Fire Technology, 55, 1911–1917, 2019

https://doi.org/10.1007/s10694-019-00844-6

Letter to the Editor

Call for Participation in the Second Workshop Organized by the IAFSS Working Group on Measurement and Computation of Fire Phenomena

Bart Merci, Department of Flow, Heat and Combustion Mechanics, Ghent University, 9000 Ghent, Belgium

Arnaud Trouvé, Department of Fire Protection Engineering, University of Maryland, College Park, MD 20742, USA*

Early 2015, a new initiative called "the IAFSS Working Group on Measurement and Computation of Fire Phenomena" (*aka* the MaCFP Working Group) was launched (http://www.iafss.org/macfp/). This initiative is endorsed and supported by the International Association for Fire Safety Science (IAFSS, http://www.iafss.org). The first workshop organized by the MaCFP Working Group was held in June 2017 as a pre-event to the 12th IAFSS Symposium in Lund, Sweden. Details are found on https://iafss.org/3770-2/ and in Ref. [1]. The primary objective of this letter is to engage the members of the fire research community to participate in the second MaCFP workshop, scheduled on April 25–26 2020 as a pre-event to the 13th IAFSS Symposium in Waterloo, Canada (http://iafss2020.ca). Continued updated information on the MaCFP Working Group effort is found at http://www.iafss.org/macfp/.

1. Background and Motivation

The general objective of the MaCFP Working Group is to establish a structured effort in the fire research community to make significant and systematic progress in fire modeling, based on a fundamental understanding of fire phenomena. This is to be achieved as a joint effort between experimentalists and modelers, identifying key research topics of interest as well as knowledge gaps, and thereby establishing a common framework for fire modeling research. The MaCFP Working Group is intended as an open, community-wide, international collaboration between fire scientists. It is also intended to be a regular series of workshops.

Co-Chairs of the organizing committee of the MaCFP Working Group http://www.iafss.org/macfp/.
* Correspondence should be addressed to: Arnaud Trouvé, E-mail: atrouve@umd.edu

2. Objectives

The central objective of the MaCFP Working Group is to develop a fundamental understanding of fire phenomena and to advance predictive fire modeling. The strategy is based on the study of elementary academic problems and a gradual move towards complexity and realism by following a building block approach to model development. The MaCFP workshop series is intended to be complementary to both the existing Verification and Validation guides developed in support of the FDS fire modeling software (https://pages.nist.gov/fds-smv/) and the FM Global Open Source Fire Modeling Workshop series (https://sites.google.com/site/firemodelingworkshop/).

The specific objectives of the MaCFP Working Group are to:

- Develop a digital archive of well-documented fire experiments that can be used as targets for CFD model validation;
- Develop a digital archive of well-documented CFD-based numerical simulations corresponding to the selected target experiments;
- Develop protocols for detailed comparisons between computational results and experimental measurements;
- Identify key research topics and knowledge gaps in computational and experimental fire research;
- Develop best practices in both computational and experimental fire research (including quality control and quantification of uncertainties);
- Establish a network between fire researchers and provide a community-wide forum for discussion and exchange of information.

The initial list of target experiments established in 2015 by the MaCFP Working Group includes five categories:

- *Category 1* Turbulent buoyant plumes; this category corresponds to open plumes and is represented by a helium plume experiment conducted at Sandia National Laboratories [2].
- *Category 2* Turbulent pool fires with gaseous fuel; this category corresponds to open flames with a prescribed fuel flow rate and is represented by a series of natural gas flame experiments conducted at the National Institute of Standards and Technology [3] and by a series of methane and hydrogen fire experiments conducted at Sandia National Laboratories [4, 5].
- *Category 3* Turbulent pool fires with liquid fuel; this category corresponds to open flames with a thermal-feedback-driven fuel flow rate and is represented by a methanol pool fire experiment conducted at the University of Waterloo [6, 7].
- *Category 4* Turbulent wall fires; this category corresponds to boundary layer flames with a prescribed fuel flow rate and is represented by a series of vertical wall flame experiments, fueled by methane, ethane, ethylene or propylene, and conducted at FM Global [8, 9].
- *Category 5* Flame extinction; this category corresponds to flames driven to extinction conditions and is represented by a series of methane and propane line flame experiments conducted at the University of Maryland [10–12].

