





PhD Position: PRedictive Microstructure-driven Material Behaviour From Advanced Data to Innovative MOdelling (PRIMO project)

OVERVIEW:

We are seeking a highly motivated PhD candidate to join our international research team working on the PRIMO project. Our cutting-edge research focuses on developing advanced modeling approaches that connect material microstructure to local mechanical behavior, with applications for the next-generation structural materials.

KEYWORDS: HR-DIC, HR-EBSD, in-situ test, ECCI, FFT calculations, polycrystal plasticity, dislocations/GNDs, datadriven approaches

RESEARCH FOCUS:

The successful candidate will work exclusively on the PRIMO project, which aims to bridge the gap between microstructural characterization and predictive modeling of material behavior. Fundamental research will be conducted for a better understanding and prediction of microstructure-sensitive mechanical behaviour of metals and alloys. This implies two main objectives:

- (1) The optimization of high-throughput SEM-based platforms to capture local microplasticity mechanisms at the mesoscopic scale. Fully automated in-situ SEM deformation tests coupled with High-Resolution Digital Image Correlation (HR-DIC) and Electron BackScatter Diffraction (EBSD) are proposed for optimal mesoscale characterization. It is coupled with additional new methodologies to obtain High Resolution EBSD maps and ECC (Electron channeling Contrast) images for optimized dislocation analysis in bulk materials.
- (2) The development of innovative multi-scale crystal plasticity models based on Mesoscale Field Dislocation Mechanics for polycrystalline specimens. These models will be enriched by the experiments led in (1) to improve their predictive capabilities and applied to polycrystals via massively parallelized FFT calculations. They will be used also as extremely valuable tools to help interpret experimental data.

The PhD research will involve:

- Characterization of deformed microstructures by advanced SEM-based techniques (in-situ SEM mechanical tests, high resolution EBSD/DIC)
- Development of data-driven approaches to extract key microstructural features on deformed microstructures and relations to material's behavior
- Design of innovative modeling frameworks that incorporate microstructural information into predictive models
- Implementation and validation of microstructure-informed numerical methods for material's behavior prediction

REQUIREMENTS

- Master's degree in Materials Science, Mechanical Engineering or a related field
- Strong background in mechanics of materials and/or computational mechanics
- Programming skills (Python, MATLAB, C++, or similar)
- Experience with numerical methods and computational modeling
- Knowledge of materials characterization techniques is required
- Familiarity with machine learning approaches is a plus
- Good written and verbal communication skills in English
- Ability to work independently and as part of a multidisciplinary team













WHAT WE OFFER :

- Fully funded PhD position for 3 years (~2000 € (gross) per month) supported by the LUE (Lorraine University of Excellence) international program through an effective collaboration with the University of Manchester
- Access to state-of-the-art research facilities and computational resources
- Opportunities for collaboration with international research groups
- Participation in international conferences, workshops, and training events
- Supportive research environment with experienced supervisors

HOST INSTITUTION AND SUPERVISORY TEAM

At LEM3 – Université de Lorraine – CNRS – Arts et Métiers (https://lem3.univ-lorraine.fr/) : Nathalie GEY, Thiebaud Richeton, Stéphane Berbenni

At the department of Material Science of Manchester University: Ali Gholinia and Michael Preuss (currently at Monash University)

HOW TO APPLY: Interested candidates should submit the following documents:

- 1. Cover letter explaining your motivation and suitability for the position
- 2. Detailed CV including academic background and relevant research experience
- 3. Academic transcripts (Bachelor's and Master's)
- 4. Names and contact details of two academic referees

Please send your application as a single PDF file to <u>nathalie.gey@univ-lorraine.fr</u> and <u>thiebaud.richeton@univ-lorraine.fr</u> with "PRIMO PhD Application - [Your Name]" in the subject line.

ADDITIONAL INFORMATION:

Application Deadline: 20/07/2025 Starting Date: from October 2025

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- [TANIST]: https://www.royce.ac.uk/equipment-and-facilities/tanist-2-tescan-and-newtec-in-situ-testing/





