CANDIDATE BRIEF

Research Fellow in Digital Twining of Ceramic Coating

Faculty of Engineering and Physical Sciences

Salary: Grade 7 (£37,099 – £ 44,263 p.a.)

Reference: EPSME1160

Location: Leeds campus

Closing date: Wednesday 08 May 2024

Fixed-term for up to 12 months

We are open to discussing flexible working arrangements

Research Fellow in Digital Twining of Ceramic Coating, Institute of Design, Robotics and Manufacturing (iDRaM), School of Mechanical Engineering.

Are you experienced in computational modelling of complex flows for materials technology and ceramic coatings? Do you want to join a world class multidisciplinary team with industry partners? Are you looking for a new and exciting challenge to develop innovative digital tools combining CFD and machine learning to reduce manufacturing-induced deficiencies of ceramics?

We have a vacancy for an enthusiastic researcher with expertise in computational fluid dynamics (CFD), complex (non-Newtonian) flows, and machine learning knowledge to work with us in the Institute of Design, Robotics and Manufacturing (School of Mechanical Engineering, University of Leeds) and a local industry partner.

You will lead work on investigating and optimising the influence of compositional change, temperature, and humidity on the rheological behaviour of a ceramic slurry using CFD. Collaborating with other colleagues and the industrial partner, you will be defining a process window for the manufactured ceramic coatings by benchmarking surface quality, thickness, uniformity, and leakage, and subsequently developing machine learning algorithms to optimise the various parameters involved in the process. You will collaborate closely with other researchers in the to develop new learning and to disseminate the project findings via publications, and presentations.

As a Research Fellow you will have a PhD (or have submitted your thesis before taking up the role), and a Bachelors or Masters degree in Mechanical Engineering, Aerospace Engineering, Maths/Computer Science, Materials Engineering or a related discipline.

Further information on the role can be found in the Additional Information section towards the end of this document.

What does the role entail?

As a Research Fellow, your main duties will include:

- Developing CFD models with proper rheological behaviour of a ceramic slurry to simulate tape casting process. This will involve developing of multiphase complex flow models in platform like Ansys-Fluent, Comsol, or OpenFOAM;
- Creating benchmark of surface quality, thickness, uniformity, and leakage influenced by process parameters, rheology of ceramic slurry, and environmental conditions (temperature and humidity) using the developed CFD tools and validated them experimental data where possible;
- Developing machine learning algorithms to optimise the various parameters involved in the tape casting process;
- Generating and pursuing independent and original research ideas in the appropriate subject area;
- Developing research objectives and proposals and contributing to setting the direction of the research project and team including preparing proposals for funding in collaboration with colleagues;
- Evaluating methods and techniques used and results obtained by other researchers and to relate such evaluations appropriately to your own research;
- Making a significant contribution to the dissemination of research results by publication in leading peer-reviewed journals and by presentation at national and international meetings;
- Working with the project collaborators (industry partner and other colleagues in the institute) to inform the current manufacturing lines with the developed digital twin of the process;
- Working both independently and as part of a larger team of researchers, industrial partners and stakeholders;
- Maintaining your own continuing professional development and acting as a mentor to less experienced colleagues as appropriate;
- Contributing to the training of undergraduate and postgraduate students, including assisting with supervision of projects in areas relevant to your research.

These duties provide a framework for the role and should not be regarded as a definitive list. Other reasonable duties may be required consistent with the grade of the post.

What will you bring to the role?

As a Research Fellow, you will have:
- A PhD (or have submitted your thesis before taking up the role) and a Bachelors or Masters degree in Mechanical Engineering, Aerospace Engineering, Maths/Computer Science, Materials Engineering or a related discipline;
- Experience in developing and using CFD models for manufacturing processes and/or engineering applications;
- Experience in developing machine learning algorithms to optimise multi-parameter processes;
- Good time management and planning skills, with the ability to meet tight deadlines and manage competing demands effectively without close support;
- A developing track record of peer-reviewed publications in international journals;
- A high level of interpersonal and communication skills, including written, verbal and presentational skills, with the ability to work well as part of a team;
- Demonstrable ability to work independently, showing initiative and creativity;
- A strong commitment to your own continuous professional development.

