



**Title of post:** Postdoctoral position: experimental study of the impact of biofuels ageing on their combustion

**General Information:**

Postdoc position at the Laboratoire Réactions et Génie des Procédés in Nancy  
Publication date of the offer: 01/2024. Starting date: April 2024

Contract period: 1 year, renewable for one year

Remuneration: 2935 € (gross monthly, adjustable according to experience)

Level of education: PhD

**Missions:**

*Context.* Several transport sectors, such as aviation or road freight, rely on combustion engines that are very difficult or impossible to replace with electric energy, and these sectors are major sources of greenhouse gas. For example, in a “business as usual” scenario, the worldwide aviation sector is expected to multiply its current CO<sub>2</sub> emissions by a factor of 4, within only 30 years. Sustainable fuels produced from biomass (biofuels), which are operational in current engines, are a solution of choice to reduce the carbon footprints of these sectors. However, the poor resistance of biofuels to liquid phase oxidation, which is the main cause of aging, is a major problem that prevents, for instance, their direct use in aviation. Aging changes the composition of biofuels and leads to cocktail effects that change their physical properties, neutralize antioxidants and can ultimately create harmful combustion pollutants. Within the European “BioSCOPE” ERC project, the post-doc hired will develop the first combustion experiments in the literature to study the influence of these cocktail effects on reactivity and pollutants emitted. Detailed kinetic simulations will also be carried out to analyze the results.

*Objectives:* The candidate will develop the experimental set-up needed to study the combustion of aged and unaged biofuels, and the analytical methods needed to measure changes in their combustion characteristics (reactivity, pollutants). The experiments will be carried out in an ideal gas-phase combustion reactor. Analytical methods developed to monitor combustion kinetics include micro-GC, GC/MS and HPLC. The candidate will use the liquid biofuel oxidation pilot (microreactor) and its analytical tools (HPLC, Raman) to oxidize biofuels in the liquid phase (ageing). Different molecules from each biofuel family and new-generation antioxidants will be studied in model aviation and diesel fuels. Simulation of coupled aging and combustion results will be carried out using detailed kinetic models developed in-house.

**Activities:**

The primary tasks of the post-doc fellow are:

- bibliographical work,
- drive the development and validation of the combustion experimental set-up,

- development and analyses of experimental databases for the ageing and combustion of different biofuels,
- writing of scientific articles and disseminate research results at conferences and seminars.

**Skills:**

We are looking for an extremely motivated candidate who will be fully involved in a challenging multidisciplinary project involving combustion kinetics, chemical engineering, chemical kinetics, microfluidics, spectroscopy, liquid chromatography and detailed kinetic modeling. Desired profile: PhD in process and chemical engineering, combustion, physical chemistry or related fields; iii) competence in experimental device development for combustion or high-temperature reactive systems and in GC/MS. Experience in other techniques detailed in the "Objectives" section of the PhD would be welcome; iii) Good level of English to work in an international environment.

**Context of work:**

The Laboratory Reactions and Process Engineering (LRGP) is a Joint Research Unit of the CNRS and the University of Lorraine. It is located in Nancy, France's second biggest student city. It is mainly located in the city center, in the premises of the National School of Chemical Industries of Nancy (ENSIC). The research lab is a leading chemical and process engineering laboratory in France and in the world (18 CNRS researchers, 82 research professors and lecturers, 43 technical and administrative employees as well as 180 non-permanent staff: contract researchers, PhD students, post-doctoral fellows and master students). The Radical Kinetics Group is part of the laboratory and has an international recognized expertise in combustion kinetics, both on the experimental and modelling sides. Existing experimental devices to study these phenomena include shock tube, laminar flames and jet-stirred reactor experiments. The PhD program takes place within the ERC Consolidator project "BioSCOPE" led by Dr Baptiste Sirjean. The hired candidate will have the opportunity to join a multidisciplinary group composed of 9 PhD students and 4 permanent academic researchers working in the field of energy and environment. Research projects funded by ERC, ANR and industrials cover subjects such as thermochemical conversion of biomass, safety for the incineration of toxics such as pesticides, fuel and lubricant ageing, pyrolytic carbon processes, pollutants formed in motor engines and hypersonic propulsion. Our group offers an immersion in renewable biofuels production, aging and combustion and in pollutants mitigation and fire safety technologies.

We offer: a multi-disciplinary formation and training using state-of-the-art research equipment, participations in national or international schools, conferences and workshops.

**Supplementary information:**

Applications must be submitted via the CNRS job portal: <https://emploi.cnrs.fr/Offres/CDD/UMR7274-BAPSIR-011/Default.aspx?lang=EN>. Questions can be sent to Dr Baptiste Sirjean ([baptiste.sirjean@univ-lorraine.fr](mailto:baptiste.sirjean@univ-lorraine.fr)).