



UNIVERSITY OF LEEDS

CANDIDATE BRIEF

Research Fellow in Durability of Cement and Concrete Materials,
Faculty of Engineering & Physical Sciences



Salary: Grade 7 (£33,797– £40,322 p.a.) Due to funding restrictions,
an appointment will not be made higher than £34,804

Reference: EPSCV1017

Closing date: Thursday 26 March 2020

Fixed-term for up to 24 months

We will consider flexible working arrangements

Research Fellow in Durability of Cement and Concrete Materials, School of Civil Engineering, Faculty of Engineering & Physical Sciences.

Are you a dynamic and highly motivated researcher in durability of cementitious materials? Are you an ambitious researcher looking for a new and exciting challenge as part of a multi-disciplinary team in the field of cement and concrete technology? Do you want to explore the factors controlling the long-term performance of the next generation of concretes produced with natural supplementary cementitious materials?

As part of an exciting, multi-disciplinary, US-UK research project [RENACEM](#), led in the UK by [Prof. Susan A. Bernal](#), the successful applicant will generate fundamental knowledge, identifying factors controlling changes in mineralogy, phase assemblage, and microstructure of natural SCM-cement blends. They will examine the effects of mix design and CO₂ exposure conditions, and their influence on the mechanical stability of concrete. This will be achieved by (i) Determining CO₂ diffusivity and the potential changes induced by CO₂ exposure in the pore structure of cement and concrete; (ii) Investigating the chemical reactions between CO₂ and the hydration products forming in blended cements as a function of exposure conditions (natural vs. accelerated carbonation) and (iii) Establishing a correlation between microstructural changes induced by carbonation and degradation of the mechanical properties of concrete specimens.

The successful applicant will conduct the research at the UKCRIC National Centre for Infrastructure Materials at the University of Leeds, in collaboration with project partners at the University of Sheffield and the University of Texas at Austin.

Holding a first degree and doctoral degree (or close to completion) in Civil, Materials, Environmental, Chemical Engineering or a closely allied discipline, you will have extensive experience in assessing durability of cementitious materials, microstructural characterisation of cementitious materials using advanced analytical techniques, evaluation of physical and mechanical properties of cement and concrete. Experience in thermodynamic or multi-physics modelling applied to cementitious materials is also desirable.



What does the role entail?

As a Research Fellow, your main duties will include:

- Pre-conditioning (e.g. crushing/grinding or thermally treating) of raw materials (e.g. soils, clays or volcanic ashes);
- Characterisation of powdered materials using techniques including (but not limited to) laser diffractometry, XRF, BET, zeta potential and optical microscopy;
- Measuring fresh state properties of cementitious binders, mortar and/ or concretes;
- Determining microstructure and phase assemblage of hardened cements using techniques including (but not limited to) X-ray diffraction, scanning electron microscopy, thermogravimetry, and spectroscopic techniques (e.g. Fourier transform infrared and/or solid-state NMR);
- Performing durability testing of cement, mortars or concretes such as (but not limited to) carbonation. This will entail standardised testing, plus determination of transport properties using conventional methodologies as well as X-ray microtomography;
- 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 preparation of periodic reports;
- Evaluating methods and techniques used, and results obtained by other researchers, and to relate such evaluations appropriately to your own work;
- Communicating or presenting research results through publication or other recognised forms of output;
- Preparing papers for publication in leading international journals and independently writing reports;
- Working both independently and also as part of a team of researchers, engaging in knowledge-transfer activities where appropriate and feasible;
- Maintaining your own continuing professional development and acting as a mentor to less experienced colleagues as appropriate;
- Contributing to the training of both undergraduate and postgraduate students, including assisting with the supervision of projects in areas relevant to the project.



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 first degree and doctoral degree (or close to completion) in Civil, Materials, Environmental or Chemical Engineering or a closely allied discipline;
- Experience in durability testing of cement, mortars or concretes particularly carbonation;
- A strong background in the chemistry and mineralogy of cementitious materials, including the chemical and physical processes that control their durability;
- Experience in determining fresh and hardened state properties of mortars and/or concretes, including (but not limited to) kinetics or reaction, mechanical strength development, and transport properties (e.g. permeability and/or porosity);
- Experience in using a range of techniques for materials characterisation applied to cementitious materials, including at least the majority of: X-ray diffraction, scanning/ transmission electron microscopy, thermogravimetry, Fourier transform infrared spectroscopy and solid state NMR spectroscopy;
- Experience studying transport properties (e.g. pore structure, water and/or gas movement) of cementitious materials;
- Experience operating data acquisition equipment, post-signal processing and programming, for interpretation of the sensing data collected from laboratory and/or field experiments;
- Good time management and planning skills, with the ability to meet tight deadlines and work effectively under pressure;
- A proven track record of peer-reviewed publications in high impact factor journals;
- Excellent written and verbal communication skills including experience presenting research outputs to a specialised academic and industrial audience;
- Proven ability to manage competing demands effectively, responsibly and without close support;
- A proven ability to work well both individually and in a team;
- A strong commitment to your own continuous professional development.



You may also have:

- Experience in concrete mix design and concrete specimens production;
- Experience conducting X-ray microtomography experiments;
- Experience in the development and implementation of algorithms for reconstruction, processing and analysis of X-ray tomographic and/or imaging data;
- Experience in thermodynamic modelling of cementitious materials;
- Experience in fluid dynamics modelling using a multi-physics software (e.g. COMSOL);
- Experience in working collaboratively with external industrial and academic partner organisations;
- Active membership in international scientific networks such as RILEM, ACI, American Ceramic Society or *fib*.

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:

[Prof. Susan A. Bernal](#), Chair in Structural Materials & EPSRC Early Career Fellow

Tel: +44 (0)113 343 39415

Email: S.A.BernalLopez@leeds.ac.uk

Additional information

Faculty and School Information

The research activities will be undertaken in the new UKCRIC National Centre for Infrastructure Materials at the University of Leeds. Further information is available on the research and teaching activities of the [Faculty of Engineering and Physical Sciences](#) and the [School of Civil Engineering](#).



A diverse workforce

The Faculty of Engineering and Physical Sciences is 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

Find out more about the benefits of working at the University and what it's like to live and work in the Leeds area on our [Working at Leeds](#) information page.

Candidates with disabilities

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