These target experiments correspond to basic configurations (building blocks) with carefully-controlled conditions and quality instrumentation and diagnostics. They also correspond to available open databases. This list will be enhanced as the MaCFP Working Group makes progress and moves towards greater complexity and realism.

3. MaCFP Repository

The MaCFP repository is hosted on GitHub (https://github.com/MaCFP). The repository contains:

- A description of each selected target experiment (organized according to the categories (1)–(5) mentioned above), including a description of the experimental configuration and a description of measured quantities and measurement uncertainties (if known);
- An electronic copy of experimental data organized in simple comma-delimited ASCII files;
- An electronic copy of computational results submitted by the different modeling groups that participated in the first MaCFP workshop, also organized in simple comma-delimited ASCII files;
- Protocols to perform comparisons between experimental data and simulation results based on (provided) MATLAB-based post-processing tools.

The repository was created and is managed by Dr. Randy McDermott (National Institute of Standards and Technology, USA).

4. Condensed Phase Phenomena Subgroup

Historically, the fire modeling community has self-organized into two distinct groups: a first group that studies combustion and heat transfer in the gas phase, and a second group that studies thermal degradation and pyrolysis in the condensed phase. The early discussions of the MaCFP Working Group have focused on gas phase phenomena, but with the understanding that quantitatively predicting flame spread and fire growth requires modeling of coupled gas phase and condensed phase processes. Following discussions that took place in April 2016, it was proposed that the MaCFP Working Group be expanded to include a subgroup dedicated to the predictive modeling of condensed phase phenomena. A committee was formed to produce a white paper and organize a planning meeting during the first MaCFP workshop. The purpose of the Condensed Phase Phenomena subgroup is to facilitate data sharing and model development to improve computational predictions of thermal degradation and pyrolysis in fire scenarios.

The specific objectives of the subgroup are to:

- Develop standard data set formats for experimental data on pyrolysis;
- Develop requirements for data set quality and establishing a data review committee;
- Incorporate compliant data into the existing MaCFP data repository;
- Create a database of pyrolysis property sets;
- Develop minimum requirements for numerical pyrolysis models;
- Organize a pyrolysis modeling discussion group.

5. First MaCFP Workshop (June 2017)

The first MaCFP workshop included a general discussion on the MaCFP effort as well as presentations of a first suite of experimental-computational comparisons corresponding to the initial list of target experiments. The workshop was structured into two sessions: a session organized by the Gas Phase Phenomena subgroup of the MaCFP Working Group and focused on CFD model validation (June 10), and a session organized by the Condensed Phase Phenomena subgroup and focused on a review of the main issues associated with pyrolysis measurements and modeling for fire applications (June 11). The workshop served as a first technical meeting for the gas phase subgroup and a planning meeting for the condensed phase subgroup. The program of the workshop and copies of the presentations can be found at https://iafss.org/3770-2/; the proceedings that report on the content and main outcomes of the workshop were published in *Fire Safety Journal* [1].

6. Second MaCFP Workshop (April 2020)

The second MaCFP workshop is being scheduled for April 25–26 2020, as a pre-event to the 13th IAFSS Symposium in Waterloo, Canada (http://iafss2020.ca).

