Ircelyon
INSTITUT DE RECHERCHES SUR LA CATALYSE ET L'ENVIRONNEMENT

Lyon 1 Université Claude Bernard

cnrs

Postdoctoral Researcher in Reaction Engineering, Flow Calorimetry & Thermal Safety

Duration: 2 years (Starting from October-November 2026)

Salary: 2320 € gross/month

Supervisor: Sébastien Leveneur (sebastien.leveneur@ircelyon.univ-lyon1.fr)

Location: IRCELYON

Keywords: Kinetic modeling, flow calorimetry, thermal runaway, biomass valorization

The development of safe and cost-efficient processes requires having **multifactorial kinetic models** [1]. Such kinetic models were evaluated not only in isothermal modes but also in non-isothermal modes and the multiphasic aspects are considered (evaporation, phase changes, etc). Such models can aid in finding the optimum operating conditions between safety and production [2].

From a process safety perspective, one of the main risks is thermal runaway, which accounts for ca. 25% of accidents in the chemical industry [3]. This risk is a persistent problem in the chemical industry because processes are usually optimized under isothermal conditions within a narrow temperature window; thus, when a temperature deviation occurs, it is difficult to predict its extent. Therefore, there is a need to develop multifactorial kinetic models based on experiments performed in isothermal and non-isothermal modes.

From a cost evaluation perspective, most kinetic models are conducted in isothermal mode, and some cost, energy, and production considerations may be overlooked. In exothermic reactions, the heat released can be used to power other high-energy-consumption units, such as distillation.

From batch to flow, it was—is—will be the motto in chemical engineering. This change is not always easy at an industrial scale, but also at a lab scale.

Classically, the thermal risk assessment is performed under batch and adiabatic conditions [4-6] to be as conservative as possible, i.e., the worst-case scenario. Even in the last 15 years, there was a big effort to use a flow reactor to develop kinetic models [7], such an approach is still modest at the lab scale.

The postdoc's role will be to study exothermic reactions, such as the oxidation of 5-HMF or furfural, in a flow calorimeter. A Fluitec flow calorimeter will be used [8-9].

References:

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3. A. Dakkoune, L. Vernieres-Hassimi, S. Leveneur, D. Lefebvre, L. Estel, Analysis of thermal runaway events in French chemical industry, Journal of Loss Prevention in the Process Industries, 62 (2019) 103938. https://doi.org/10.1016/j.jlp.2019.103938
4. Y. Wang, L. Vernières-Hassimi, V. Casson-Moreno, J.-P. Hébert, S. Leveneur, Thermal risk assessment of levulinic acid hydrogenation to γ-valerolactone, Organic Process Research & Development, 22(9) (2018) 1092-1100. https://doi.org/10.1021/acs.oprd.8b00122
5. W. Y. Pérez-Sena, T. Salmi, L. Estel, S. Leveneur, Thermal risk assessment for the epoxidation of linseed oil by classical Prisleschajew epoxidation and by direct epoxidation by H2O2 on alumina, Journal of Thermal Analysis and Calorimetry, 140 (2020) 673–684. https://doi.org/10.1007/s10973-019-08894-2

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6. Yanjun Wang, Igor Plazl, Lamiae Vernières-Hassimi, Sébastien Leveneur, From calorimetry to thermal risk assessment: γ-valerolactone production from the hydrogenation of alkyl levulinates, Process Safety and Environmental Protection, 144 (2020) 32-41 https://doi.org/10.1016/j.psep.2020.07.017
7. Alexandre Cordier, Marcel Klinksiek, Christoph Held, Julien Legros, Sébastien Leveneur, Biocatalyst and continuous microfluidic reactor for an intensified production of n-butyl levulinate: kinetic model assessment, Chemical Engineering Journal, Volume 451, Part 1, 1 January 2023, 138541, https://doi.org/10.1016/j.cej.2022.138541
8. Kim-Long Diep et al., A Scalable Dynamic Cascade Flow Reactor for Challenging Continuous Heterogeneous Processes, Chimia 79 (2025) 433–440, doi:10.2533/chimia.2025.433
9. This Zahnd et al., Modeling and Safe Operation of Fatty Alcohol Ethoxylation in a Continuous Flow Calorimeter, Org. Process Res. Dev. 2026, 30, 628−640, https://doi.org/10.1021/acs.oprd.5c00362

What you will gain

- Strong expertise in advanced kinetic modeling
- Hands-on experience with calorimetric instrumentation
- Publications in high-impact journals
- Participation in international conferences
- Interdisciplinary training environment
- Based in Lyon — widely regarded as the gastronomic capital of France — the position offers both scientific excellence and a vibrant lifestyle.

Requirements:

-Doctoral degree in chemical engineering with good knowledge in chemical reaction engineering;
-Experience in experimental work and solid background in analysis;
-The candidate should have good knowledge of kinetic modeling.
-Fluent in English.

How to apply and get further information:

The candidates should send a detailed curriculum vitae, a motivation letter, a transcript of record, doctoral degree, recommendation letters, and other valuable documents (language and degree certificates, awards, etc.). **These documents must be sent to** sebastien.leveneur@ircelyon.univ-lyon1.fr **before the 1st of June 2026**.

Assessment

The candidate assessment is a two-step evaluation. In the first step, the jury will evaluate the different applications based on the provided documents. The selection of the candidates for the second step (i.e., interview in English) will be done based on the quality of their chemical engineering and chemistry education (courses and marks), their abroad experience in research or other activity, their language skills (mainly English), the relationship between their doctoral thesis and this post-doctoral position, their scientific publication (article and/or communication on congresses), their recommendation letters and the quality of their resume and motivation letter.

In the second step, the selected candidates (from the first step) will pass an interview. This interview can be done online by video conference calls. The interview procedure will last ca. 45 minutes per candidate, and the candidate will present themselves and describe their research activities. The evaluation will be done based on their presentation, quality of their responses, and motivation to do this thesis.