UNIVERSITY OF LEICESTER

Job Summary

Job Title: Research Associate in Data-Driven Alloy Design and Experimental Metallurgy for High-Temperature Applications
Grade: 7
Salary: £40,704 to £46,970 per annum, pro rata if part-time
Department: School of Engineering
Hours/Contract: Full time or job share, fixed-term from 01 February 2027 to 31 January 2030
Job Family: Teaching and Research
Reference: 14253

Role Purpose

This three-year post is funded by an EPSRC New Investigator Award to Dr Gebril El-Fallah, Principal Investigator in the Alloy Design & Phase Transformations Research Group at the University of Leicester. The project addresses a major challenge in high-temperature materials research by seeking to develop austenitic steels with exceptionally low thermal expansion without compromising their mechanical strength and structural stability. The research focuses on advanced power-generation systems, with potential applications in aerospace, fusion energy and defence.

The Research Associate will play a leading role in designing, making and heat-treating new steel alloys, combining experimental research with computational methods to investigate their behaviour and performance. This will involve developing and applying thermodynamic and kinetic models alongside machine learning to guide alloy design and understand the influence of composition, processing and magnetic phase stability on material properties. Experimental work will cover thermal expansion and magnetic measurements, X-ray diffraction (XRD), scanning and transmission electron microscopy (SEM and TEM), electron backscatter diffraction (EBSD), including 3D EBSD at the University's Hercules Facility, and high-temperature tensile, creep and fatigue testing. The successful candidate will work closely with the Principal Investigator and collaborators at the Henry Royce Institute and Marcegaglia Stainless Sheffield Ltd, contributing to research that connects fundamental materials science with the demands of industrial applications.

Main Duties and Responsibilities

Research

- Design and make Fe–Ni-based austenitic steels, select processing routes, undertake heat treatments and prepare specimens for characterisation and testing.
- Develop, train and validate data-driven models, using experimental results and thermodynamic predictions to relate composition and processing to thermal expansion, phase stability and mechanical properties.
- Use model predictions and experimental feedback, in discussion with the PI, to identify promising compositions and guide further alloy trials.
- Measure thermal expansion and phase transformations by dilatometry and thermal cycling; characterise crystal structure by X-ray diffraction and magnetic behaviour by magnetometry.
- Examine grain structure, phases, interfaces and precipitates using SEM, EDS, EBSD and TEM, with 3D EBSD and correlative analysis through Leicester's Hercules Facility.

- Carry out and analyse high-temperature tensile, creep and fatigue tests, assessing how microstructure and magnetic behaviour affect mechanical integrity during thermal exposure and cycling.
- Integrate modelling and experimental findings to establish quantitative links between alloy composition, microstructure, thermal expansion and mechanical performance.
- Maintain accurate laboratory records, well-curated research datasets and reproducible modelling workflows, while meeting agreed milestones and following laboratory safety procedures.
- Contribute to peer-reviewed publications, technical reports, conference presentations and research discussions with academic and industrial collaborators.

Professional Development

- Develop expertise in physical metallurgy, advanced microscopy, scientific computing and high-temperature testing, with opportunities for training, publications and career development.

Impact and Knowledge Exchange

- Work with academic and industrial partners to examine the practical value of new low-expansion steels and the routes needed for further development.
- Communicate research findings to specialist and wider audiences and contribute to knowledge exchange with industrial partners.

Leadership and Citizenship

- Share technical expertise with research students and colleagues and support good experimental and data-management practice.
- Contribute to an inclusive, collaborative research environment in the School of Engineering.

Internal and External Relationships

Work closely with Dr Gebril El-Fallah (PI), members of the Alloy Design & Phase Transformations Research Group, research students and technical staff.

Collaborate with the Henry Royce Institute, Marcegaglia Stainless Sheffield Ltd and the Hercules Facility team on experiments, specialist characterisation and the interpretation of results.

Travel within the UK and internationally as required for partner meetings, collaborative research activities and conferences.

