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 high-throughput SEM-based characterizations, as well as advanced modeling approaches that connect material microstructure to local mechanical behavior, with applications for the next-generation structural materials.

KEYWORDS: polycrystal plasticity, HR-DIC, HR-EBSD, in-situ test, ECCI, micromechanical calculations, dislocations/GNDs, data-driven approaches

RESEARCH FOCUS:
The successful candidate will work on the PRIMO project, which aims to bridge the gap between microstructural characterization and predictive modeling of material behavior. The research will be conducted in strong interaction with the PERP - AMMETIS consortium (AI-assisted Simulations of Microstructure driven Mechanical properties from high Throughput and multiscale analysis: https://www.pepr-diadem.fr/projet/ammetis-2/). 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 (scanning electron microscopy) 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 micromechanical models that consider the effects of crystal defects (dislocations, grain boundaries, precipitates, etc.).* These models will be enriched by the experiments led in (1) to improve their predictive capabilities and applied to polycrystals. They will also be used also as valuable tools to help interpret the experimental observations.

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

REQUIREMENTS

- Master's degree in Materials Science, Mechanical Engineering or a related field
- Knowledge of materials characterization techniques is required
- Programming skills (Python, MATLAB, C++, or similar)
- Experience with numerical methods and computational modeling is a plus
- Familiarity with machine learning approaches is also 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 - starting from October 2026 (~2300 € (gross) per month). It is supported by I-site Lorraine 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:
nathalie.gey@univ-lorraine.fr and thiebaud.richeton@univ-lorraine.fr
with "PRIMO PhD Application - [Your Name]" in the subject line.

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