Postdoctoral position in:

Near-wall Combustion with High-Temperature Materials

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The design of future ultra-compact gas turbines requires to address multi-physical near-wall energy processes. For instance, heat losses are critical as burnt gases temperature is much higher than melting points of common metal alloys [1]. Even though considerable efforts were devoted to increase allowable temperature of advanced metal casting, the current solution consists in adding various thermal protective methods. Unfortunately, these methods also incur a thermal yield penalty. Development of higher-temperature materials such as ceramic matrix composites (CMCs) is thereby crucial to enable significant efficiency gains. Nevertheless, detailed experimental data of wall temperature, heat fluxes and near-wall bounded flow topology are therefore required to improve design of future combustion material technologies and fidelity provided by coupled multi-physical numerical simulations.

A position is currently open through a national funding in order to lead a groundbreaking and multi-physical experimental research to address critical unanswered questions of heat transfer and cooling performances with such promising materials. The candidate will integrate the reactive flows department which is primarily developing and implementing cutting edge laser-based diagnostics to a large variety of industrial applications [2]. The research responsibilities entail:

- The design of a fundamental combustion test bench allowing to produce a flame interacting with different materials and the implementation of several optical laser diagnostics.
- The implementation of phosphor thermometry to obtain wall temperature measurements: lying on spectroscopic properties of rare-earth doped ceramic particles which are coated on the wall [2], this technique will be implemented with the phase-delay approach (i.e. by measuring the luminescence signal relative to an oscillating excitation source).
- The development of the digital image correlation in order to collect strain maps of materials, based on the tracking of the displacements of a pattern applied on the surface.
- The feasibility to simultaneously apply phosphor thermometry and digital image correlation in order to assess thermo-mechanical fatigue of materials.

The funding is secured for 2 years at CNRS-CORIA laboratory (Rouen, France), with possibility to renew (subject to additional funding and satisfactory performances). For more information, please contact Dr. Pradip Xavier (pradip.xavier@coria.fr). Interested candidates should send a detailed academic CV (including list of publications) and contact details of two/three references.

Candidates should have a PhD in mechanical engineering or optics. Knowledge in fluid mechanics and optical diagnostics for reactive flows is required. Experience in conducting experiments in combustion is appreciated.

[1] Poinsot, P. & Veynante, D., Theoretical and Numerical Combustion, 3rd edition, 2011.
[2] Grisch, F., Boukhalfa, A., Cabot, G., Renou, B., & Vandel, A. (2016). CORIA Aeronautical Combustion Facilities and Associated optical Diagnostics, AerospaceLab, (11), 2016.
[3] Brubach, J., Pflitsch, C., Dreizler, A. & Atakan, B., Prog. Ener. Comb. Sci. 39(1), 37-60, 2013.
[4] Whitlow, T et al., Comp. Struct. 210, 179-188, 2019.