

TECHNISCHE  
UNIVERSITÄT  
DARMSTADT

## ADP/Bachelor/Master thesis (Experimental)

### *Design and commissioning of a metal particle ignition reactor for iron particle ignition experiments*

### *Konstruktion und Inbetriebnahme eines Metallteilchen-Zündreaktors für Experimente zur Zündung von Eisenpartikeln*

Reaktive Strömungen und Messtechnik (RSM)

Reactive Flows and Diagnostics

#### Motivation

The project **Clean Circles** is dedicated to solving global energy problems by using iron as CO<sub>2</sub>-free, renewable and efficient chemical energy carrier. First, electricity from renewables is used to reduce iron oxide (energy storage). Then, the iron is oxidized to release thermal energy for electricity generation at a different place and time (energy release). In the collaborative research project, scientists and students from different Universities work closely on numerous experiments and simulations.



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#### Objectives

In this student work, a new metal particle ignition reactor (MPIR) with well-defined boundary conditions should be designed and tested for single iron particle experiments. MPIR will include three modules: electrostatic-based single particle generator, an optically accessible ignition channel, and an external heating system by an annular gas flame. The concept of MPIR originates from the so-called micro-flow reactor (see Fig. 1), which has been successfully applied for gaseous and liquid fuel ignition studies. The advantage of this setup is to study the ignition/reaction kinetic by converting the transient process to a space-dependent process. Within this work, this concept should be realized for metal fuel ignition measurements.

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The topic is suitable for ADP, Bachelor and Master theses, and the work tasks are adapted accordingly.

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#### Tasks:

- Literature review on applications of the existing micro-flow reactors
- Design and manufacture a new MPIR with Siemens NX
- Optimization of the channel diameter by simplified CFD simulations
- Commissioning and first tests of the MPIR performance
- Thesis writing and presentations

#### Requirements:

- Interest in lab work
- Knowledge of Siemens NX and CFD software (e.g. Ansys Fluent, Comsol, or similar) is preferred.

**Are you interested? Dann melde dich bei mir! Feel free to contact me!**

**Beginn: Ab sofort! Soon!**

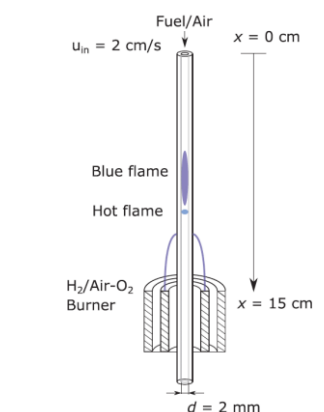


Figure. 1. Vertical-type micro flow reactor with controlled temperature profile.

