Postdoctoral position at MATEIS (INSA Lyon)

In situ nanomechanical testing of multifunctional graphene-reinforced ceramic-based composites using Transmission Electron Microscopy

Description

This job offer is related to a project supported by the ANR (French Agency for Research). The main objective of the project concerns the development of novel graphene ceramic matrix composites (GCMC), and more particularly silicon-based matrices of tribological interest, SiC and Si3N4, combining both high mechanical resistance and good thermal and electrical functionalities for dry- or water- lubricated tribological applications. This project is an active cooperation between internationally recognized actors, 3 public laboratories, LTDS, CIRIMAT and MATEIS and one industrial technical center, CETIM, to achieve these objectives.

The composites are fabricated and characterized by a PhD student at CIRIMAT. Another PhD student at LTDS is in charge of the tribological characterization and crack initiation and propagation study under cyclic stresses in dry and humid conditions under severe mechanical and thermal stresses (contact pressure up to 1 GPa and temperature up to 300 °C) to identify friction and damage mechanisms.

In relation with both PhD students, you will first perform advanced characterization using Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). Samples with very different characteristics will be selected and a large part of your work will be devoted to *in situ* mechanical tests (compression, friction) in TEM to investigate the mechanisms involved. The experiments will be carried out on an aberration-corrected environmental TEM on samples you will prepare using a FIB/SEM microscope. *Operando* experiments in the TEM may also be performed by inserting gas, to test the influence of the surrounding environment. You will work in close relation with the PhD students hired in the project, but also with several microscopists from the SNMS team in the MATEIS lab. As a member of the SNMS team in the MATEIS lab, you will be able to participate to all events organized by the team and the lab.

MATEIS is a Materials Science and Engineering laboratory with a multidisciplinary approach including Physics, Chemistry and Mechanics. The three classes of materials are investigated (metals, ceramics, polymers and their composites) integrating volume, surfaces and interfaces. MATEIS is focused on relations between Process-Microstructure-Properties, with an experimental and/or modelling approach. MATEIS focuses particularly on advanced processing methods, microstructural evaluation (often in situ and in 3D), mechanical and multi-functional properties in relation to architectures, as well as modelling at different scales. MATEIS is involved on societal issues (‘Materials for’): health, energy, environment, transport, building applications.

The general objective of the SNMS group (Structures, Nano and Micro-Structures) is to understand the micro- and nano structure of materials and multi-materials studied within the groups of the MATEIS laboratory, with a view to better understanding the relations between their properties of use and structural aspects. Development of new characterization techniques in scanning and transmission electron microscopy is presently focused on *in situ* and *operando* techniques on the different microscopes of the CLyM (Consortium Lyon Saint-Etienne de Microscopie). The SNMS team is composed of 2 professors, 5 associate professors, 1 researcher, 5 engineers or technicians and about 10 PhD or postdoctorate students.

Requirements

- PhD in material sciences, in physics in which the focus of your project was on transmission electron microscopy.
- at least **2 years well-documented, hands-on expertise in high resolution transmission electron imaging.** TEM in situ nanocompression experiments would be a plus.
- **proficiency in spoken and written English**, French is an asset
- capacity for interdisciplinary and international teamwork and excellent communication skills
- **excellent publication records**
- documented experience in elastic/plastic behavior of materials and the determination of mechanical properties

Starting date: January, 2023
Fixed term: 12 months
Salary: according to public service grids depending on the experience of the applicant

Your application MUST contain the following information:

- **cover letter** of maximum **2 pages** that should include (1) a **statement about the research you have done**, and (2) **how you fit** the above described **tasks and qualifications**,
- **CV including a publication list** and **coordinates of at least 2 referees**.

and has to be sent to **lucile.joly-pottuz@insa-lyon.fr** and **karine.masenelli-varlot@insa-lyon.fr**