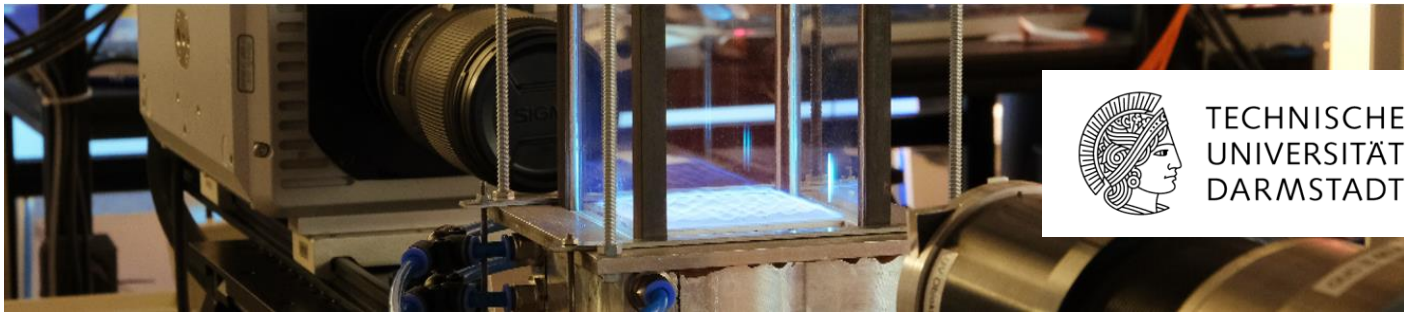

Master-Thesis / ARP

Characterization of soot formation of solid fuel particles in oxygen-enriched conditions

Charakterisierung des Rußbildung von festen Brennstoffpartikeln unter sauerstoffangereicherten Bedingungen

Motivation:

The institute of Reactive Flows and Diagnostics focuses on fundamental combustion research and has established world-class combustion laboratories with novel optical diagnostics methods. Advanced imaging methods combing modern lasers and cameras enable the understanding of complex processes in gas and solid combustion.

State of the art

Soot emission is one of the most important issues in the utilization of hydrocarbon fuels. A deep understanding of the soot and nano-sized particle formation in gas and solid fuel flames is an essential aspect of combustion research. In laboratory-scale experiments, in-situ laser diagnostics have been widely established to gain fundamental knowledge. Laser-induced incandescence (LII) has proven to be a powerful tool for particle-concentration and particle-size measurements in combustion systems. This technique has been implemented in previous work and applied for 2D soot imaging measurements in a laminar diffusion flame fueled by ethylene, e.g., in a Gülder-burner configuration. To quantify the soot volume fraction, 1D extinction measurements have been performed simultaneously to calibrate the qualitative LII signals. These combined methods should be further applied for solid fuel combustion studies on the single-particle level. In further steps, in a well-established laminar flow reactor, semi-quantitative 2D LII imaging has been first conducted on bituminous coal and biomass particles. Here, the reaction zone and PAH formation could be visualized at the same time, e.g., by using laser-induced fluorescence (LIF) techniques, to support the interpretation of the soot formation

Objectives

The comprehensive experimental data requires intelligent data processing algorithms. Within this work, simultaneously acquired image data should be evaluated in Matlab (image processing tools) using efficient programming structures (object orientated programming). The code structures should be friendly to further extension and maintenance. The main purpose of data evaluation is to extract essential parameters related to soot formation in solid fuel combustion. They are, e.g., 1D absorption ratio, 2D soot volume fraction, soot flame topology, particle positions, particle number density, particle size and shape and etc. Conditional statistical analysis that includes all parameters should be performed in a systematic way to enable a deep understanding of soot formation processes in single particle and particle group combustion. Theoretical

The topic is suitable for ARP and Master's theses, and the work tasks are adapted accordingly.

Tasks:

- Familiarization with the topics of optical measurement technology and combustion of solid fuels
- Redesign the current processing routines with object-orientated programming in Matlab
- Evaluate data and perform conditional statistical analysis
- Perform simulations with the theoretical models in LIISim
- Interpretation of the results, write final report/thesis, hold intermediate and final presentations

Requirements:

- Interest and motivation in programming work
- Good knowledge and experience with MATLAB (image processing tools)
- Basic knowledge in optical diagnostics/combustion

Are you interested?

Dann melde dich bei mir! Feel free to contact me!

Beginn: Ab dem 15.Nov.2021

Reaktive Strömungen und Messtechnik (RSM)

Reactive Flows and Diagnostics

RSM Reaktive Strömungen + Messtechnik

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