Fatigue and Self-Heating of New Titanium Alloys from Additive Manufacturing

This post-doc focuses on the study of new titanium alloys derived from additive manufacturing, intended for various application fields such as naval, transportation, medical, etc. To achieve these objectives, it combines physical metallurgy and mechanics to understand fatigue damage mechanisms and develop a model for calculating the fatigue limit. The ultimate goal is to propose a tool for predicting the durability of parts made from metastable materials, taking into account the influence of microstructure. Using a rapid characterization method based on self-heating under cyclic loading, the project aims to extend its application to the study of fatigue properties of metastable materials.

The program is divided into five tasks:

1. Manufacturing and processing of alloys
   Manufacturing of specimens via the SLM method from super-elastic NiTi powder. The specimens will be used for subsequent steps.

2. Observation of the microstructure of the alloys and its evolution
   Characterization of grains using optical microscopy, EBSD, and transmission electron microscopy. Analysis of deformation and damage mechanisms.

3. Determination of the fatigue properties of the alloys
   Fatigue tests with a high number of cycles under different tensile loads to determine the fatigue properties of the material.

4. Conducting self-heating tests on the alloys
   Tests based on the temperature evolution of a specimen subjected to cyclic loads. Study of repeatability and the influence of loading frequency.

5. Modeling of self-heating and its relation to fatigue
   Use of a multi-scale probabilistic approach to model the behavior of the alloys and establish predictive SNP curves comparable to classical Wöhler curves.

Desired Profile

- PhD's in Materials Science
- Strong background in physical metallurgy and mechanics
- Preferably but not mandatory, some:
  - Experience with additive manufacturing techniques, particularly SLM
  - Familiarity with microstructural characterization techniques such as optical microscopy, EBSD, and transmission electron microscopy
  - Proficiency in conducting fatigue tests and analyzing results
- Rigor, autonomy, and strong team collaboration skills
- **Mobility requirement:** Candidates must have spent at least 18 months outside of France between May 1st, 2021 and the start date of the post-doc, in accordance with eligibility criteria.

Application

- CV
- Cover letter
- Letter of recommendation

Supervision and Conditions

The post-doc will be supervised by a team of researchers specializing in additive manufacturing and materials science, with access to state-of-the-art characterization facilities at the Laboratoire d'Étude des Microstructures et de Mécanique des Matériaux (LEM3, UMR CNRS 7239) and the Institut de Recherche Dupuy de Lôme (IRDL, UMR CNRS 6027).

- **Start date:** As soon as possible
- **Duration:** 18 months
- **Locations:** IRDL in Brest and LEM3 in Metz (France)
- **Remuneration:** 2,860 €/month
- **Language:** English and/or French
- **Application deadline:** 30 of September 2025
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