Post-doc proposal (M/F)

Study of microstructural evolution of neutron irradiated ultra-fine grained austenitic stainless steels by atom probe tomography

Groupe de Physique des Matériaux
UMR CNRS 6634 – Université de Rouen Normandie et INSA de Rouen Normandie

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Funding : The projet « RESIRAN » (Irradiation resistance of nanostructured austenitic steels) is funded by CARNOT ESP (Energy and Propulsion systems).
The post-doc contract will be managed at the University of Rouen Normandie.

Duration : 15 months fixed-term contract

Keywords : Ultrafine grained austenitic stainless steels, irradiation, microstructure, atom probe tomography, electron microscopy

Context :
Under irradiation, austenitic stainless steels (ASS), used for internal structures of pressurized water reactors are subjected to a degradation of their properties. Reducing the grain size of ASS is a way to enhance radiation resistance, grain boundaries acting as sinks for point defects at the origin of microstructural evolutions under irradiation.
The objectives of the RESIRAN project, funded by the Carnot ESP (Energy and Propulsion Systems) is to evaluate the stability of the microstructure using atom probe and electron microscopy and mechanical properties (tensile tests) of a nanostructured ASS irradiated with neutrons at several fluences. The aim is to confirm or not the potential of this kind of materials, to better understand mechanisms at the origin of the ageing under irradiation and to correlate microstructural evolutions with mechanical properties evolutions.
The successful candidate will conduct atom probe (sample preparation, analysis and data processing) and electron microscopy experiments, present the results during project progress meetings and contribute to the drafting of deliverables and publications.

Description of actions :
- Bibliography on irradiated austenitic stainless steels and nanostructured steels
- Sample preparation (focused ion beam machining SEM/FIB)
- Characterization of microstructures (electron back scattered diffraction EBSD, atom probe tomography APT, transmission electron microscopy TEM)
- data analysis and interpretation
- Participation to progress meetings
- Contribution to the drafting of the deliverables
- Writing scientific articles

Required skills :

- Strong knowledge in physical metallurgy (diffusion, phase transformation)
- Complementary knowledge on aging under irradiation of metal alloys is an additional asset
- Technical skills required in microscopy (SEM/FIB or/and APT or/and TEM)
- Independent work
- Team work

Laboratory presentation :

The Material Physics Group (GPM, UMR 6634) is a laboratory from the University of Rouen Normandie (URN), the National Center for Scientific Research (CNRS) and INSA Rouen Normandie. It is located on the Sciences and Engineering Rouen Normandie Campus in Saint-Etienne du Rouvray - France. The GPM is structured into 5 departments:

- Scientific Instrumentation,
- Metallurgy, Microstructure, Mechanics
- Functional materials and nanostructures
- Disordered systems and polymers
- Thematic openings and Innovations

It brings together 160 staff including 60 Associate professors, professors and Researchers, 30 Technical and Administrative staff and 70 PhD students, postdocs and internship students.

The recruited post-doc researcher will be attached to the "Metallurgy, Microstructure, Mechanics" department which includes 4 thematic teams:

- Nuclear materials
- Phase transformations Microstructures
- Multi-scale modeling of phase transformations
- Mechanics of materials

He/she will work in the "Nuclear Materials" team. This team is working on understanding the aging mechanisms (thermal or irradiation aging) of materials used in current reactors (generation II), on the development of new materials for next reactor generations (Generation IV, fusion) and on the relationships between microstructures and mechanical properties. It now brings together 3 Associate professors / professors, 5 PhD students and is supported by 8 research engineers, study engineers and technicians.

Risks :

Work in controlled area (radiation protection)

Working duration :

100%

Required diploma :

PhD thesis

Salary :

Monthly gross salary between 2600 € and 2800 € according to experience