Postdoctoral fellow position at PC2A laboratory, Univ. Lille, France

Spectroscopic laser diagnostics implemented to ammonia laminar flame structure measurements

To reach the Carbon neutrality target in 2050 as announced Europe in its Green Deal, the electricity demand will be strongly increased for energy, transport and heating/cooling systems. For that, most countries consider clean and renewable energy resources (as wind and solar) as the main energy resources for the future. However, due to their intermittency and the need to keep a secure electricity supply, the energy storage will be an integral part of the modern electricity smart grid. One solution to store the renewable energy excess is what is commonly named '**electro-fuels'**. Hydrogen is often considered as the best candidate but suffers up to now from some drawbacks such as its storage capacity and safety. Another alternative is Ammonia (NH_3), which can be considered as a 'mere' hydrogen (H_2) carrier. So far, most applications rely on preliminary partial thermal cracking of NH_3 to N_2 and H_2 to counteract the high ignition temperature of NH_3 and its low flammability (a positive safety characteristic). The lack of knowledge regarding the oxidation chemistry of NH_3 and the combustion process itself currently limits the optimization of NH_3 combustion.

The SIAC project is 4-years funded by the French Government (ANR) bringing two laboratories (PC2A at Lille, and FITe at Orléans) and CERFACS recognized for their researches in combustion fields from fundamental kinetic to modelling turbulent combustion through experimental investigation of turbulence-premixed flame interaction.

PC2A is offering a 18-24 months postdoc position (starting beginning of 2024), mainly experimental, on topics related to NOx formation in ammonia premixed flames. To reach a better knowledge of the pollutant emission, it is necessary to perform laboratory scale experiments. The proposal is focused on three main targets that address the SIAC project.

First, **low-pressure laminar flames** will be studied by implementing an original experimental strategy based on advanced laser diagnostics to quantitatively detect radicals in ammonia, ammonia/hydrogen and also in ammonia/NO premixed flames. The experimental work will consist in acquiring a unique experimental quantitative database of NO formation in laminar flames using in-situ advanced laser diagnostics (laser-induced fluorescence (LIF) and absorption) and probe sampling techniques (FTIR), detecting challenging trace species like NH_2 and HNO to clarify the NO routes of formation. This experimental work will be performed in strong interaction with a PhD student already enrolled in the project with the French Environment and Energy Management Agency (ADEME) and the LabEx CaPPA.

Second, **chemiluminescence** analysis in low-pressure flames will be performed in order to identify the possible correlation between the excited species (NO*, OH*, NH*, NH_2*) and the corresponding species in their ground state. This information is fully relevant for the turbulent flame analysis as performed at FITe-Orléans.

Third, **LIF and Planar LIF** will be implemented in a canonical burner dedicated to the characterization of flame/vortex interaction. This FLAVOR burner from FITe will be installed at PC2A in order to characterize the reaction zone of the wrinkled flame using measuring NH and NH_2.

Keywords: ammonia, NOx emissions, laminar combustion, spectroscopy, LIF, chemiluminescence

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Academic requirements: PhD degree in the field of chemistry, chemistry-physics, and a strong aspiration to perform experimental work are required. Knowledge in the field of combustion chemistry and laser techniques are appreciated.

How to apply? Send a letter to the postdoc supervisors (Nathalie Lamoureux and Pascale Desgroux) before the 31th October 2023, CV and motivation letter, and recommendation letters.

Laboratory: PC2A https://pc2a.univ-lille.fr/, https://pro.univ-lille.fr/nathalie-lamoureux

Supervisors: Nathalie Lamoureux, Pascale Desgroux

Duration: 18-24 months, from January/February 2024

Funding: 100% ANR SIAC (Scientific Improvement of Ammonia Combustion) from the French national Agency of Research. The gross salary is approximately 2800€/month (depending on experiences)

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