Bachelor/Master Thesis

Development of advanced laser diagnostic for in-situ measurements of local gas composition in sooting flames

Formation of soot is a highly complex physio-chemical process which is one of the least understood processes in combustion research. To shed light on soot formation and validate numerical models for soot prediction, there is an urgent demand for joint information of soot quantities and local mixture fraction. A promising approach for measurement of local mixture fraction in sooting flames is an advanced laser-based technique named “laser-induced breakdown spectroscopy (LIBS)”. A high-energy laser beam is focused to generate a plasma in a defined local spot. The radiation of the plasma contains information on the element composition which is used to determine the mixture fraction. At ITV, we are aiming to employ LIBS to sooting flames of novel alternative bio-hybrid fuels to improve our understanding on soot formation process of these fuels. Within this thesis, we will install the laser and detection system. Thereafter, detailed measurements in gas mixtures of well-known composition will be performed to calibrate the system and verify its functionality. LIBS-measurements will be performed in ethylene counterflow flames to elaborate the potential of the system under sooting flame conditions. Finally, the setup will be employed to laminar counterflow flames of bio-hybrid fuels.

Tasks:
- Support the installation of the LIBS setup
- Perform LIBS measurements in sooting flames
- Develop post-processing routines to analyze the experimental data

Requirements:
- Independent and reliable working skills
- Passion in experimental work
- Knowledge in fundamentals of combustion
- Languages: German and English
- Experience in Matlab (beneficial)

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