Postdoctoral Position – TEM Investigation of Re effect on creep Mechanisms in Ni-Based Superalloys

Location: CEMES-CNRS, Toulouse, France

Duration: 18 months

Project Overview

This postdoctoral position focuses on understanding the role of rhenium (Re) in controlling the high-temperature creep behavior of Ni-based superalloys, which are critical materials for high-pressure turbine blades in aeroengines. While Re is known to significantly enhance creep resistance through solid-solution strengthening, the fundamental mechanisms governing its effect on dislocation mobility remain unclear. This project aims to identify and quantify the key physical parameters (e.g., stacking fault energy, short-range order) that control creep at high temperature.

The work will involve advanced microstructural characterization using transmission electron microscopy (TEM), including **in situ high-temperature tensile testing**, complemented by atom probe tomography.

Research Environment

The project is part of the **SRO-Ni Matrix** international collaboration funded by ANR (France) and DFG (Germany), in partnership with the University of Bayreuth.

Single-crystal Ni-based superalloys with varying Re contents will be produced and creep-tested by the German partner, while the work at CEMES will focus on investigating deformation mechanisms at the microscopic scale.

Your Role

You will carry out cutting-edge TEM investigations combining **in situ experiments** and **post-mortem analyses** to explore deformation mechanisms in γ-phase single crystals (850–1100 °C). Your main responsibilities will include:

- Preparing TEM samples and micro-mechanical specimens for in situ testing
- Performing in situ TEM tensile experiments and post-creep analyses
- Characterizing dislocation dynamics and deformation mechanisms
- Comparing alloys with different Re contents to assess its impact on defect behavior
- Collaborating with project partners and correlating microscopic and macroscopic results
- Publishing results in leading journals and presenting at international conferences

Profile

We are looking for a highly motivated candidate with:

- Strong expertise in **TEM applied to metallic materials**, ideally Ni-based superalloys
- Experience in **defect characterization** (dislocations, stacking faults, etc.)
- Solid understanding of **plasticity and deformation mechanisms at the dislocation scale**
- Ability to work in an international collaborative environment

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Supervision

- Florence Pettinari-Sturmel (University of Toulouse, CEMES-CNRS)
- Joël Douin (CNRS Research Director, CEMES)

How to Apply

Please send your application to: **florence.pettinari@cemes.fr** and apply via the CNRS portal:

https://emploi.cnrs.fr/Offres/CDD/UPR8011-FLOPET-004/Default.aspx