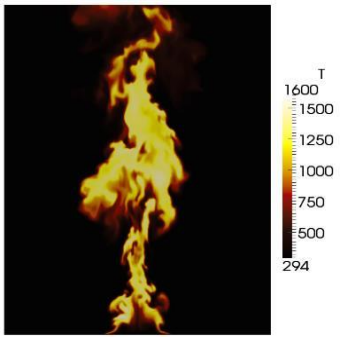
Department of **Structural Engineering and Building Materials**
Research group: **Fire Safety Science and Engineering**
Promotors**: Prof. Bart Merci, Dr. Georgios Maragkos,** and **Dr. Alexander Snegirev**

PhD position on

# A novel combustion modelling approach for critical and transient phenomena in fire-driven turbulent diffusion flames: extinction, re-ignition, production of toxic species

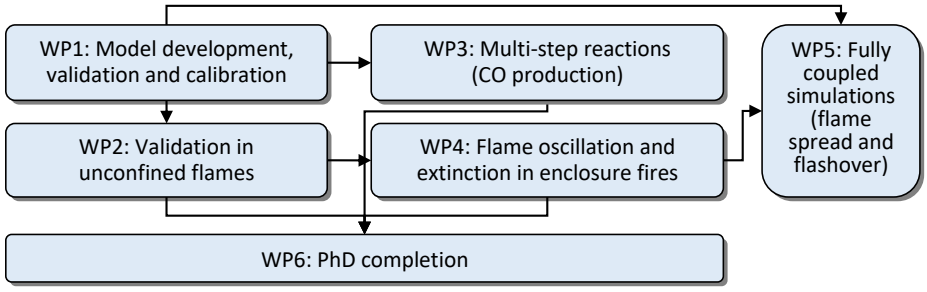
## Motivation




Predictive modelling of compartment fires remains very challenging, due to the prohibitively wide spectrum of scales to be resolved in simulations of turbulent flames and two-way coupling of gas-phase combustion with gasification of combustible material. This project will advance both problems by developing, from revisited theory, a novel sub-grid combustion model (SCM) for unresolved gas-phase combustion phenomena in large-eddy simulations (LES). The SCM will be capable of capturing flame extinction and (re-)ignition accurately, enabling prediction of these critical transient phenomena in fires by inclusion of finite-rate chemistry. The novel SCM will be implemented in multiple software packages and validated against available experimental data. Its advantage over conventional models (infinitely fast chemistry) will be demonstrated. The SCM will be tested in a systematic manner for unconfined flames and then applied to predict transient development of under-ventilated enclosure fires. With respect to the latter, dynamics of burning rate will be thoroughly examined with and without full coupling between the gaseous flame and fuel gasification rate. While advancing the problem of gas-condensed fuel coupling, charring and non-charring combustible materials as well as liquid fuel evaporation together with complex heat and mass transfer will be considered, and the finite-rate chemistry effects in flaming combustion will be investigated. A new approach for production of toxic species (CO) in under-ventilated fires will be developed and validated.

## Job description

You will be closely involved in implementation of the novel modelling concepts in commercial (ANSYS Fluent) and open-source (OpenFOAM and/or FDS) software and perform a very extensive and systematic CFD study, assessing and further developing the SCM. The flow chart gives an overview of the work packages.



**Your profile**

- You have an MSc degree in mechanical/thermal/chemical engineering or fire safety engineering.
- You have a strong interest in numerical simulations, combustion and fire modelling.
- You have proven experience in using ANSYS Fluent, with the ability to code and implement user-defined functions, or OpenFOAM, with the ability to modify existing and incorporate new code blocks.
- You have proven experience of numerical simulations in fluid dynamics, preferably in combusting flows and fires.
- You have good skills in written and oral communication in English.
- You are flexible, responsible and able to work independently as well as in a team.

**What we offer**

Ghent University (https://www.ugent.be/en) is one of the major universities in Belgium, and most of its activities take place in and around fascinating historic city of Ghent. You will work in an internationally well-recognized team with many years of experience in CFD simulations of fires. You will receive a generous salary, in the context of living expenses in Ghent. Project funding is guaranteed for the entire PhD period of 4 years.

**How to apply**

Submit your application via email before 27 July 2025 to Prof. Bart Merci (Bart.Merci@UGent.be), Dr. Georgios Maragkos (Georgios.Maragkos@UGent.be) and Dr. Alexander Snegirev (Alexander.Snegirev@UGent.be). Applications must include:

- A cover letter in which you specify why you are interested in the position and why you consider yourself a suitable candidate (800 words max).
- Your full CV, including a full transcript of records to date (complete degrees and grade lists).
- E-mail addresses of at least two reference persons.