Planning and Organising

Plan and deliver the experimental and data-driven research programme against agreed project milestones, coordinating laboratory work, modelling, data analysis and facility access with the

PI and collaborators.

- Schedule alloy making, characterisation and high-temperature testing efficiently, observing equipment availability and safe-working requirements.
- Review results and model performance regularly with the PI and adapt experiments and alloy selections in response to the evidence.S

Qualifications, Knowledge and Experience

Essential

- A PhD (completed or close to completion) in materials science, metallurgy, materials engineering, mechanical engineering or a related discipline, or equivalent research experience.*
- Research experience in metallic alloys, including alloy making, heat treatment, mechanical testing or microstructural characterisation.*
- Experience of at least one relevant technique, such as SEM, EBSD, TEM, X-ray diffraction, dilatometry or high-temperature mechanical testing.*
- Experience in quantitative data analysis and scientific programming or modelling, using Python, MATLAB or equivalent tools.*
- Ability to design experiments, evaluate complex datasets and interpret links between processing, structure and material properties.*
- Evidence of contributions to peer-reviewed papers, technical reports or equivalent research outputs.*

Desirable

- Experience of machine learning or statistical modelling applied to materials data, such as regression, Gaussian processes or uncertainty quantification.
- Experience with TEM, 3D EBSD or FIB-SEM, magnetic characterisation, thermal-expansion measurements or high-temperature creep and fatigue testing.
- Understanding of austenitic steels, magnetic phase stability or computational thermodynamics.

Skills, Abilities and Competencies

Essential

- Able to plan and carry out research independently while working constructively with a multidisciplinary team.*
- Clear written and verbal communication, with the ability to present technical findings to academic and industrial audiences.*
- Sound analytical judgement, care in experimental work and a commitment to accurate, reproducible research.*

- Able to manage competing tasks, solve practical research problems and deliver work to agreed deadlines.*
- Willingness to work with external collaborators and learn new experimental and computational methods.*

Desirable

- Experience contributing to joint academic–industry research or working across multiple research facilities.
- Experience mentoring students or supporting junior researchers.

**Criteria to be used in shortlisting candidates for interview*

Reason for Fixed Term Contract

The reason for the fixed term contract is stated in section 1.9 in the summary of contractual terms in your contract of employment.

Criminal Declaration

If you become an employee, you must inform your manager immediately, in writing, if you are the subject of any current or future police investigations/legal proceedings, which could result in a criminal offence, conviction, caution, bind-over or charges, or warnings.

Supporting University Activities

As a University of Leicester citizen, you are encouraged to support key university activities such as clearing, graduation ceremonies, student registration and recruitment open days. We encourage all staff as citizens to work flexibly across the University if required. If supporting these activities is likely to affect your workload, please speak to your line manager in the first instance

University Values

Inclusive - We are diverse in our makeup and united in ambition. Our diversity is our strength and makes our community stronger.

Inspiring - We are passionate about inspiring individuals to succeed and realise their ambitions. We challenge our community to think differently, to get involved, and to constantly embrace new ideas.

Impactful - As Citizens of Change we will generate new ideas which deliver impact and empower our community

Freedom of Speech

The University is committed to upholding freedom of speech and academic freedom within the law throughout our recruitment processes. We ensure that all candidates are considered based on merit and suitability for the role, without regard to their lawful viewpoints or the expression of challenging or controversial ideas. Our recruitment policies and practices are designed to protect applicants from

discrimination or adverse treatment on the basis of their opinions, and to foster an environment where open debate and diverse perspectives are valued as essential to our academic mission.

Equity and Diversity

We believe that equity, diversity and inclusion is integral to a successful modern workplace. By developing and implementing policies and systems that challenge stereotypes across all aspects of our work, we have a culture that recognises and values the diverse contributions of our staff which benefits everyone. Our strong values of inclusivity and equality support our efforts to attract a diverse range of high quality staff and students, and identify our University as a progressive and innovative workplace that mainstreams equality, diversity and inclusion.