

## PhD Position at IFP Energies nouvelles (IFPEN) in Mechanical Engineering

### Analysis of Heat Transfer in Internal Combustion Engines using Optical Diagnostics

The social, political and environmental context demands significant emissions reductions in regulated pollutants and greenhouse gases, especially CO<sub>2</sub> in the transport sector. IFP Energies nouvelles develops innovative technological solutions with a view to reducing CO<sub>2</sub> and exhaust gas pollutant emissions.

This subject falls within the scope of IFPEN research activities on the development of advanced, innovative high efficiency internal combustion engines. A major strategy targets the reduction of wall heat transfer. Indeed depending on the engine operating point and its combustion mode these losses can reach approximately 15-25% at high load engine operation, and up to 50% under engine idle. A fundamental knowledge of heat losses sources is required, in particular the influence of the interaction between the reactive flow and the combustion chamber walls. A detailed physical insight into these mechanisms and the effect of different combustion modes could help identify solutions which could reduce heat losses, through optimization of the combustion chamber, and therefore improve engine thermal efficiency.

The objective of the PhD is to study quantitatively the influence of the different combustion modes (propagation / diffusion / stratified / homogeneous) on heat loss mechanisms. The goal is to evaluate how characteristic parameters of the combustion mode influence the evolution and the magnitude of heat losses during the engine cycle. The original approach angle adopted here consists in instrumenting an optical engine with advanced measurement techniques (surface temperature and heat flux measurement) and comparing different combustion strategies. The candidate will be expected to perform a detailed analysis on the subject and depending on the results obtained during the course of the PhD, the candidate could orient his work to include for example a comparison of experimental results with numerical simulations, an evaluation of the potential of chamber adiabatisation, or an analysis of gas-wall coupling using advanced diagnostics.

The novelty of this subject will provide the selected candidate with a wide vision on three major engine disciplines, in which IFPEN is internationally acclaimed: combustion, optical diagnostics and heat transfer. Moreover, the candidate will acquire knowledge in experimental physics, engine technologies and numerical simulation.

**Keywords:** Optical Diagnostics, Heat Transfer, Internal Combustion Engine, Temperature, Combustion.

**Contact :** Guillaume PILLA, [guillaume.pilla@ifpen.fr](mailto:guillaume.pilla@ifpen.fr)

<b>Directeur de thèse</b>	Prof. Marc BELLENOUE, Pprime Institute, CNRS-ENSMA University of Poitiers, FLUIDIC-THERMIC-COMBUSTION Dpt
<b>Ecole doctorale</b>	CNRS-ENSMA University of Poitiers, FLUIDIC-THERMIC-COMBUSTION Dpt ( <a href="http://www.univ-orleans.fr/prisme">http://www.univ-orleans.fr/prisme</a> )
<b>Encadrant IFPEN</b>	Dr Guillaume PILLA, Chef de Projet, Dpt Systèmes de Combustion et Adéquation Carburant
<b>Localisation du doctorant</b>	IFP Energies nouvelles, Rueil-Malmaison, France
<b>Durée et date de début</b>	3 years, starting preferably on October 1st, 2015
<b>Employeur</b>	IFP Energies nouvelles, Rueil-Malmaison, France
<b>Qualifications</b>	Engineering School and/or University Master degree in relevant disciplines (fluid mechanics, combustion, physics, optics, thermodynamics...).
<b>Connaissances linguistique</b>	Fluency in French or English, willingness to learn French
<b>Autres qualifications</b>	I.T. skills (Matlab, Office...)

For more information or to submit an application, see [theses.ifpen.fr](http://theses.ifpen.fr) or contact the IFPEN supervisor.

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