



**The Combustion Institute**

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## **PhD Scholarship - ONERA the French Aerospace Lab**

### **Title: Development of optical techniques for in-situ characterization of soot kinetics in combustion at high pressures and temperatures**

The predicted significant growth in air traffic urges for new research in combustion, particularly in two directions: 1) to improve fuel efficiency which copes with diminishing fossil resources and 2) to curb down combustion emissions with respect to environmental and climate issues. The solution to the first issue seems to lie in combustion at higher temperatures and pressures but this can have a negative impact on the second issue particularly concerning soot emissions. ONERA can play a key role in this research as it has a long experience in combustion studies carried in its large panel of facilities and with the help of non-intrusive optical diagnostics tools. The objective of the thesis work is to extend and/or develop the techniques which can characterize soot formation and emissions at high temperature and pressure conditions. Laser Induced Incandescence (LII), sensitive to soot particles, is the key technique on which efforts will be concentrated. But the coupling of LII to other techniques can be quite helpful to complete our understanding on soot kinetics. These complementary tools are: Laser Induced Fluorescence (LIF), a technique used to detect soot precursors and other combustion parameters like OH, Laser Extinction (LE) which can help distinguish different soot types using different excitation/emission wavelengths and quantify the LII signal and Soot Spectral Emissions (SSE) that is used for soot temperature estimations. The experimental work will start by studying the coupling of these techniques in well-known atmospheric pressure conditions (McKenna and/or classical burners). Then, gradually, their response will be studied at higher pressures on a monodisperse burner implemented on a 20 bar high-pressure chamber and further on a newly research test rig (MICADO). In order to extend the feasibility of the techniques they will be implemented on other available test rigs at ONERA, which are working at pressures as high as 60 bars.

**Duties:** This PhD student position involves practical work, the interpretation of experimental results and the implementation of developed optical systems in applications related to aviation industry domain. Your duties include training in scientific work as following: participating in recommended PhD-courses, presenting at scientific conferences and writing scientific publications.

**Offer Requirements:**

- University degree (master or equivalent) in Physics, Engineering or Chemistry

- Language level: English – advanced; French – basic (and/or advanced is a plus)
- Have a strong willing to develop experimental skills in optical techniques and/or combustion fields
- Good or intermediate knowledge of thermodynamics, combustion, optical measurements and statistics
- Good oral and written communication skills
- Creativity, flexibility and adaptability to teamwork

**Application procedure:** please send the following documents to [cornelia.irimiea@onera.fr](mailto:cornelia.irimiea@onera.fr) with the reference name **MFE-DMPE-2019-07**

- CV
- One-page motivation letter
- One-page summary of your master (and/or bachelor) thesis
- Your academic transcript (obtained during bachelor and master) that shall include your grades and rankings
- Reference letters from two referees with their names and contact details

#### **Contact information**

The direct link to the PhD scholarship:

<https://w3.onera.fr/formationparlarecherche/sites/w3.onera.fr.formationparlarecherche/files/mfe-dmpe-2019-07.pdf>

Organization: ONERA the French aerospace Lab (<https://www.onera.fr/en> )

Department: DMPE - Multi-Physics Department for Energy (<https://www.onera.fr/en/dmpe>)

Localization: 8 Chemin de la Hunière, 91120 Palaiseau, France (nearby Paris)

For additional information please contact: Dr. Cornelia Irimiea, ONERA – Multi-Physics department for energy, [cornelia.irimiea@onera.fr](mailto:cornelia.irimiea@onera.fr), + 33 66 10 55 393 or Dr. Xavier Mercier, PC2A – Laboratoire de PhysicoChimie des Processus de Combustion et de l'Atmosphère, [xavier.mercier@univ-lille.fr](mailto:xavier.mercier@univ-lille.fr), + 33 32 04 34 804

**Application due date:** 15 June 2019

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