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Postdoctoral fellowship

Micromechanical modeling of additively manufactured microstructures assisted by machine learning to design new materials with improved mechanical performance –

Link for online application
https://emploi.cnrs.fr/Offres/CDD/UMR7239-VINTAU-001/Default.aspx

Summary of the position and institutes
12-month postdoc offer, renewable for an additional 12 months
Advisors: V. Taupin (SIMaP), A. Guitton (LEM3)
Affiliation: LEM3 Metz & SIMaP Grenoble
Tentative start date: January 2026

We offer a 24-month full-time postdoctoral position. The contract is ideally starting in January 2026. The contract includes health coverage and paid holidays. The position offers a dynamic international environment and close supervision by senior scientists. The opportunity to develop theoretical and computational skills (modeling, simulations, machine learning…) to foster a career in academia or industry. The gross salary for the postdoc position is approximately ~3000 €/month. The candidate will be hired by LEM3 lab, Metz. When starting, the candidate will spend one year at SIMaP lab, Grenoble, and possibly spend the next year at LEM3 lab, Metz.

SIMaP (https://simap.grenoble-inp.fr) and **LEM3** (https://lem3.univ-lorraine.fr) are two French research laboratories host by CNRS, and by Université of Lorraine at Metz (LEM3), and Grenoble Alpes at Grenoble (SIMaP). The two labs are well-recognized worldwide for their scientific activities in the experimental and theoretical investigation of metallic microstructures and mechanics of materials.

General context and objectives. The Postdoc researcher will take part in the French collaborative research program ANR IMP3D (https://anr.fr/Projet-ANR-24-CE08-3737). The consortium includes 4 partner labs, LMS (Paris), LEM3 (Metz), SIMaP (Grenoble), and CEA (Paris). We aim at a better micromechanical understanding of links between processing, microstructures, and mechanical properties of metallic alloys produced by additive manufacturing. We consider three critical aspects, which are (i) the three-dimensional, heterogeneous, and multiscale morphology of microstructures, (ii) the presence of residual stresses due to the printing process, and (iii) the heterogeneous plastic deformation of materials when solicited mechanically. To do so, we aim at addressing three scientific questions: (Q1) What are the elementary plasticity mechanisms at small scale that impact the mechanical response, (Q2) how to estimate the residual stresses at the scale of grain aggregates and, (Q3) can machine learning methods be useful to guide the design of new microstructures with better mechanical performance? We develop and use robust and complementary experimental and modeling tools to answer these questions. We propose 3 main research tasks, respectively, (T1) the development of a spectral discrete dislocation dynamics code numerically able to simulate the deformation of small grain aggregates with precipitates and pores, (T2) the measurement of residual stresses in grains with high-resolution 3D-EBSD assisted by thermomechanical modeling, and (T3) the use of a micromechanical model fed by X-ray 3D imaging to generate a material database for training

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and testing machine learning algorithms. We will consider at first copper-chromium industrial alloys as a model system for our study. At longer term, our strategy can be extended to more complex high performance aluminum alloys.

Short description of the project: The Postdoc researcher will focus on scientific question (Q3) and related research task (T3), dedicated to coupling of micromechanical simulations with machine learning. The postdoc researcher will run micromechanical simulations using experimental data gathered within the course of the project. This includes in particular 3D high-resolution electron backscatter diffraction and X-ray tomography data. The postdoc will then propose a machine learning based strategy to propose and simulate new microstructures with targeted improved mechanical performance.

Skills required: Micromechanical modeling and materials science (priority), artificial intelligence and machine learning for materials science (necessary), scientific computing (necessary), scanning electron microscope-based characterization techniques (a plus).

Contacts: please contact **both** persons below and join a CV. One or two reference letters would also be appreciated. If selected for an interview, the candidates will present their scientific background and discuss possible strategies to reach the objectives of the project.

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