The organizing committee of the Gas Phase Phenomena Subgroup for the second MaCFP workshop is composed of:

• Alexander Brown	Sandia National Laboratories, USA
• Michael Gollner	University of Maryland, USA
• Anthony Hamins	National Institute of Standards and Technology, USA
• John Hewson	Sandia National Laboratories, USA
• Andre Marshall	University of Maryland, USA
• Randy McDermott	National Institute of Standards and Technology, USA
• Bart Merci (*Co-Chair*)	Ghent University, Belgium
• Arnaud Trouvé (*Co-Chair*)	University of Maryland, USA
• Yi Wang	FM Global, USA
• Beth Weckman	University of Waterloo, Canada

The organizing committee of the Condensed Phase Phenomena subgroup is composed of:

• Benjamin Batiot	University of Poitiers, France
• Morgan Bruns	Virginia Military Institute, USA
• Isaac Leventon	National Institute of Standards and Technology, USA
• Thomas Rogaume	University of Poitiers, France
• Stanislav Stoliarov	University of Maryland, USA

The exact format of the workshop is yet to be determined but is likely to be a mix of invited oral presentations and group/panel discussions, guided by plenary introductions and concluded by reports of main outcomes. Proceedings will be produced after the workshop and submitted for publication in *Fire Safety Journal*. The proceedings are intended to review progress, summarize accomplishments of the workshop and provide guidance with clear objectives for the next workshop.

6.1. Gas Phase Phenomena Subgroup

In response to several comments that were made following the first MaCFP workshop, we plan to have a more focused program at the second workshop and aim for a deeper discussion of a small subset of the MaCFP target configurations (as opposed to an overview of all cases). We currently plan to limit oral presentations and discussions to the following three target experiments:

- *Category 1* (Turbulent buoyant plumes): the helium plume experiment studied at Sandia National Laboratories [2];
- *Category 3* (Turbulent pool fires with liquid fuel): the methanol pool fire experiment studied at the University of Waterloo [6, 7] and also currently studied at the National Institute of Standards and Technology [13];
- *Category 5* (Flame extinction): a new controlled co-flow round diffusion flame experiment studied at FM Global [14–16].

Note that this list is still flexible and may be modified prior to the workshop based on the feedback received and on the interest expressed by researchers contributing experimental and numerical data to the workshop. The GitHub MaCFP repository (https://github.com/MaCFP) will continue to host data for the entire list of the MaCFP target configurations.

6.2. Condensed Phase Phenomena Subgroup

While a major goal of the MaCFP Working Group is to make accurate CFD predictions of flame spread and fire growth in realistic scenarios, a prerequisite to such predictions is to reach a mature understanding of how to characterize the physical/chemical properties of flammable materials: these properties are needed by computational fire models. The physical/chemical properties of flammable materials are typically obtained by some combination of milligram-scale and/or

bench-scale tests such as thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), the cone calorimeter, or the flame propagation apparatus.

For the second MaCFP workshop, the focus of the condensed phase subgroup will be on using milligram-scale and bench-scale tests to determine the relevant physical/chemical properties for computational fire models. We plan to use a common test material such as black ''Acrylite'' for analysis by all participants.

7. Call for Participation

The MaCFP Working Group is inviting the members of the entire fire research community to participate in the second workshop. While the workshop topic is of direct interest to experimental and computational fire researchers, the workshop should also be of broad interest to the community at large. Registration to the April 2020 workshop will be fully open.

7.1. Gas Phase Phenomena Subgroup

Members of the fire research community can participate in the gas phase subgroup effort in one or both of the following ways:

- From now until April 2020: participate in the planning of the workshop by interacting with the organizing committee, making suggestions and generating/contributing simulation results to be discussed at the workshop;
- April 25–26, 2020: attend and participate in the discussions at the workshop.

7.2. Condensed Phase Phenomena Subgroup

Members of the fire research community interested in participating in the condensed phase subgroup effort are invited to contact Dr. Morgan Bruns (Virginia Military Institute, USA) at brunsmc@vmi.edu. Comments and suggestions are welcome, in particular any suggestion on the selection of test materials and test data.

8. Conclusion

The organizing committee of the MaCFP Working Group is looking forward to welcoming many of you in its effort and to holding its second workshop at the 13th IAFSS Symposium in April 2020.

Important issues like membership to the organizing committee of the MaCFP Working Group and the selection of new target experiments for the third MaCFP workshop will also be discussed at the second workshop. Suggestions on these topics are also welcome anytime.

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