

October 2025

Master internship

Morphological transitions during recycled Al alloys solidification: phase-field modelling.

General information

Workplace: Nancy, France**Type of contract:** master internship**Contract period:** 4 to 6 months**Starting date:** february 2026**Proportion of work:** Full time**Remuneration:** according to french law**Desired level of education:** Master's degree in physics, chemistry or material sciences.**Experience required:** -

Missions / Activities

The carbon footprint reduction of the modern alloys is mainly achieved by the quick increase of the recycled alloys use. Recycling aluminum (Al) alloys allow to save up to 95 % of the energy. The eco-design of novel Al alloys from recycled materials could be achieved by means of innovative processes such as additive manufacturing. The targeted novel alloys must tolerate the presence of impurities, mostly transition elements (TE) (Fe, Cr, Mn...) encountered in scraps, while preserving high mechanical properties. The TE elements are well known to trigger the formation of intermetallic compound phases (IMC), which are very harmful to the mechanical properties by increasing the stress. Conventional solidification processes (at low solidification velocities V_{sol}) such as castings, promote the IMC growth, whereas innovative processes involving rapid solidification, such as additive manufacturing, diminish it. The challenge is to minimize, if not eliminate, IMC using the additive manufacturing processes. To achieve this goal, a deep understanding of the link between rapid solidification and pattern (microstructure morphology) formation including IMC formation is necessary.

In this internship, we aim at the study of microstructure dynamics of Al alloys during solidification considering the short-range order (SRO) in the liquid. We will focus on the morphological transitions in Al-TE (with TE for transition elements) alloys. The thermophysical properties of the solid-liquid (S-L) interface will be gathered from molecular dynamics calculations in collaboration with SIMAP institute.

The internship will likely offer an opportunity to a Ph. D thesis from October 2026.

Work context

The intern student will be supervised by Dr A. K. Boukellal, Dr M. Plapp.

The intern student will be based at IJL, and regular zoom meetings will be organized with Dr. M. Plapp (from Laboratoire de Matière Condensée, Palaiseau).

Skills

Knowledge of thermodynamics of phase-transitions (Solidification), metallurgy

High interest to numerical simulations.

Knowledge of phase-field modelling, high performance computing (HPC) and GPU parallelization are highly recommended.

Knowledge of English (oral and written) is important, and knowledge of French would be an advantage.

As an enthusiastic student you like teamwork and have a flexible approach to collaborating with experimentalists.

Constraints and risks

The position you are applying for is in a sector relating to the protection of scientific and technical potential. It therefore requires, in accordance with the regulations, that your arrival be authorized by the competent authority of the Ministry of Higher Education, Research and Innovation.

About Institut Jean Lamour

The Institute Jean Lamour (IJL) is a joint research unit of CNRS and Université de Lorraine. Focused on materials and processes science and engineering, it covers materials, metallurgy, plasmas, surfaces, nanomaterials and electronics. It regroups 183 researchers/lecturers, 91 engineers/technicians/administrative staff, 150 doctoral students and 25 post-doctoral fellows. Partnerships exist with 150 companies, and our research groups collaborate with more than 30 countries throughout the world. Its exceptional instrumental platforms are spread over 4 sites; the main one is located on Artem campus in Nancy.

Application

Applicants are invited to send a CV and cover letter together with diploma copies to:

A. K. Boukellal (CNRS Researcher) : ahmed.boukellal@univ-lorraine.fr

M. Plapp (CNRS Researcher) mathis.plapp@polytechnique.fr