You may also have:
- Experience of pursuing external funding to support research;
- Knowledge of manufacturing processes related to ceramic coating;
- Experience in modelling of complex (non-Newtonian) flows;
- Practical experience in dealing with materials processing/manufacturing;
- The ability to interact with PhD students, Masters students and undergraduates in ways that will enhance the student experience in the School.

How to apply

You can apply for this role online; more guidance can be found on our How to Apply information page. Applications should be submitted by **23.59** (UK time) on the advertised closing date.

Contact information

To explore the post further or for any queries you may have, please contact:

Dr Masoud Jabbari, Lecturer (Assistant Professor)
Email: M.Jabbari@leeds.ac.uk

Additional information

Background: Tape casting is used extensively in the production of batteries and fuel cells and there is an increasing need to process thicker layers which is causing a number of challenges for manufacturers. The slurry used in tape casting is a mixture of different ingredients, i.e. ceramic powder, solvent, binder, dispersant (liquid and solid phases). The presence of these various ingredients influences the rheology of the ceramic slurry, which is key factor for processing the flow during manufacturing. Process parameters like casting speed, and machine configurations, are other factors that impact the uniformity, homogeneity, and ultimately the quality of the produced tapes. Most importantly, it is the interplay between all abovementioned parameters that directly influence key performance factors of the parts, and raises challenges to achieve consistency.

The Project: The proposed project is aimed at tackling current industrial challenges: optimising ceramic slurry recipe and its compositional changes with respect to the environmental impacts (temperature and humidity) and the flow behaviour during manufacturing; achieving uniform thickness in high volume manufacturing of thick ceramic tapes and maintaining consistent properties across the entire tape; developing validated multiphysics models to predict key performance factors (e.g. leakage) and control it considering different material composition and process condition; combining experimental data, multiphysics model, and using machine learning algorithms to optimise the entire manufacturing chain of tap casting and predict scaling factors/remedies from lab-scale production to industrial lines. The project will have a wider environmental and commercial impacts: reducing material waste and promoting sustainable manufacturing with less harm to environment; high performance materials for renewable applications aligned with UK's net zero ambitions; transferring the know-hows to different applications/markets such as batteries and hydrogen fuel cells/electrolysers for electric/hybrid transport.

Please note: If you are not a British or Irish citizen, you will require permission to work in the UK. This will normally be in the form of a visa but, if you are an EEA/Swiss citizen and resident in the UK before 31 December 2020, this may be your passport or status under the EU Settlement Scheme.

Faculty and School Information
Further information is available on the research and teaching activities of the [Faculty of Engineering and Physical Sciences](#) and the [School of Mechanical Engineering](#).

A diverse workforce
As an international research-intensive university, we welcome students and staff from all walks of life and from across the world. We foster an inclusive environment where all can flourish and prosper, and we are proud of our strong commitment to student education. Within the Faculty of Engineering and Physical Sciences we are dedicated to diversifying our community and we welcome the unique contributions that individuals can bring, and particularly encourage applications from, but not limited to Black, Asian and ethnically diverse people; people who identify as LGBT+; and people with disabilities. Candidates will always be selected based on merit and ability.

The Faculty of Engineering and Physical Sciences are proud to have been awarded the Athena SWAN [Silver](#) Award from the Equality Challenge Unit, the national body that promotes equality in the higher education sector. Our [equality and inclusion webpage](#) provides more information.

Working at Leeds
We are a campus-based community and regular interaction with campus is an expectation of all roles in line with academic and service needs and the requirements of the role. We are also open to discussing flexible working arrangements. To find out more about the benefits of working at the University and what it is like to live and work in the Leeds area visit our [Working at Leeds](#) information page.

Information for disabled candidates
Information for disabled candidates, impairments or health conditions, including requesting alternative formats, can be found on our [Accessibility](#) information page or by getting in touch with us at hr@leeds.ac.uk

Criminal record information

Rehabilitation of Offenders Act 1974

A criminal record check is not required for this position. However, all applicants will be required to declare if they have any 'unspent' criminal offences, including those pending.

Any offer of appointment will be in accordance with our Criminal Records policy. You can find out more about required checks and declarations in our Criminal Records information page.