PhD position at IFP Energies nouvelles (IFPEN)

Physical sciences / Mechanical engineering

Development of quantitative experimental diagnostics for the characterization of pool fires at engine like conditions

The introduction of direct injection systems in gasoline engines (GDI) enhanced significantly their efficiency, but costs a significant increase in nanoparticles emissions. To face new engine regulations and to keep improving efficiency and performances, engine manufacturers need to fully understand the mechanisms behind nanoparticles formation in GDI engines.

In GDI, the impingement of the spray on the walls of the combustion chamber causes the formation of a thin film of liquid fuel. If the liquid film is not evaporated at the moment of the combustion, it will burn in a specific combustion mode called *pool fire*. This combustion mode is considered one of the main responsible for the nanoparticles emissions in GDI engines.

This thesis aims at putting in place an experiment in a simplified environment to understand how to control or mitigate nanoparticle formation in this combustion mode. The data acquired in the experiments will constitute a unique database for engine development and computational model validation.

The experiments will take place in an optically accessible combustion chamber and will rely principally on optical diagnostics. The worldwide recognized expertise of IFPEn and IVG in optical diagnostics and the state of the art laboratories are a privileged starting point for this research subject.

The scientific challenges of the present thesis follow two main axes. The first is devoted to the development of specific optical diagnostics, namely, laser induced fluorescence and 2D-extinction. The diagnostics, already mastered at IFPEn for other applications, need a specific development for the study of pool fires. In this phase, the collaboration with the IVG laboratory of the University of Duisburg Essen, give the possibility of going further in the understanding and uncertainty quantification of the results obtained. The second axis aims at gaining on fundamental understanding on the physical-chemical parameters controlling pool fires.

The PhD will be carried out in collaboration between IFPEN and the University of Duisburg Essen.

Keywords: Optical Diagnostics, Laser Induced Fluorescence, Nanoparticles, Soot, Liquid Film

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Doctoral School	ED 579 (SMEMAG)/ Sciences mécaniques et énergétiques, matériaux et géosciences, https://www.universite-paris-saclay.fr/fr
IFPEN supervisor	Dr. Michele BARDI, research engineer, R104, engine and vehicle systems department, *michele.bardi@ifpen.fr*
PhD location	IFP Energies nouvelles, Rueil Malmaison, France/ *Institut für Verbrennung und Gasdynamik, Duisburg, Germany*
Duration and start date	3 years, starting preferably on September-October, 2018
Employer	IFP Energies nouvelles, Rueil Malmaison, France
Academic requirements	Master degree (or equivalent) in applied physics or energy with a solid base in fluid-dynamics and combustion.
Language requirements	Fluency in English, willingness to learn French
Other requirements	Competencies in optics and photo-physics, even at empirical level, will be positively considered.

For more information or to submit an application, see theses.ifpen.fr or contact the IFPEN supervisor.

About IFP Energies nouvelles

IFP Energies nouvelles is a French public-sector research, innovation and training center. Its mission is to develop efficient, economical, clean and sustainable technologies in the fields of energy, transport and the environment. For more information, see www.ifpen.fr.

IFPEN offers a stimulating research environment, with access to first in class laboratory infrastructures and computing facilities. IFPEN offers competitive salary and benefits packages. All PhD students have access to dedicated seminars and training sessions.