



# PhD position : Investigation of overlooked reaction pathways for atmospheric peroxy radicals



**Discipline: Atmospheric chemistry**

**Title of the PhD: Investigation of overlooked reaction pathways for atmospheric peroxy radicals**

**Line Manager: Alexandre Tomas**

**Workplace: Bourseul site, Douai, Marie Curie building**

**Type of contract and duration: CDD 3 years**

## **CONTEXT:**

Public establishment belonging to IMT (Institut Mines-Télécom), placed under the supervision of the Ministry of Industry, IMT Nord Europe has three main objectives: providing our students with ethically responsible engineering practice enabling them to solve 21st century issues, carrying out our R&D activities leading to outstanding innovations and supporting territorial development through innovation and entrepreneurship. Ideally positioned at the heart of Europe, 1 hour away from Paris, 30 min from Brussels and 1h30 from London, IMT Nord Europe has strong ambitions to become a main actor of the current industrial transitions, digital and environmental, by combining education and research on engineering and digital technologies.

Located on two main campuses dedicated to research and education in Douai and Lille, IMT Nord Europe offers research facilities of almost 20,000 m<sup>2</sup> in the following areas:

- Digital science,
- Processes for industry and services,
- Energy and Environment,
- Materials and Processes.

For more details, visit the School's website: [www.imt-nord-europe.fr](http://www.imt-nord-europe.fr)

The PhD work will be carried out in the frame of a collaboration between the Atmospheric Sciences and Environmental Engineering research unit (SAGE) of the Centre for Education, Research and Innovation in Energy and Environment (CERI EE) and the KTH Royal Institute of Technology in Stockholm (Sweden).

SAGE has ongoing research activities focusing on atmospheric chemistry, air quality and the impacts of human activities on the composition of the atmosphere. It has currently a staff of about 50 people including 17 full-time faculty members. Research projects aim at a better understanding of the physical and chemical processes involved in the formation, transport and aging/transformation of gaseous and particulate pollutants in outdoor and indoor atmospheres.

The KTH Royal Institute of Technology is the largest technical research and learning institution in Sweden, and one of European leading technical and engineering universities. The Division of Applied Physical Chemistry has research activities encompassing the grand challenges in analytical, inorganic, nuclear, and physical chemistry. This division is composed of 13 faculty members and senior researchers.

SAGE and KTH are looking for a motivated PhD student to conduct scientific research in the field of atmospheric chemistry. The proposed work seeks to advance our understanding of the peroxy radical chemistry in the

atmosphere, which will ultimately help improving atmospheric chemistry models. This project mainly involves experimental work in the laboratory.

**BRIEF:**

A complete understanding of chemical transformations occurring in the atmosphere is important to tackle fundamental issues related to air quality and climate change. However, there is increasing evidence that our understanding of the oxidative capacity of the atmosphere is incomplete, leading to uncertain estimations of the lifetime of primary emitted trace gases and the production rates of secondary pollutants. In this context, **organic peroxy radicals (RO<sub>2</sub>) are important species due to:**

**(i) their role in sustaining the oxidative capacity of the atmosphere** via propagation reactions to the hydroperoxy (HO<sub>2</sub>) and hydroxyl (OH) radicals, the latter being the main atmospheric oxidant during daytime;

**(ii) the formation of byproducts such as ozone**, which also acts as an oxidant and a source of OH.

Several intensive field campaigns performed over the past 2 decades have evidenced discrepancies between modelled and measured concentrations of RO<sub>x</sub> radicals, bringing into question our understanding of the peroxy radical chemistry.

This PhD will be conducted within the framework of the European-funded EPHEMERAL (Detection and Speciation of Gas-Phase Atmospheric Peroxy and Criegee Radicals) project, which seeks to improve our understanding of fundamental aspects of the RO<sub>x</sub> radical reactivity in the laboratory.

The main objective of this work is to **better characterize overlooked reaction pathways of atmospheric RO<sub>2</sub> radicals**, including homogeneous gas-phase reactions and radical-particle interactions.

The PhD work will focus on the following activities:

- Review the existing literature on the reactivity of atmospheric RO<sub>2</sub> radicals
- Conduct atmospheric simulation chamber experiments to investigate gas-phase reactions of a few targeted RO<sub>2</sub> radicals
- Conduct flow tube experiments to investigate the uptake of these radicals onto submicron particles
- Perform box modeling to identify operating conditions for chamber and flow tube experiments, and to interpret laboratory results
- Write up research results and participate in the dissemination through publications, conferences and seminar presentations
- Help in the supervision of master students

The successful applicant will work at IMT Nord Europe in Douai (France) under the supervision of Dr. Sébastien Dusanter and Pr. Alexandre Tomas, and at the KTH institute (Sweden) under the supervision of Pr. Barbara Nozière (KTH).

**REQUIRED PROFILE:** master degree in a relevant area of atmospheric sciences

Skills	Knowledge
Pre-requisites: Good proficiency in English Communication and interpersonal skills	Pre-requisites: Chemical kinetics
The following skills would be an asset for this project: Laboratory kinetics Analytical techniques of gas-phase and particulate species	The following knowledge would be an asset for this project: Atmospheric chemistry

**CONDITIONS :**

The job is to be filled as to 01/11/2022 for a period of 36 months (temporary contract).

**INFORMATION AND APPLICATION METHODS:**

For any information on the missions, please contact:

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For any administrative information, please contact the Human Resources Department: [jobs@imt-nord-europe.fr](mailto:jobs@imt-nord-europe.fr)

To apply, please connect to our recruitment platform via the following link:

**DEADLINE DATE FOR SUBMISSIONS:** 20/05/2022