Post Doctoral position on “Modelling of soot formation in flames”

Supervisors: Pascale DESGROUX and Abderrahman El BAKALI

PC2A, Université de Lille1 (France)

The main objective of this work is to improve the knowledge on the hydrocarbon oxidation at high temperature.
The first step of the numerical investigation proposed in this work is focused on the gas phase. It is proposed a numerical investigation of the effect of four parameters:

(i) the equivalence ratio
(ii) the pressure
(iii) the nature of the fuel
(iv) the hydrogen as the additive

At PC2A laboratory, we have experimental data which cover the 3 previous points. These data were obtained using several techniques analysis associated with a microprobe sampling system, in particular gas chromatography (GC) and the Laser Induced Fluorescence (LIF). The pressure and the equivalence ratio effect (points i and ii) was examined in the case of the laminar premixed methane flames. The point iii) was the subject of many experimental studies at PC2A: in addition to methane fuel, various fuels were studied, in particular n-butane and alkane mixtures representative of natural gas oxidation. The last point (iv) was examined in the case of the rich atmospheric laminar premixed methane flames.

The first step of this work will consist in a fine study of the literature to supplement the available experimental data base, in particular in terms of studies targeting the formation of the heavy PAHs. A numerical study will then be carried out to validate a single mechanism able to predict the oxidation of the whole fuels. The modeling work will be carried out on the basis of our previous mechanism developed for rich methane combustion (Energy 43 (2012) 73-84 El Bakali et al.). This mechanism is currently the subject of the extension to the rich n-butane combustion.

The second part of this work relates to the modeling of the soot formation in the previous flames. Measurements of soot volume fraction at various equivalence ratios have been obtained at PC2A in low and atmospheric pressure premixed laminar methane flames. The effect of hydrogen on the soot volume fraction was also studied in the methane flames operating at atmospheric pressure. The candidate will then examine the impact of the phase gas previously validated, on the soot volume fraction measured with and without hydrogen by Laser-induced Incandescence (LII). The candidate will participate to the incorporation of the phase gas mechanism to a soot code and examine the effect of the four above mentioned parameters.

Physico-Chimie des Processus de Combustion et de l’Atmosphère PC2A
UMR 8522 CNRS-Lille1 Plateforme de Métrologie Optique MeOL
Université Lille1 Sciences et Technologies
Cité scientifique – Bât C11/C5/CERLA - 59655 Villeneuve d’Ascq Cedex
Tél. +33 (0)3 20 43 49 31 | Fax. +33 (0)3 20 43 69 77
www.univ-lille1.fr/pc2a www.cnrs.meol.fr

The candidate will be in a strong interaction with two phD students and will be invited to participate to the national and international meetings.

Experience in flame modeling, PAH modeling or soot modeling expected.

This postdoc is related and funded by the Labex CaPPA: http://labex-cappa.univ-lille1.fr/

Location: PC2A, Université de Lille1, France
Duration: 12 months. Starting 2014.

Contact:
Send CV to pascale.desgroux@univ-lille1.fr and abderrahman.el-bakali@univ-lille1.fr
Phone: 33 3 20 43 49 30
http://www.univ-lille1.fr/umr8522/

Physico-Chimie des Processus de Combustion et de l'Atmosphère PC2A
UMR 8522 CNRS-Lille1 Plateforme de Métrologie Optique MeOL
Université Lille1 Sciences et Technologies
Cité scientifique – Bât C11/C5/CERLA - 59655 Villeneuve d'Ascq Cedex
Tél. +33 (0)3 20 43 49 31 | Fax. +33 (0)3 20 43 69 77
www.univ-lille1.fr/pc2a www.cnrs.meol.fr