MSCA PHD POSITION

CONTINUOUS-FLOW ACTINOMETRY FOR SUSTAINABLE PROCESSES

Keywords: Chemical reaction engineering, photoreactor, flow photochemistry

This PhD project will be located in the **Chemical Engineering Laboratory** (LGC, http://www.lgc.cnrs.fr), a joint research unit between the National Center of Scientific Research (CNRS), the National Polytechnic Institute of Toulouse (Toulouse INP) and the University of Toulouse. LGC is one of the largest chemical and process engineering research institutes in France (about 300 people), with a strong expertise in the field of Process Intensification and Sustainable Processes, including flow photochemical engineering.

The PhD student will be supervised by **Dr. Karine Loubière** from LGC and **Dr Mengxue Zhang** from Corning SAS.

Project description

The chemical industry is the fourth-largest producer in the manufacturing sector in Europe, and has already made significant progress in reducing greenhouse gas (GHG) emissions through optimized processes. However, to meet the European climate change objectives by 2050 and become carbon-neutral, it must transition away from fossil fuels towards renewable energy sources. A promising approach is using **light** from artificial light sources or sun to drive reactions, enabling new pathways and degrees of freedom for process development in intrinsically electrified chemical manufacturing. Photochemistry in continuously operated reactors meets many principles of Green Chemistry and Process Intensification, including enhanced safety, high energy efficiency, and reduced waste. Photons are environmentally friendly and traceless reagents that allow to shorten multi-step syntheses of complex molecules and to make accessible a portofolio of novel compound families.

However, light attenuates exponentially in the reaction medium, more or less depending on the radiative properties (absorption, scattering) of the reactional medium. Designing, operating and scaling efficient photochemical processes thus require to develop special knowledge and know-how for describing the coupling between radiation and kinetics at the different scales. Multidisciplinary approaches have thus to be implemented, integrating fundamental principles of the radiative transfer physics and photochemistry into engineering modelling methods.

The **MSCA industrial doctoral network PROSPER** in which this PhD project belongs aims to address these overall challenges. The offered PhD project will focus on the **development of actinometry methods for efficient deployment in LED-driven continuous-flow millistructured reactors**. The objectives are

- establishing benchmark chemical actinometry adapted for modern large-scale photoreactors, both in UV and visible spectral domains,

- developing modelling tools for calculating the incident photon flux from experimental data with enough accuracy while being easy-to-implement mathematically,
- developing standard experimental procedures that enable application by all scientists and engineers in the field of photochemistry, ideally with online analytics,
- complementing actinometry with online radiometry for long-term monitoring of LEDs and process control,
- applying the actinometric methods to large-scale flow photoreactors in collaboration with the industrial partner,
- establishing key reactor performance guidelines for the assessment of photoreactor in terms of energy efficiency.

The PhD project will take place half the time at the Chemical Engineering Lab (Toulouse, France) and at the Corning European Technology Center (Avon, France). A one-month secondment at Ulm University (Germany) is also planned.

Profile

The candidate should have a **Master's degree in Chemical Engineering** with strong overall marks. Strong background in chemical reaction engineering is required. He/She should also demonstrate good skills for experimental work as well as for modelling. Knowledge of photochemical processes will be regarded as a plus. He/she must have strong scientific curiosity and ability for collaborative work at interdisciplinary boundaries.

Importantly, applicants must also meet **the requirements of the Marie Skłodowska-Curie Conditions of Mobility of Researchers**. Researchers can be of any nationality and are required to undertake transnational mobility. This means that researchers must not have resided in the country of their host beneficiary (France) for more than 12 months in the past 3 years.

Administrative aspects

- *Starting date* : **November 1st 2025**
- *Gross Salary :* 3300 € per month A Mobility allowance will be paid with this salary (~ 500 € per month). Depending on the family obligations of the candidate, a Family Allowance (currently set at 380 € per month) could be also added.
- *Employer:* Toulouse INP university (www.inp-toulouse.fr)

Terms for applying to the position.

Please send CV (2 pages), letter of motivation and recommendation letters to:

- Dr. Karine LOUBIERE (karine.loubiere@cnrs.fr)
- Dr. Mengxue Zhang (ZhangM40@corning.com)
- *Deadline:* **September 7th 2025**