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Determination of various absorbing species in sooting flames using UV-VIS-absorption-spectroscopy

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For a deeper understanding of the soot-formation process, profound knowledge about the species concentrations in a flame is required. After the decomposition of the fuel-air mixture into radicals, polycyclic aromatic hydrocarbons (PAH) are formed. They play a key role as soot precursor materials. Through further growth, large planar PAHs are developing. They form 3-D objects by either physical bonding or chemical mechanisms and finally result in the first soot nuclei [1], from which finally soot aggregates form through growth and aggregation.

While small PAHs mainly absorb in the ultraviolet (UV) region, the absorption spectra are shifted to the visible (VIS) range with increasing carbonization. Sheer soot absorbs over a wide spectral range, from UV to infrared (IR) wavelength. Using a laser driven light source, emitting from 170 nm up to 2100 nm, absorption spectra of a wide range of species can be detected by a line of sight measurement. By applying a deconvolution procedure, based on a regression between a measured absorption spectra and a database, the existence of different species can be captured [2].

In this work, a study of absorption spectra at different heights above burners with premixed- and diffusion flames and various fuels is presented, demonstrating the potential of the technique. Additional emphasis is put on possible measurement artefacts, caused by chromatic aberration over the wide spectral range.

References

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[2] A. Tregrossi, B. Apicella, A. Ciajolo, C. Russo, *Chemical Engineering* **57**, (2017)