Helmholtz-Zentrum Dresden-Rossendorf e.V.

With cutting-edge research in the fields of ENERGY, HEALTH and MATTER, around 1,500 employees from more than 70 nations at Helmholtz-Zentrum Dresden-Rossendorf (HZDR) are committed to mastering the great challenges facing society today. The Institute for Resource Ecology (IRE) conducts applied basic research into the protection of people and the environment from the effects of radioactive radiation. The Department of Structural Materials is looking for a

Postdoc (f/m/d) Methods Development for Micromechanical Characterization and Modeling of Mechanical Behavior of Ion-Irradiated Nuclear Structural Materials within Materials Acceleration Platforms

Resistance to radiation-induced damage is a critical requirement for materials used in nuclear reactor construction, particularly given the demanding operating conditions expected in next-generation fission and fusion reactors. At HZDR, we pursue a range of strategies for developing innovative structural materials for nuclear applications. To do so, we study radiation resistance using ion-irradiated samples, which means characterizing very thin layers close to the sample surface. Our on-site Ion Beam Center gives us a real advantage here: irradiation, characterization, and model development sit close together, so results feed straight back into our models, from targeted sample preparation onward. The postdoc position advertised here centers on advancing the methods we use to characterize and model the mechanical behavior of ion-irradiated, innovative nuclear structural materials — materials that are currently being deployed across several national and international collaborative projects. Beyond the mechanical characterization of thin ion-irradiated layers by nanoindentation to quantify radiation-induced hardening and embrittlement, the position's main focus is on developing and applying numerical models that help us understand how radiation-induced microstructural damage translates into changes in macroscopic mechanical properties. Several open methodological questions remain here, for instance, how to derive robust property values (hardness, stress-strain behavior) from depth-resolved nanoindentation data on graded, ion-irradiated layers. Addressing them offers real scope for independent scientific contribution. A key part of this work involves integrating these methods into so-called Materials Acceleration Platforms (MAPs), which combine numerical simulations, ion irradiation, and fast experimental screening to search systematically for structural materials suited to innovative nuclear applications. The position is methods-driven at its core: rather than developing individual materials ourselves, our focus is on building, validating, and providing the micromechanical characterization and modeling tools that different materials-development projects across the MAP can draw on. We explicitly welcome your own methodological ideas and priorities — whether that means microstructure-based modeling, digital screening approaches, or new experimental analysis methods. You'll join an interdisciplinary team of currently four PhD students, three postdocs (including this position), and four senior scientists, supported by technical staff (workshop, metallography, engineering), and embedded in an international network of project partners. We actively support and encourage involvement in securing follow-up funding as part of the role.

City: Dresden; Starting date (earliest): 01/11/26; Remuneration: TVöD-Bund; Reference number: 2026/101; Closing date: 16/08/26

Tasks

- Developing and applying numerical models to derive the mechanical properties of irradiated materials from micromechanical measurement data, e.g., microstructure-based prediction of hardness profiles or extraction of bulk-equivalent property values
- Developing and integrating rapid screening methods and a digital framework for handling nanoindentation data within our Materials Acceleration Platform
- Mechanically characterizing thin ion-irradiated layers by nanoindentation, including the numerical analysis of the results
- Investigating radiation-induced damage in innovative nuclear materials as part of various national and European collaborative projects
- Documenting, analyzing, and publishing results (papers, conference contributions)

Requirements

- Completed PhD in Materials Science, Physics, Materials Engineering, Nuclear Engineering, or a related field
- Strong background in the microstructure and mechanical properties of metallic materials and their experimental characterization, ideally through micro-/nanoindentation and complementary imaging techniques (e.g. AFM)
- Hands-on experience in the numerical modeling of mechanical material properties, e.g., finite element simulation, crystal plasticity modeling, analytical/semi-empirical hardening models, or data-driven analysis methods, along with a demonstrated ability to independently develop new methodological approaches
- Experience with, or strong interest in, radiation-induced damage phenomena (hardening, embrittlement, swelling)
- Familiarity with nuclear structural materials and advanced reactor concepts is an advantage
- Solid basis in scientific data analysis and statistical evaluation
- Enthusiasm for tackling demanding scientific questions and seeing them through
- Strong communication skills and a collaborative mindset, both within the institute and with external partners
- Independent, structured, and solution-oriented way of working
- Genuine team spirit within international research consortia
- Confident use of scientific software (e.g., Origin, MATLAB) and good working knowledge of MS Office
- Programming skills (ideally C/C++ or Python); experience with scientific data management or building analysis pipelines is a plus
- Excellent written and spoken English; working knowledge of German is a plus

What we offer

- A vibrant research community in an open, diverse and international work environment
- Scientific excellence and extensive professional networking opportunities

- Salary and social benefits in accordance with the collective agreement for the public sector (TVöD-Bund) including 30 days of paid holiday leave, company pension scheme (VBL)
- Depending on the personal qualifications, the candidate may be classified in salary group 13 according to TVöD-Bund
- We support a good work-life balance with the possibility of part-time employment, mobile working and flexible working hours
- Numerous company health management offerings
- Employee discounts with well-known providers via the platform Corporate Benefits
- An employer subsidy for the "Deutschland-Ticket Jobticket"

Application

We look forward to receiving your application documents (including cover letter, CV, diplomas/transcripts, etc.), which you can submit via our online-application-system: https://www.hzdr.de/db/Cms?pNid=490&pLang=en&pOid=78302

More information at https://stellenticket.de/206191/TUBS/
Offer visible until 16/08/26