine learning (ML) model in Python for forecasting the release of volatiles from residues and biomass. As a first step, the current state of the model will be analyzed. Furthermore, relevant literature data will be reviewed to extend the model's applicability to a wider range of operating conditions and reactor concepts. Based on these findings, the predictive model for volatile release will be further developed. In the final step, existing data will be used to compare the improved model with structural and physical models reported in the literature. The results will be critically evaluated 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