2025 INTERNSHIP PROPOSAL

Flame jet instabilities in a molten glass bath

Context

Saint-Gobain designs, produces and markets mineral insulation materials such as stone wool, which bring comfort and thermal performance to buildings, vehicles and infrastructure. The materials that make up rock wool can be melted using several types of furnace technologies before being fibered into wool. Some of these technologies involve coupled phenomena between flame jets and molten rock baths, which can trigger hydrodynamic instabilities. These instabilities represent a challenge for the regular conduct of the process, which is why it is necessary to acquire a detailed understanding of the physics of the stirred glass bath.

Objectives of the internship

In the laboratory, an initial study was conducted using a model system replicating the behavior of a flame jet, represented by an air jet injected into a water bath modeling the glass melt. This experimental setup successfully reproduced the instabilities observed in glass furnaces, characterized by surface sloshing in the bath accompanied by lateral jet oscillations. This preliminary work paved the way for studying the coupling mechanisms between the bath surface and a single jet.

In industrial furnaces, the presence of multiple injectors can lead to couplings between submerged jets. The objective of the internship is to investigate these interactions and the overall system dynamics using an experimental setup with three air jets injected into a water bath. The study will examine the collective behaviors of the jets as a function of key parameters, such as the aspect ratio of the tank, the spacing between jets, and the injection flow rates. The results will be compared with those of the previous single-jet study to extend the existing model by incorporating jet coupling effects.

Desired profile

First year of Master or second year of engineering school student, having studied fluid mechanics, physics, modelling. Rigorous and thoughtful candidate, with a particular interest in experience and a capacity for synthesis.

Duration : 3 to 6 months

Lieu : Laboratoire d'Hydrodynamique de l'École polytechnique, École polytechnique, Route de Saclay, 91120 Palaiseau

Contact :

Sophie Ramananarivo – LadHyX – sophie.ramananarivo@polytechnique.edu
Stéphane Perrard – PMMH – stephane.perrard@espci.fr
Marc Cordelle Vacher – marc.vacher@polytechnique.edu