SOUTH WEST NUCLEAR HUB

PhD Opportunities in Nuclear Structural Integrity

The University of Bristol's Solid Mechanics Research Group (SMRG) has a number of PhD projects available, commencing in 2019.

These projects would suit candidates with a good first degree and/or Masters in Engineering, Mathematics or the Physical Sciences. These projects offer excellent opportunities for both experimental and modelling work along with travel opportunities to conferences and multi-user X-ray and neutron facilities in the UK and internationally.

Working with partners in major nuclear industry companies such as EDF Energy, UK Atomic Energy Authority and National Nuclear Laboratory also offers excellent opportunities to consider a future career in the nuclear sector.

UoB is also a partner in a newly-announced EPSRC Centre for Doctoral Training in Nuclear Energy Futures, led by Imperial College. Some of the SMRG projects can be incorporated into the CDT if desired; compared to a normal 3.5 year PhD, the CDT is 4 years in duration, with much of the first year focusing on taught courses and personal/professional development.

An enhanced stipend may be available. Please contact Professor Chris Truman (c.e.truman@bristol.ac.uk) or Dr Mahmoud Mostafavi (m.mostafavi@bristol.ac.uk) with any informal enquiries.

The available projects are:

- High temperature digital image correlation of small punch test (UKAEA)
- Plasticity-induced damage in high temperature reactors (EDF Energy)
- Simulation and experimental validation of creep–fatigue interaction (UKAEA)
- Welded joints behaviour in high temperature reactors (EDF Energy)
- Multi-scale mechanical stress in nuclear fuel cladding (NDA and NNL)

For more information visit bristol.ac.uk/engineering/research/solids/

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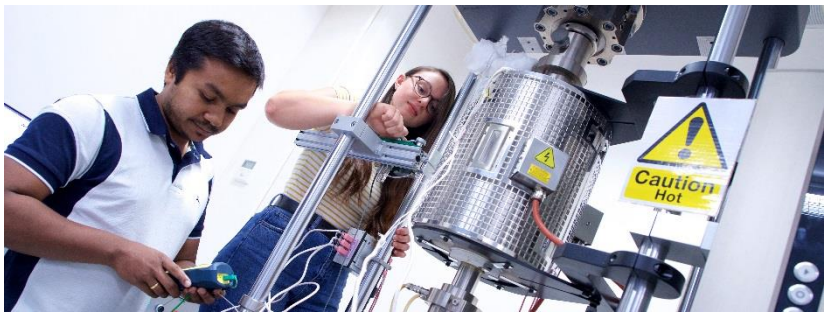

PhD Studentships in Nuclear Structural Integrity – High temperature digital image correlation of small punch test

Supervisor(s): Dr Harry Coules (UoB) and Dr Yiqiang Wang (UKAEA)

Sponsor(s): EPSRC and United Kingdom Atomic Energy Authority

Creep damage is the principal life limiting factor in the life of a thermal plant. Materials behaviour in creep regime is evaluated using uniaxial tests. However, the majority of components experience a multi-axial stress state. Stress multi-axiality can have a significant effect on the rate of initiation and growth of creep cavities. This project is aimed at designing, optimising, and eventually exploiting optical techniques for creep study of small punch tests.

This is a joint PhD project between EDF Energy and UKAEA. The project will involve using digital image correlation (DIC) to characterise multi-axial creep deformation and finite element simulation to interpret the experimental data; and carrying out neutron and synchrotron experiments working alongside experienced SMRG postdoctoral researchers. The research will also involve correlating results against modelling activities.

Entry Requirements

The positions are open to candidates with a 1st or 2:1 first degree (and/or Masters) in Engineering, Materials Science, Physical Sciences or Mathematics. Experimental and theoretical modelling projects are available; there is sufficient flexibility in the research programme so that candidates can shape research projects in line with their own interests in consultation with their supervisors.

For enquiries Please contact Professor Chris Truman (c.e.truman@bristol.ac.uk) or Dr Mahmoud Mostafavi (m.mostafavi@bristol.ac.uk) with any informal enquiries.

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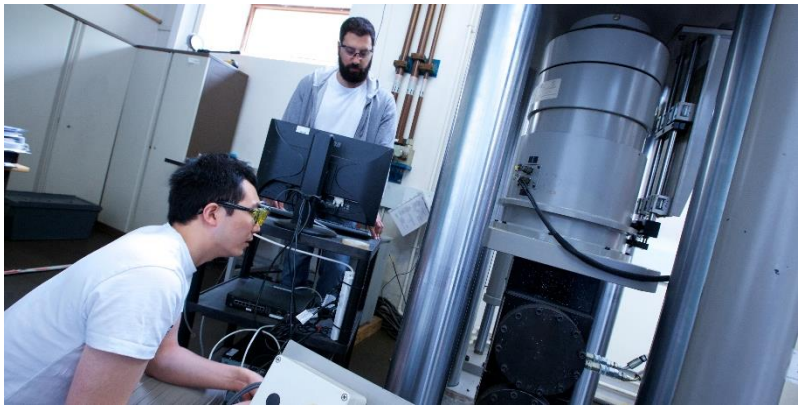

PhD Studentships in Nuclear Structural Integrity – Simulation and experimental validation of creep–fatigue interaction

Supervisor(s): Dr Mahmoud Mostafavi (UoB) and Dr Mike Gorley (UKAEA)

Sponsor(s): EPSRC and United Kingdom Atomic Energy Authority

Capitalising on the knowledge and expertise of long-term operation of high temperature reactors, the UK is well positioned to lead international efforts to design and build the high temperature components of a fusion reactor. However, the loading profile of a fusion reactor is different from that of a fission reactor. While a fission reactor experiences only a few hundred major cycles with long dwells in its lifetime, a fusion reactor is expected to see thousands of cycles a year. This will make the damage mechanism from which fusion reactor components suffer unique. This project is aimed at simulating this creep fatigue interaction using finite element modelling and validating the model using advanced experimental techniques.

