



The University of Manchester

THE UNIVERSITY OF MANCHESTER
PARTICULARS OF APPOINTMENT
FACULTY OF SCIENCE & ENGINEERING
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF MATERIALS
RESEARCH FELLOW IN SYNCHROTRON X-RAY COMPUTED TOMOGRAPHY
VACANCY REF: SAE-026416

Salary: Grade 7 £46,485 - £56,921 per annum (according to relevant experience)
Hours: 1 FTE
Duration: Fixed term until 31st March 2027
Location: ESRF, Grenoble France

Enquiries about the vacancy, shortlisting and interviews:

Manager: Prof. Philip Withers

Email: philip.withers@manchester.ac.uk

Background

‘Manufacturing by Design’ is a 5-year, EPSRC-funded International Centre to Centre (IC2C) collaboration project which aims to shine new light on manufacturing processes and products through developing best-in class 3D imaging. It brings together the newly instituted, EPSRC-funded National Research Facility for Lab X-ray CT (NXCT) with the European Synchrotron Radiation Facility (ESRF) and several partners in academia and industry.

NXCT is the UK National Research Facility for lab-based X-ray computed tomography. It comprises world-leading capability in lab-based XCT from the universities of Manchester, Southampton, Warwick, University College London and Diamond Light Source. It provides open access to novel *in situ* and multiscale X-ray imaging capability to the UK academic and industrial communities, and aims to provide a seamless link to synchrotron X-ray imaging.

The European Synchrotron Radiation Facility (ESRF) is the world's most intense X-ray source and a centre of excellence for fundamental and innovation-driven research. Located in Grenoble, France, the ESRF owes its success to the international cooperation of 22 partner nations, of which 13 are Members and 9 are Scientific Associates. Following on from 20 years of success and excellence, the ESRF has embarked upon an ambitious and innovative modernisation project, the Upgrade Program, implemented in two phases: Phase I (2009-2015) and the ESRF-EBS -Extremely Brilliant Source

(2015-2022) programs. With an investment of €330 million, the Upgrade Program has produced even more intense, coherent and stable X-ray beams.

Our aim is to exploit and further develop the new and upgraded beamlines within the ESRF's Structure of Materials family of beamlines (specifically BM18, ID15A and ID19) to achieve a step jump in the volume of manufactured components that can be examined and the rate at which we can image manufacturing processes. By linking this capability to the framework of the NXCT, we will create a pathway and the necessary capabilities for UK users to plan, execute and analyse high frame rate CT or large component imaging data from additively manufactured materials, composites and batteries.

ID19 is a world-class high frame rate imaging instrument; the EBS step jump upgrade will increase the contrast significantly. With imaging rates of 5×10^6 fps combined with excellent phase contrast at high energy and coupled to various sample environments it provides unique insights into manufacturing and degradation processes in real-time in 2D and 3D.

ID15A is a newly refurbished beamline devoted to operando and time-resolved diffraction and imaging, total scattering and diffraction computed tomography. The beamline is equipped with optimized focusing optics and a photon-counting CdTe pixel detector, allowing for both unprecedented data quality at high energy (up to 120 keV) and for very rapid triggered experiments. Heterogeneous, real working systems can be studied with a combination of high spatial, temporal and structural resolution.

BM18 will be the largest and most ambitious (€12m total cost) micron resolution scanner in the world and is being constructed through an €6m partnership with the Fraunhofer Institute for Integrated Circuits. Conventionally synchrotron imaging has allowed high resolution but only on mm sized samples. Because of the long working distance, high energy X-rays (up to 300 keV) and a 45 m long hutch, this beamline will be able to scan parts up to 700x700x2500mm, thereby increasing the volumes that can be imaged non-destructively at micron resolution by a factor $>10^6$ extending the field of view (FoV) to resolution ratios well beyond that currently achievable anywhere. It will also be able to accommodate parts, or environmental rigs, weighing up to 300kg.

Overall Purpose of the Job

The appointed post will be at postdoctoral fellow level or postdoctoral associate level, according to relevant experience. One will be more focused on software and analysis and the other more focused on the development of instrumentation and environmental rigs. This job description is for a postdoctoral fellow who will be the key contact between collaborating teams. You will develop and lead the execution of proposals for research projects at the ESRF within the framework of the objectives of 'Manufacturing by Design' and coordinate the activities with the various collaborators.

The post holder will be located within the Structure of Materials group at the ESRF.

The appointed person will focus on helping to develop the instrumentation, as well as the integration of environmental rigs for time lapse experiments. Example experiments include: developing high-speed 3D tomography techniques to investigate battery cell failure; pioneering multi-laser processing of novel alloy powders by incorporating quad-laser optics into our *in situ* additive manufacturing (AM) rigs; and to support the *ex situ* time-lapse studies of extensive and coupled damage in composite structures on BM18.

The post holder will have expertise in handling, analysing and visualising the very large 3D datasets that BM18 (large 3D volumes), ID15A (multimodal) and ID19 (time lapse sequences) will provide. In particular she/he will work with the ESRF and the Fraunhofer Institute. She/he will lead the development of the data compression, streaming and analysis capability required to interrogate a large-volume object in real-time. In addition, they will coordinate many of the experiments on BM18, for example driving the scout and zoom capability needed to identify and quantify defects in AM and composite components.

Key Responsibilities, Accountabilities or Duties

The ESRF is an evolving, dynamic organisation; therefore the range of duties set out below is indicative and not prescriptive. It is expected that you will become fully embedded in the Beamline teams. Given that you will be working for the University of Manchester but located for most of the time at the ESRF you will be expected to demonstrate a high degree of autonomy and adaptability to meet the developing needs of the Facility. The post holder will be expected to:

- Design and develop the software or experimental capabilities needed to support the “Manufacturing by Design” project that exploit the beam lines at the ESRF.
- Coordinate the link between the NXCT, the ESRF, and the Fraunhofer Institute for Integrated Circuits.
- Initiate and manage collaborations with key academic and industrial partners to define mutually beneficial research projects.
- Author scientific papers, prepare progress reports and present at conferences.
- Show a high level of initiative and autonomy with the organisation and time management skills to effectively and efficiently plan and organise activities.
- Mentor and support the research associate on the ‘Manufacturing by Design’ project.

Person Specification

Essential

- A PhD or equivalent in a scientific discipline and substantial post-doctoral experience.
- Ability to coordinate a consortium project involving many parties and simultaneous activities and to manage project reporting.
- Experience of working on synchrotron beamlines or other large facilities.
- Expertise in the collection of X-ray computed tomography data and its analysis, or the development of instrumentation and in situ rigs.
- To be able to represent the IC2C consortium at meetings and more widely at the ESRF.

Desirable

- Experience and knowledge of energy storage or materials manufacturing.
- Demonstrable experience of leading and developing own research activity.
- Experience of developing/designing equipment.
- Experience of Aviso or other 3D visualisation and/or other large data analysis tools.
- Experience of programming for the analysis of images.



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