

Institut of Process Engineering Chair of Mechanical Process Engineering

Workshop on Metal Fuels and Metal Dust Combustion

The Emmy Noether Group for Dispersed Multiphase Flows at the Otto von Guericke University Magdeburg and the Department Energy Plant Technology of the Ruhr University Bochum jointly organized a workshop on “Metal Fuels and Metal Dust Combustion” on 29/09/2023. The workshop took place at the Waldorf Astoria in the city center of Berlin. You may download the workshop announcement and flyer here. > Flyer (https://www.mvt.ovgu.de/mvt_media/Downloads/flyer.pdf)

Scope and aims

Over the course of the past decade, the idea of using metal powders as recyclable, carbon-neutral energy carriers has gained momentum and research groups all over the world have begun to address open questions, both fundamental and applied, on single particle combustion, dust flames, recycling strategies or practical combustor technologies. In order to provide a common forum for these efforts, to support the synthesis of experimental and modeling endeavors and to facilitate thought exchanges, we organized a workshop with chaired sessions on recent and on-going research pertaining to the emerging field of an energy economy based on metal fuels. A particular objective of the workshop was to discuss the definition of a set of target dust flames for which experimental databases for model calibration and validation can be established and maintained.

Target flames

The first target flame put forward after the workshop is a **laminar iron dust Bunsen flame** designed and investigated by researchers from the Karlsruhe Institute of Technology and TU Darmstadt. The corresponding dataset includes detailed information on the burner geometry and operating conditions and will be amended in the future. The current dataset can be accessed through the link at the bottom of the following webpage where you will also find a list of relevant publications:

> <https://csc.ebi.kit.edu/60.php> (<https://csc.ebi.kit.edu/60.php>)

Program and session topics

The workshop program encompassed oral and poster presentations on experimental investigations, modeling efforts, numerical methods as well as economic analyses relevant to the metal fuel cycle and the combustion of metal powders. You may access the slides for the welcome presentation of the workshop, the workshop program and the book of abstracts detailing the participants' contributions here.

> Introduction (https://www.mvt.ovgu.de/mvt_media/Downloads/slides.pdf)

> Program (https://www.mvt.ovgu.de/mvt_media/Downloads/program.pdf)

> Book of abstracts (https://www.mvt.ovgu.de/mvt_media/Downloads/book.pdf)

The topics covered by the contributions include:

- ▶ Cycle economy, retrofitting and infrastructural changes
- ▶ Single metal particle combustion
- ▶ Intra-particle chemistry and phase changes
- ▶ Laminar and turbulent dust flames
- ▶ Metal-water slurry reactors
- ▶ Smoke and pollutant formation

Registration

The workshop was financially supported by the German Research Foundation (DFG). The participation fee of € 85.45 per person covered sustenance-related expenses and included non-alcoholic beverages as well as catering during lunch and coffee breaks

Guest lecture

The workshop was attended by Prof. J. M. Bergthorson who also gave a guest lecture on "The physics and chemistry of metal combustion and metal-water reactions" as part of the preceding '31. Deutscher Flammentag' at the TU Berlin. All workshop participants were welcome to attend this lecture at no extra charge.

Upcoming events

The next workshop on a Metal-enabled Cycle of Renewable Energy (MeCRE) will be organized by the Clean Circles team and Eindhoven University of Technology and will take place from 13 to 15 November 2024 in Darmstadt, Germany.

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