



TOWARDS CLOSED-CARBON AND CARBON-FREE THERMOCHEMICAL CONVERSION: FLASH-BOILING OF SYNTHETIC FUELS

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Motivation Main Challenges **Working Hypotheses Objectives and Challenges Objectives and Challenges** Closed carbon cycles or carbon-• Fuels must work in existing · Short-chain fuels prone to flash-Flash-boiling can be beneficial to free processes needed to boiling due to high volatility optimize combustion processes systems reduce emissions in · Drop-in capability of fuels in → low boiling point Enhancing spray atomization combustion-dependent sectors existing systems → high vapor pressure Enhancing mixture formation Energy efficient synthesis of → Significant advancements in fuels (short-chained fuels) energy efficiency and environmental sustainability Closed carbon cycles for propulsion Carbon-free combustion processes The Fuel Science Center - Adaptive A Contribution to the Realisation of the Energy Transition: FSC The Fue Conversion Systems for Renewable Energy Optimisation of Thermochemical Energy Conversion Processes for the Flexible Utilisation of Hydrogen-based and Carbon Sources Renewable Fuels Using Additive Manufacturing Approach Approach Liquid Ammonia Development of a test Design of adapted bench developmen Innovative test bench for first time and Screening burner-system with Modeling investigation of micro defined operation range droplet and spray for liquid ammonia wall/film interaction combustion under realistic boundary conditions Determination of probability study Investigation of **Topology Study** flash-boiling dynamics Flash-Boiling different fuels and Interaction inside and outside High-speed injection systems with nozzles as function of visualization regard to high-speed topology visualizations, droplet size and droplet velocity Enhanced test bench for Flash boiling dynamics impact phenomena single droplet inside and outside Micro-droplet Surface Study High speed Flash-Boiling generation (piezo nozzles as function of shadowgraphy Ultra-high-speed dropper) and surface roughness & Planar laser visualization acceleration induced up to 5 Mio fps flourescence Study of the influence of Phase-Doppler Determination of Phase-Doppler Mixture-Formation Tailored adaptation of target surface measurements of quantitative measurements of oil properties, surface droplet dynamics droplet dynamics roughness and catalytic characteristics of the coating on the droplet turbulent droplet-gas wall interaction stream High-speed Z-type Schlieren properties for gas dynamics **Development** of laser OH* Chemiluminescence High-speed Z-type Schlieren Determination of flame Pollutant Emissions based measurement for flame structure for $\ensuremath{\text{gas}}$ dynamics structure, stability, and techniques for high emissions for LNH₃ ex-situ FTIR and spectrometry for temporal resolution of spray-flames from SLE gas composition / NO_x production phase change phenomena tapered burner Suction pyrometer for gas temperature Flash-boiling can be used for Optimizing energy Developing innovative technologies consumption and control strategies greenhouse gas







