

Position

Postdoctoral Research Fellow: Effect of Oxides on Segregation During Steel Casting Solidification Group, Institut Jean Lamour, Université de Lorraine

18 month fixed-term contract

Background / Project Details

The primary circuit of a nuclear reactor (pressure vessel, steam generator, pressurizer) is built from forged and welded low-alloy steel parts. The chemical composition of the cast ingots used for forging these parts is not uniform. Chemical heterogeneities, known as segregation, cannot be entirely removed during the manufacturing process. Consequently, forged parts exhibit local variations of chemical composition, which can significantly impact their mechanical properties.

Institut Jean Lamour (IJL) is recruiting a **Postdoctoral Research Fellow** to investigate the effects of oxides on segregation during casting of large steel ingots. Conventional research on segregation during steel casting focused on transport phenomena related to convection and density differences between solid and liquid phases. This project investigates the recent hypothesis that channel-shaped segregation patterns may form by a different phenomenon, the entrainment of solute-rich liquid by the motion of oxide particles during solidification. The post-doctoral research fellow will investigate this phenomenon using both experimental and computational methods available at IJL, in tight collaboration with industry.

The contract is for **18 months**. The project is funded by **ArcelorMittal Industeel**, **CEA**, and **Framatome**.

This research topic falls under a *Zone à régime restrictif* (ZRR) and as such the researcher must pass a security clearance check to hold the position. More information is available at <http://www.sgdsn.gouv.fr/>

Responsibilities

The post-doctoral research fellow will be responsible for the topic of oxide effects on segregation during steel casting, working in collaboration with permanent researchers of IJL and with the industrial partners. He/She will take a leading role in bringing the Large Ingot Simulator (LIS) – a novel lab scale experimental setup, currently at an advanced stage of development – to full operation and will pioneer its scientific applications. The LIS will replicate the thermal conditions of solidification found in the core of an industrial ingot, to reproduce the size and the morphology of the microstructures formed in various steel grades. The behavior of different types of oxide particles introduced into the LIS will be investigated to explain their possible role in the formation of channel segregations. Analysis of experimental characterization will be assisted by numerical simulations using in-house multiscale models of solidification.

Main Activities

- Design and development of experiments.
- Characterization of steel samples.
- Numerical simulation and data analysis.
- Writing of documentation and scientific articles.
- Reporting results to industrial partners.

Requirements	• PhD in Materials Science/Engineering or other relevant discipline. • Fluent in English, some knowledge of French beneficial. • Expertise in metallographic preparation and characterization. • Experience with experimental methods to elaborate metallic samples. • Experience in steel metallurgy, or solidification. • Familiarity with using computational models. • Comfortable working both independently and within a team.
Salary	Starting at 2600 € (gross) per month, depending on the experience of the candidate
Starting date	Immediately, or upon availability of the successful candidate
How to apply	Applications must include: • a motivation letter, • a detailed CV, • contact addresses of two referees. Selected candidates will be interviewed by a selection committee.
Scientific contacts	Julien ZOLLINGER, julien.zollinger@univ-lorraine.fr Miha ZALOŽNIK, miha.zaloznik@univ-lorraine.fr Institut Jean Lamour, 2 allée André Guinier, BP 50840, F-54011 Nancy CEDEX
About Institut Jean Lamour	
Institut Jean Lamour (IJL) is a joint research unit of the CNRS and the University of Lorraine and is one of the largest institutes in materials science and engineering in Europe. It covers the fields of materials, metallurgy, plasmas, surfaces, nanomaterials, and electronics. IJL has around 500 members, including 180 researchers, 90 engineers, technicians, administrative staff, 150 doctoral students, 30 post-docs, and welcomes about 80 interns every year. IJL collaborates with more than 150 industrial partners and its academic collaborations reach into 30 countries worldwide. Its exceptional instrumental park is spread over four sites, the main one being the new building located in the ARTEM campus in Nancy. In the Solidification Group of IJL we study the formation of the structure during solidification of metal alloys, by numerical modeling and experimentation. We work on a wide spectrum of projects, integrating industrial and fundamental problems. The group currently comprises 6 permanent researchers and 7 PhD students and postdoctoral fellows. We have strong expertise in experimental and numerical methods, with in house developed software and experimental apparatuses.	