Institut de Recherche Dupuy de Lôme

THESIS OFFER

Determination of the heat capacity and latent phase change heats of liquid metals at high temperature by aerodynamic levitation.

To meet a growing need in the nuclear, transport and defense industries, IRDL has been developing molten metal characterization devices for several years in order to better understand new assembly and additive manufacturing processes, particularly through modelling. The complexity of the measurements linked together to the liquid state of the material and the high temperatures studied (1500 - 3000 ° C) requires special methodologies without contact by levitation. The laboratory is currently successfully using aerodynamic levitation to estimate density or surface tension, but to date, very few studies have focused on the study of the mass heat capacities and latent heats of materials at these temperature levels.

The materials targeted concern metals such as iron, nickel, niobium, or titanium, which are widely used in the field of transport, military, aerospace or nuclear industry. The development of new alloys based on these elements, which requires melting steps, requires of course knowledge of its properties over a wide range of temperatures above 2,000 °C.

The thesis will use on the one hand the existing levitation device operational in the laboratory (at atmospheric pressure) but will also develop the same type of measurement in a new chamber to strongly increase the pressure (100 bar - funded by UBS) in order to control evaporation phenomena, which represents an ambitious and innovative evolution in this field.

The estimation of the heat capacity will be carried out by inverse methods (least squares, Bayesian) by comparing the experimental temperature of the liquid metal with that obtained via a representative model of the experiment (numerical or analytical). Access to a new property at an unprecedented temperature level will certainly increase the laboratory's radiance.

The candidate must present skills in physical measurements, heat transfer, experimental assembly, numerical modeling and must have an appetite for physics in general.

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Method of financing and salary
Academic funding; Salary according to current regulations

Place of the thesis
IRDL – Lorient
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Documents to be provided
CV, motivation letter

Frame
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