LABORATOIRE D'ÉTUDE DES MICROSTRUCTURES ET DE MÉCANIQUE DES MATÉRIAUX

Manufacture and characterization of multi-property SMA parts using LPBF process (additive manufacturing)

Workplace
LEM3 Metz

General Information
Start : October 2025
Contract period : 36 month
Quantity of work : full time
Gratification function convention

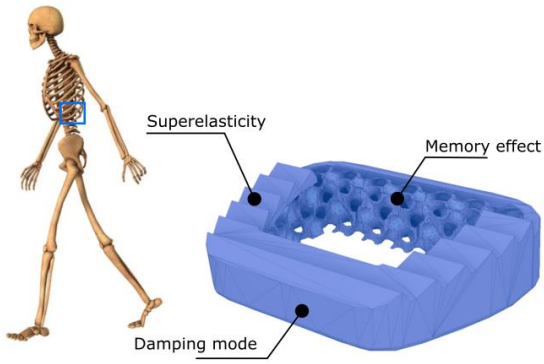
To candidate
CV and covering letter to be sent by e-mail to

Pascal Laheurte
Professeur des Universités
Pascal.laheurte@univ-lorraine.fr

And copy to

Gaël LE COZ
Ingénieur de Recherche
gael.lecoz@univ-lorraine.fr

Context:
4D printing brings a new dimension to 3D printing, through its ability to evolve over time. The NiTSCH project focuses on the field of metal additive manufacturing by bringing this 4th dimension through the use of Shape Memory alloys (SMA). Based on the previous know-how of the academic and industrial partners in NiTi alloy and Additive Manufacturing, the project proposes the emergence of tools and libraries to design and manufacture 4D printing functional hierarchical structures with high added value, unique, innovative by the ability to exhibit a wide range of thermomechanical responses. They will provide the opportunity to design and manufacture medical devices with gradients in properties using a combination of metallurgy (superelasticity, pseudoelasticity, memory effect) associated with the generation of specific geometries (auxetics, lattices, etc.)..



About the laboratory:
LEM3 (1) is a research unit (UMR) attached to the University of Lorraine (UL), the CNRS and Arts et Métiers. It is part of the UL's Matière, Matériaux, Métallurgie, Mécanique (M4) scientifique cluster. LEM3 is an academic research laboratory with a threefold mission: to manage research projects in mechanics and materials, to promote the results of this research and to contribute to university training and continuing education through and for research.
The thesis will be carried out within the MMSV department, with ongoing interaction with the laboratory's Additive Manufacturing platform. The thesis is part of an ANR (Agence National de Recherche) NiTSCH project and regular exchanges with i2M (Bordeaux) are expected, as well as with Start-Up Pint (Metz) (3), which specializes in the development of alloys and their processing by FA.

Objectives:
The aim of the thesis will be to propose:

(1) Metallurgical and mechanical characterization of NiTI additive manufacturing parts with several properties. To this end, the PhD student will define a materials experimental plan and will manufacture her/his specimens on the FA platform.

(2) Optimizing the heat treatments associated with NiTi in the context of FA.

(3) The production and characterization of multi-property architectural structures with a medical application.

(4) Implementing the data obtained in the AMF models developed at LEM3 (Smart+) and I2M (3Mah) as part of the project (thesis no. 2).

He or she will characterize the samples using all the equipment on the Micromeca (microscopy) and Mecarhéo (mechanical characterization) platforms

Activities:

The PhD student will develop his/her skills in the following areas:

- Metal Additive Manufacturing
- Microstructural characterization
- Thermomechanical characterization
- Transcription of data into numerical models

Profile of the candidate:

In the final year of engineering school or equivalent Master degree, the candidate should have an interest in experimental scientific research in the fields of additive manufacturing and metallurgy.
The candidate must be rigorous and independent, and have the ability to project themselves towards the needs of digital approaches.

Direction:

The thesis will be directed and co-directed by P. Laheurte (Pr) and G. Le Coz (IR). Co-supervision will be provided by P. Lohmuller (IR) and L. Peltier (IR).

(1) https://lem3.univ-lorraine.fr/
(2) https://lem3.univ-lorraine.fr/plateforme-procedes/
(3) https://pint.fr/
(4) https://data.inpi.fr/brevets/FR3134734