TWO-YEARS POST DOCTORAL POSITION (2022-2023)

Title: Experimental study of Hydrogen combustion in Fluidized Bed to reduce Greenhouse gas emission.

Supervisors:
Dr. Benoît Bédat (bedat@imft.fr), Dr. Renaud Ansart (renaud.ansart@ensiacet.fr) and Prof. Olivier Simonin (olivier.simonin@imft.fr)

Institutions involved: Institut de Mécanique des Fluides de Toulouse (IMFT)
Laboratory: IMFT - UMR 5502
Salary: 2200 Euros/month (net salary)

In order to reduce greenhouse gas emission, the excess of electricity produced will be converted mainly to hydrogen by water electrolysis. Then, hydrogen will become an important energetical vector in the future. The main application that will be considered is to produce electricity by using fuel cell. Another possible use of hydrogen will be to burn it to generate directly heat. Compare to natural gas, hydrogen exhibits a faster chemical kinetics and produce more nitrogen oxides when it freely burns. Gas-particle fluidized beds have some characteristics that can be useful: large particles thermal inertia, efficient mixing and heat wall transfer. In consequence, it is possible to inject hydrogen without premixing, control the temperature of the particle and the gas and then the chemical activities limiting the pollutant emissions and flashbacks. The use hydrogen in gas-particle fluidized beds is a novel and not use industrial process.

IMFT starts an experimental study on the combustion of Hydrogen in fluidized bed. The purposes of this experimental actions are to prove that hydrogen can be burnt safely without generating pollutants. Heat exchanger design is also an important point to investigate in this context.

A two-years post-doctoral research is proposed to investigate:

1) Hydrogen injection design: several set-up will be tested to improve the mixing and reduce the pollutant formation. This action will be investigated in non-reacting conditions with helium for safety and also in reacting conditions with hydrogen.
2) Heat exchanger design: an air and water cooling will be tested to investigate optimum burning conditions for each set-up.

For the two previous items, temperature and gas analysis (helium, hydrogen and nitrogen oxides) will be performed. The experimental data will be compared to 3D unsteady numerical simulations performed with an N-Euler approach. The funding comes from the Projet “H2 VERT / LitHyLowNox” and the ANR grant “MIMOSAH”.

Requirements:
The candidate has a PhD in chemical engineering with a focus on fluidized bed and combustion/reactions. He/she should be familiar with experimental set-up and gas composition analysis. The post-doctoral appointment should start at the beginning of 2022.