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Date: 05.04.2022

# Bachelor thesis (literature survey)

# Development of a flame-tube experimental setup

Hydrofluorocarbon refrigerants are now systematically removed from the market, due to their high global warming potential (GWP). Replacements with low GWP exist but give rise to safety hazards as they are found to be mildly flammable. Hence, a fundamental understanding of their combustion behavior is needed. One property to describe the combustion behavior for safety evaluation is the laminar flame speed, which considers the combined effects of diffusivity, exothermicity, and reactivity. While accurate data are critical for a reliable safety assessment of such refrigerants, the experimental facilities need to be also simple, practical, and robust for industry usage. Currently, the employed complex techniques at the Institute for Combustion Technology for the experimental determination of flame speeds are the Schlieren method, Particle Image Velocimetry (PIV) and the pressure rise method.

In this thesis, the standard methods used in the refrigeration industry to determine the laminar flame speed of refrigerants will be analyzed. Additionally, a detailed literature survey will be conducted and supported by 1D reactive CFD simulations.
Based on the knowledge gained, a flame-tube experimental setup will be developed for accurate depiction of refrigerant flame speeds and simple implementation in the industry.

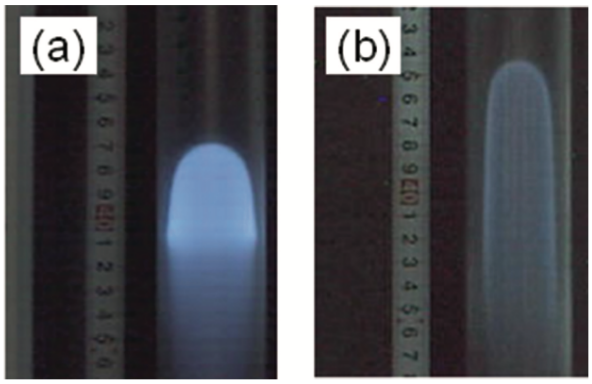


***Figure 1*** *Direct photography of tube flame: (a) stoichiometric R-32/air mixture, (b) R-32/134a (70/30 wt%) mixture at 21 vol%.*

**Tasks**

- Familiarize with state-of-the-art experiments for determination of flame speeds
- Literature survey of existing flame tube experiments and 1D reactive CFD simulations with in-house code “FlameMaster”
- Development of an improved industry-suited experimental setup

**Requirements**

- Interest in experiments
- Reliability, independence, motivation
- Knowledge in thermodynamics, fluid mechanics and combustion desirable
- Good English skills desirable

For your application, please send a CV and your grade sheet to the contact below.

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**Please refer to our website for further information:** https://itv.rwth-aachen.de/