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Investigation of combustion processes in different reactor setups using i2PEPICO

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Combustion experiments using the i2PEPICO technique have been proven a valuable addition to the existing established synchrotron based methods. High sensitivity towards radicals, especially hard to measure fuel radicals, and a superior identification of isomeric species allow for a more complete experimental investigation of chemical reaction networks. A detailed knowledge of the most important reactions plays a key role for the development of a predictive understanding of combustion processes and it is particularly important for ignition processes and the mitigation of pollutants.

In addition to the successful demonstrated laminar flame experiments, the combination of molecular-beam mass spectrometry (MBMS) and photoelectron-photoion-coincidence spectroscopy (PEPICO) is used to detect the reactive key species experimentally in reactor setups, e.g. plug-flow or jet-stirred configurations. The vast range of operating conditions available in reactors enables access to combustion applications that are typically not achievable by flame experiments. The pressure and the reaction times at a specified temperature can be controlled easier and more systematically in a flow reactor than in a model flame, e.g. enabling the investigation of the peroxy chemistry governing the low temperature oxidation regime.

Expanding the i2PEPICO flame setup with a flow reactor is a future goal to characterize the intermediates formed via low-temperature reaction pathways in a wider parameter range by temperature-dependent concentration profiles. Improvements on the flow reactor setup will be similar to the present DLR flow reactor, which has been modified to be suitable for technical fuels (e.g. multi-component mixtures like Jet A-1) allowing for phenomenological analysis of occurring combustion intermediates like soot precursors or pollutants. Using the superior detection und identification capabilities of the i2PEPICO flame system with such a flow reactor design is a promising addition in combustion diagnostics. Here, initial experiments and design studies of a first flow reactor approach at the Swiss Light Source (SLS) will be shown and discussed.

Summary

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