

Post-Doctoral Fellowship

Experimental investigation of sooting turbulent flames by laser diagnostics

Description

Two French research laboratories, CORIA and PC2A, invite applications for a two-year post-doctoral position dealing with experimental investigation by laser diagnostics of soot formation in turbulent flames. The project is one part of a national research project, ASMAPE (Advanced Soot Models for Aeronautics and Piston Engines) with the financial support of French Research Agency (ANR) and involving several academic and industrial partners (Peugeot-Citroën, SNECMA, IFPEN). The general purpose of the project is the development of modeling for the formation and evolution of soot particles in engines (automotive and aeronautics). The originality of ASMAPE is to propose an innovative integrated research work bringing together advanced optical diagnostics, chemical kinetics and turbulent combustion.

The present application concerns the experimental investigation of sooting turbulent flames.

The study will be performed in a canonical configuration chosen to provide experimental conditions where turbulence can be modified and characterized. The configuration is a turbulent jet flame implemented in a combustion chamber designed to provide controlled inlet condition and well-defined boundary conditions in order to build a database suitable for numerical modeling. Advanced laser diagnostics will mainly cover instantaneous characterization of the flow field and of the soot volume fraction field, including localization of soot precursors (polycyclic aromatic hydrocarbons (PAH)) and oxidation zones. 2D cartography of soot volume fraction will be performed by laser induced incandescence (LII) and PAH will be detected by laser induced fluorescence (LIF). The flow aerodynamics in sooting and non-sooting region will be characterized by particle image velocimetry (PIV). The mixture fraction fields will be obtained by PLIF of a fuel tracer in the isothermal regions of the jets, while the reaction and soot oxidation zones will be visualized by OH PLIF. One important aspect of the project concerns the study of fuels of interest for automotive and aeronautics applications. A strong interaction with the partners of ASMAPE will be promoted, particularly with the groups involved with laminar flames investigation and soot modelling in order to select the most appropriate operating conditions of the turbulent flames (Reynolds numbers, fuel composition...) for assessment of soot modeling.

This project involves the collaboration of two laboratories CORIA and PC2A. CORIA is a laboratory from a partnership between CNRS, University and INSA of Rouen (<http://www.coria.fr/>). Its research activities deal with the investigation of reacting turbulent flows, and cover several domains, as combustion, two-phase flows and energetic systems. The research group involved in ASMAPE is active in the analysis of the phenomena involved in turbulent combustion and the development advanced laser diagnostics, like PIV, PLIF and Raman scattering. PC2A is a laboratory of Lille1 University and CNRS (<http://pc2a.univ-lille1.fr/>). The covered topics are connected with combustion and atmospheric chemistry. The research group involved in ASMAPE is active in the development of laser diagnostics in flames and chemical mechanisms of combustion processes, particularly PAH and soot formation. The group has a long expertise in quantitative laser diagnostics of minor species and soot particles (LIF, LII, CRDS).

CORIA will be the place where the experiments will be conducted.

Profile of the applicant:

PhD in combustion with experience in laser diagnostics (LII, PIV or LIF)

- Skills in the set-up and control of laser diagnostic techniques (LII, PIV, LIF) in gaseous phase reactive systems (combustion, plasmas,...).
- Personal experience in data and image processing.

Location: CORIA, University of Rouen, France

Duration: 24 months. Starting 2014.

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Remuneration:

The salary corresponds to the standard CNRS Post-Doctoral fellowship (this includes social security)