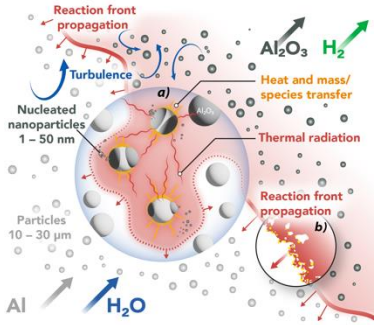
Bachelor's Thesis

Simulation of flame propagation in Aluminum-Steam suspensions

TECHNISCHE UNIVERSITÄT DARMSTADT

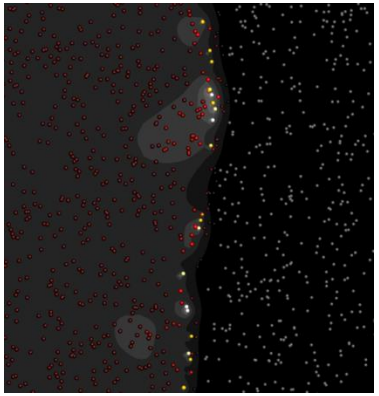
STFS

Motivation & Background



Micron sized metal powder can serve as a carbon free energy carrier in a circular energy economy, in a similar manner as hydrogen. Energy is stored by reducing aluminum ore to aluminum. The CO_2-free combustion of aluminum particles suspended in pure steam (H_2O) is one possible thermochemical process to release the stored energy, obtaining around half of the energy in the form of heat and hydrogen gas, respectively.

Recently at STFS, a Lagrangian point-particle model has been developed which features the most important physical processes of individual particle combustion on the micro-scale. This enables simulations of macroscopic flame propagation through particle suspensions. In this thesis, the interaction of these micro-scale processes on the macroscopic flame propagation, i.e. flame stabilization is to be evaluated.



Tasks

- Familiarize yourself with the particle model and flame solver
- Set up and run parameter variations of flame simulations, varying single particle model parameters
- Evaluate the results, analyze the flame structure and find the effects on the the macroscopic processes

Focus areas

Simulation	●●●
Modeling	●○○
Implementation	●○○
Data analysis	●●●

Date

23.06.2025

Start from

23.05.2025

Contact

Johannes Mich

mich@stfs.tu-darrmstadt.de

L1|01 292

+49 6151 16-24153

Our research project