THE UNIVERSITY OF MANCHESTER

PARTICULARS OF APPOINTMENT

FACULTY OF SCIENCE & ENGINEERING

SCHOOL OF NATURAL SCIENCE

DIVISION OF CHEMISTRY

RESEARCH ASSOCIATE IN SOLID TRANSFORMATIONS

VACANCY REF: SAE-019384

Salary:	Grade 6 £33,309 to £40,927 per annum, depending on relevant experience
Hours:	Full Time
Duration:	Fixed Term from the 1 October 2022 to 30 September 2025
Location:	Oxford Road, Manchester

Enquiries about the vacancy, shortlisting and interviews:
Name: Martin Attfield
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BACKGROUND

This project aims to investigate solid transformations in crystalline metal-organic framework (MOFs) materials by following such transformations at the nanoscale using real time atomic force microscopy (AFM) at the surface of single crystals of these materials. The successful applicant will be based in the Nanoporous Materials group within the Department of Chemistry, School of Natural Sciences, the University of Manchester under the supervision of Dr Martin Attfield and Prof. Michael Anderson.

The Nanoporous Materials group (http://www.cnm.manchester.ac.uk/) is housed in a refurbished suite of laboratories that is extremely well-equipped for the synthesis and nanoscale characterisation of nanoporous materials, including a state-of-the-art high speed Bruker JPK NanoWizard ULTRA Speed 2 AFM and a JPK Nanowizard II Bio AFM fitted with variable temperature liquid cells (-10 – 100 °C) and advanced optical microscopes, and a Veeco Multimode AFM with NanoScope III controller. The world class characterisation instrumentation and facilities of the Department and University are also available for this project.

MANCHESTER 1824
The University of Manchester

Overall Purpose of the Job

Stimuli induced solid transformations underpin the formation and action of numerous functional materials including crystalline metal-organic frameworks (MOFs).[1] Understanding the mechanisms and kinetics of these transformations at the nanoscale will enable the development of new and enhanced forms of MOF. The overarching purpose of this position is to gain an enhanced understanding of crystal structure transformations of MOFs in the bulk and surface through gaining nanoscopic level detail of the real time transformation process at the crystal surface of selected MOFs and then applying this understanding to develop the form and process performance of these MOFs. Atomic force microscopy (AFM) will be used to observe and analyse such transformation processes in real time at the nanoscopic level to provide the knowledge to drive the formation of MOFs with different beneficial attributes. The AFM work will be accompanied by additional ancillary work including the synthesis of known or modified MOFs, and characterisation including crystallographic (powder or single crystal X-ray diffraction) and electron microscopy techniques.

This overall purpose will be met through accomplishing the following objectives:

(i) To observe and image at high-resolution the crystal surface of several MOF systems in real time under real conditions during single crystal-to-single crystal MOF structure transformations using the technique of in-situ AFM.
(ii) To determine the mechanism, rate constants and activation energies for these transformation processes through direct image analyses of the collected AFM images for transformations conducted under different conditions.
(iii) To create MOFs in these systems with different beneficial attributes including hierarchical porous frameworks or particle form for enhanced diffusivity, or specific sized and shaped crystallites for heightened selectivity during adsorption or extended process longevity.

Reference [1] P. Naumov and P. K. Bharadwaj, CrystEngComm, 2015, 17, 8775-8964.

Key Responsibilities, Accountabilities or Duties

The range of duties will include:

- Plan and manage own research activity in collaboration with others.
- Collaborate with academic colleagues in the Attfield and Anderson groups on areas of shared research interest to ensure rapid progress in achieving the overall aims of the project.
- Be involved in the assessment of student knowledge and supervision of projects.
- Assist in the development of student research skills.
- Develop research objectives and proposals for own or joint research, with the assistance of a mentor if required.
- Conduct individual and collaborative research projects.
- Write up research work for publication and for annual reports for the LeverhulmeTrust.
- Continually update knowledge and understanding in field or specialism.
- Translate knowledge of advances in the subject area into research activity.

- Deal with routine communication using a range of media.
- Communicate complex information, orally, in writing and electronically.
- Prepare proposals and applications to external bodies, e.g. for funding and contractual purposes.
- Communicate material of a specialist or highly technical nature.
- Liaise with colleagues and students.
- Build internal contacts and participate in internal networks for the exchange of information and to form relationships for future collaboration.
- Join external networks to share information and identify potential sources of funds.
- Manage own research and administrative activities, with guidance if required.
- Work with colleagues on joint projects, as required
- Attend and contribute to relevant meetings. Contribute orally and by other means to meetings and seminars associated with the Nanoporous Materials group and the Department of Chemistry.
- Use new research techniques and methods.
- Use initiative and creativity to identify areas for research, develop new research methods and extend the research portfolio.
- Use creativity to analyse and interpret research data and draw conclusions on the outcomes.
- Contribute to collaborative decision making with colleagues in areas of research.
- Use research resources, laboratories and workshops as appropriate.
- Balance with help the competing pressures of research and administrative demands and deadlines.
- Be aware of the risks in the work environment and their potential impact on their own work and that of others.

Person Specifcation

Essential:

- Have, or be about to obtain, a relevant PhD (or equivalent) in a relevant discipline to the project, eg Chemistry, Materials, Earth Sciences, Engineering, Physics, Pharmacy
- Experience of ex-situ and real time in-situ atomic force microscopy (AFM) or a related scanning probe microscopy with associated data analyses
- Experience of chemical synthesis
- Excellent communication and interpersonal skills
- Excellent time management and organisational skills
- Ability to work independently and as part of a team

- Ability to liaise confidently and effectively with a range of individuals
- Flexible approach to dealing with research problems as they arise
- Willingness to learn and develop
- Ability to present in both written and oral publications
- Ability to meet deadlines
- Strong journal publication record, commensurate with your career stage
- The ability to evaluate complex data using appropriate analysis tools
- Ability to contribute to broader management and administrative processes.
- Ability to assess and organise resources
- Understand equal opportunity issues as they may impact on areas of research content.
- Be able to help in the supervision of undergraduate and postgraduate students within the group and have a desire to pass on skills and knowledge to them

Desirable:

- Experience of the synthesis and characterisation of metal organic framework or coordination polymers
- Experience of the characterisation of crystalline materials eg electron microscopy, powder and single crystal X-ray diffraction
- Experience of crystallisation of extended solids