

POST DOC OFFER 2021

Subject title : Development of a multispectral cavity-enhanced measurement technique for drone based smoke particle characterisation in large scale fires

(12 months, extendable by 12 additional months, ca. 2400€/month net depending on experience)

Supervisors : Marek Mazur (mazurm@coria.fr), Jérôme Yon (yon@coria.fr)

Localization : CORIA laboratory, St Etienne du Rouvray, France, Optics and Lasers department.

Key words : Black carbon, Particle matter, Multispectral cavity based measurements, drones, UAV

Project description:

Black carbon (BC) is known to be harmful for the human respirational and cardiovascular health and to contribute to air pollution and global warming. These nanoparticles are formed during the incomplete combustion of hydrocarbons, such as industrial fires, as shown in *Figure 1*. For an understanding of their impacts, in-situ experimental analysis of the smoke is crucial. Drones are an ideal mean to provide such measurements resolved in time and space, however current systems are limited. Indeed, a large variety of techniques exist providing information about BC particles size, volume fraction, morphology, however the most comprehensive technologies are available only on laboratory scale.



Figure 1 : Fire in the Lubrizol factory in Rouen in September 2019. The black smoke colour is due to soot particles in the burnt gases

In this context, the European project FIREDRONE will address this lack by developing a compact airborne system for live monitoring of dangerous emissions in the context of industrial or accidental fires. The objective is to enable a faster and cheaper analysis of particles in fire smoke compared to existing solutions while keeping a good accuracy. For this purpose, the CORIA laboratory, internationally renowned for their experimental combustion and fire studies, will develop first at laboratory scale a novel multispectral cavity-enhanced measurement technique that will give access to a vast quantity of measurands. The metrology will then be miniaturised and mounted on a drone that will be developed by project partners of the FIREDRONE consortium. The missions of the post doc will be the following:

1. Develop further and analyse a laboratory-based multispectral black carbon particle analysis technique, which will be deployed on an academic flame at CORIA and will serve as a base-line for the miniaturized diagnostic.
2. Transpose the gained knowledge on a miniature cavity-based setup, that will allow to carry out measurements in smoke. The Post doc will be involved in the supervision of master interns who will participate in that project and will also exchange with external suppliers who will support the miniaturization process.
3. Carry out tests of the miniature metrology on its own and (at the end) mounted on a drone in different scenarios: a) an atmospheric pollution analysis station, b) firefighter training centre, c) large scale fire simulators.

Requirements:

- PhD degree in Engineering or Natural sciences, with a focus on laser based measurements on aerosols
- Aptitude and motivation for experimentation and practical hand-on work
- Experience in laser-based diagnostics is necessary. Experience in electronics and control is an advantage
- Good knowledge in English and/or French is mandatory. Will to communicate the results in written/oral form

How to apply:

The employment beginning is planned in March 2021. Please send before 1st December 2020 a curriculum vitae, a motivation letter, a list of publications and other documents that you consider useful (recommendation letters, awards etc) in digital form to Marek Mazur (mazurm@coria.fr) and Jérôme Yon (yon@coria.fr).