

## Characterising and modelling the behaviour of concrete in nuclear power plants

*Imperial College London – Department of Civil and Environmental Engineering*

*Research Associate*

*Fixed term appointment of 36 months*

*Salary in the range: £32,100 - 40,720*

We wish to recruit a Post-doctoral Research Associate to undertake a 36 months research project within the Concrete Durability Group of the Department of Civil and Environmental Engineering based at the South Kensington campus of Imperial College London ([www.imperial.ac.uk/concretedurability](http://www.imperial.ac.uk/concretedurability)).

The project concerns understanding the influence of microstructure and hydration kinetics on bulk properties of concrete such as mass/ionic transport properties, shrinkage, creep, strength and elasticity. The primary objective of this project is to establish relationships between constituent materials, microstructure and bulk properties as a function of time, for concretes and exposure environments relevant to nuclear power plants. The project is funded by Électricité De France (EDF) and NNB Generation Company.

The project will combine microstructure characterisation and numerical modelling techniques to examine and model the influence of microstructure on important aspects of the behaviour of concrete as a function of time. The overall aim is to improve the ability to assess the long-term performance of concrete in nuclear power structures.

Suitable applicants will have a PhD or equivalent experience in cement science or concrete technology. Ideally this will include characterising microstructure and measuring engineering properties and possibly multi-scale modelling of concrete.

The researcher will take a leading role in carrying out the research and co-ordinating with other researchers based at EDF R&D Materials Ageing Institute at Les Renardières, France. The researcher will be expected to participate in regular meetings and research visits within UK and France. An ability to speak French would be desirable, but is not essential.

For informal enquiries, please contact Dr Hong Wong (email: [hong.wong@imperial.ac.uk](mailto:hong.wong@imperial.ac.uk), phone: +44 (0)20 7594 5956) or Professor Nick Buenfeld ([n.buenfeld@imperial.ac.uk](mailto:n.buenfeld@imperial.ac.uk), phone: +44 (0)20 7594 5955).

Our preferred method of application is online via our website <http://www3.imperial.ac.uk/employment> (please select "Job Search" then enter the job title or vacancy reference number **EN20120239TT** into "Keywords"). Please complete and upload an application form as directed.

Alternatively, If you are unable to apply online, please contact Ms Ruth Bello (email: [r.bello@imperial.ac.uk](mailto:r.bello@imperial.ac.uk), phone: +44 (0)20 7594 6040) to request an application form, quoting reference number **EN20120239TT** in the request.

Closing date for applications: Thursday, 23 August 2012

*Committed to equality and valuing diversity. We are also an Athena Bronze SWAN Award winner, a Stonewall Diversity Champion and a Two Ticks Employer*

## Imperial College London

### Department of Civil and Environmental Engineering

### Research Associate in Concrete Science/Technology

#### Job Description

<b>Job Title:</b>	Research Associate
<b>Job Family:</b>	Level B, Academic and Research Job Family
<b>Responsible to:</b>	Professor Nick Buenfeld Dr. Hong Wong
<b>Key Working Relationships (internal):</b>	Academic and research staff in the Concrete Durability Group Research students in the Concrete Durability Group
<b>Key Working Relationships (external):</b>	Électricité de France S.A. (EDF) NNB Generation Company Ltd.

#### Purpose of the Post

To take a leading role in carrying out a 36-month research project on characterising and modelling the behaviour of concrete in nuclear power plants. The project concerns understanding the influence of microstructure and hydration kinetics on bulk properties of concrete such as mass/ionic transport properties, shrinkage, creep, strength and elasticity. The main objective of this project is to establish relationships between constituent materials, microstructure and bulk properties as a function of time, for concretes and exposure environments relevant to nuclear power plants. The project will combine microstructure characterisation and numerical modelling techniques to examine and model the influence of microstructure on important aspects of the behaviour of concrete. The overall aim is to improve the ability to assess the long-term performance of concrete in nuclear power structures. The project is funded by and carried out in collaboration with EDF and NNB.

#### Key Responsibilities

- To become familiar with the state-of-art of research on the microstructure of concrete, microstructure characterisation techniques and numerical modelling of concrete properties from microstructure.
- To learn and apply the numerical techniques developed by EDF R&D for predicting bulk properties of concrete from microstructure.
- To participate in the experimental programme that will include sample preparation, microstructure characterisation and measurement of bulk engineering properties.
- To analyse the experimental data with the aim of understanding and modelling the influence of microstructure on bulk properties.

- To assist in the development and validation of numerical models for predicting bulk properties of concrete from microstructure. The modelling approaches include homogenisation principles, multi-scale techniques and three-dimensional simulation from reconstructed microstructure.
- To interact and co-ordinate with internal and external collaborators on an ongoing basis.
- To participate actively in regular meetings and research visits within UK and France.
- To lead in the preparation of reports and scientific publications.
- To assist in training users and routine maintenance of the microscopy labs in the Concrete Durability Group.
- To assist in the supervision of MEng, MSc and PhD projects related to the project and to provide limited teaching support within the Department as appropriate.
- To comply with relevant College policies, including Financial Regulations, Equal Opportunities Policy, Promoting Race Equality Policy, Health and Safety Policy, Information Systems Security Policy and Intellectual Property Rights and Register of Interests Policies.

**Job descriptions cannot be exhaustive and the post-holder may be required to undertake other duties, which are broadly in line with the above key responsibilities.**

*Imperial College is committed to equality of opportunity and of eliminating discrimination. All employees are expected to adhere to the principles set out in its Equal Opportunities in Employment Policy, Promoting Race Equality Policy and Disability Policy and all other relevant guidance/practice frameworks.*

## **PERSON SPECIFICATION**

Applicants are required to demonstrate that they possess the following attributes.

### **Qualification**

- A PhD or equivalent (or be nearing completion of a PhD) in cement science or concrete technology

### **Knowledge and Experience**

- Advanced level of knowledge in cement hydration and microstructure of concrete.
- Experience in microstructure characterisation techniques including backscattered electron microscopy, X-ray microanalysis and digital image analysis.
- Familiarity with testing properties of hardened concrete such as mass/ionic transport, shrinkage, creep, strength and elasticity.
- Knowledge or experience in three-dimensional imaging techniques such as focus-ion beam nanotomography would be desirable.
- Experience in modelling concrete microstructure and properties would be desirable

### **Competencies, Skills and Abilities**

- Excellent numerical ability and computer programming skills.
- Excellent communication skills in both oral presentation and scientific writing (including evidence of published papers).
- Ability to carry out all the required technical tasks of the project
- Ability to work effectively with staff and students within the group, and from project partners and other collaborators.
- Apply excellent project management and team-working skills.
- Ability to project a professional manner at meetings, conferences and seminars with authority and coherence.