Entry Requirements

The positions are open to candidates with a 1st or 2:1 first degree (and/or Masters) in Engineering, Materials Science, Physical Sciences or Mathematics.

Experimental and theoretical modelling projects are available; there is sufficient flexibility in the research programme so that candidates can shape research projects in line with their own interests in consultation with their supervisors.

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PhD Studentships in Nuclear Structural Integrity – Plasticity-induced damage in high temperature reactors

Supervisor(s): Professor David Knowles (UoB) and Dr Marc Chevalier (EDF Energy)

Sponsor(s): EPSRC and EDF Energy

Creep damage is the principal life limiting factor in the life of a thermal plant. In a plant the damage accumulates over decades but to study creep damage root-cause and effects in reasonable timescale, short term experimental testing (creep acceleration) is required.

Often creep is modified by other deformation processes of time-independent plasticity and this is also thought to influence damage evolution. Decomposition of creep damage from other damage processes in high stress creep tests, which incorporate a level of plasticity, is the focus of this project.

The project will employ advanced experimental techniques such as digital image correlation, electron backscattered diffraction and synchrotron X-ray diffraction. These will be combined with state-of-the-art modelling, including crystal plasticity finite element analysis.

Entry Requirements

The positions are open to candidates with a 1st or 2:1 first degree (and/or Masters) in Engineering, Materials Science, Physical Sciences or Mathematics.

Experimental and theoretical modelling projects are available; there is sufficient flexibility in the research programme so that candidates can shape research projects in line with their own interests in consultation with their supervisors.

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PhD Studentships in Nuclear Structural Integrity – Welded joints behaviour in high temperature reactors

Supervisor(s): Professor Chris Truman (UoB) and Professor David Dean (EDF Energy)

Sponsor(s): EPSRC and EDF Energy

Welded joints are one of most safety critical locations in a reactor structure. They are often prone to damage after decades of operation and can be considered to be one of the life-limiting factors in the UK's advanced gas cooled reactors. This is because of the complexities involved in a weld including the residuals stress, varying microstructure and their complicated geometry. The aim of this project is to identify the criticality of the stress concentration created at the interface of a welded joint through advanced experimental techniques such as Digital Image Correlation and synchrotron X-ray diffraction.

Entry Requirements

The positions are open to candidates with a 1st or 2:1 first degree (and/or Masters) in Engineering, Materials Science, Physical Sciences or Mathematics.

Experimental and theoretical modelling projects are available; there is sufficient flexibility in the research programme so that candidates can shape research projects in line with their own interests in consultation with their supervisors.

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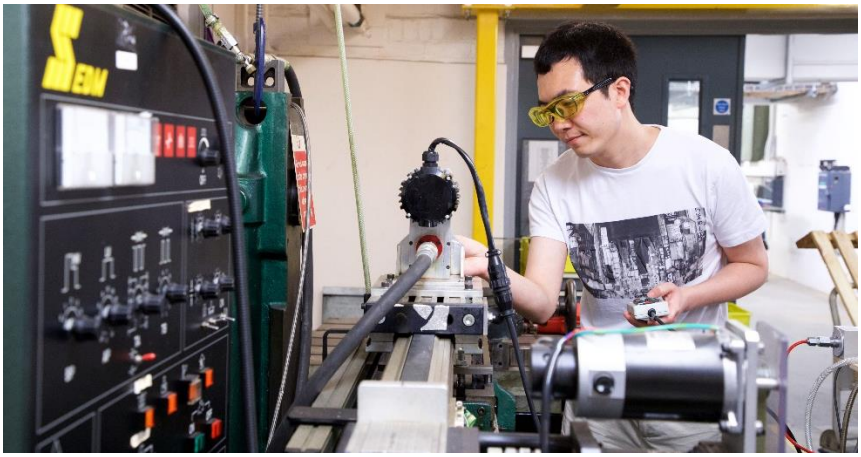

PhD Studentships in Nuclear Structural Integrity – Multi-scale mechanical stress in nuclear fuel cladding

Supervisor: Dr Harry Coules (UoB)

Sponsor(s): Nuclear Decommissioning Authority and National Nuclear Laboratory

Intergranular stress corrosion cracking (IGSCC) is an issue of interest in respect of the long-term storage of irradiated (spent) nuclear fuel from the UK's Advanced Gas-cooled Reactor (AGR) nuclear power plants. AGR fuel cladding is stainless steel; in order to underpin the long-term storage of this fuel underwater in purpose-built storage ponds, it is necessary to develop a better understanding of the influence of mechanical stress on IGSCC. This will be done by using a number of different methods and equipment, including well-equipped residual stress and microstructural characterisation laboratories at Bristol, as well as UK and international X-ray and neutron user facilities. Depending on the outcome of the experimental work, there may be opportunities to help develop stress measurement technology for deployment on real samples of spent fuel at the Sellafield nuclear site in Cumbria.

Entry Requirements

The positions are open to candidates with a 1st or 2:1 first degree (and/or Masters) in Engineering, Materials Science, Physical Sciences or Mathematics.

Experimental and theoretical modelling projects are available; there is sufficient flexibility in the research programme so that candidates can shape research projects in line with their own interests in consultation with their supervisors.

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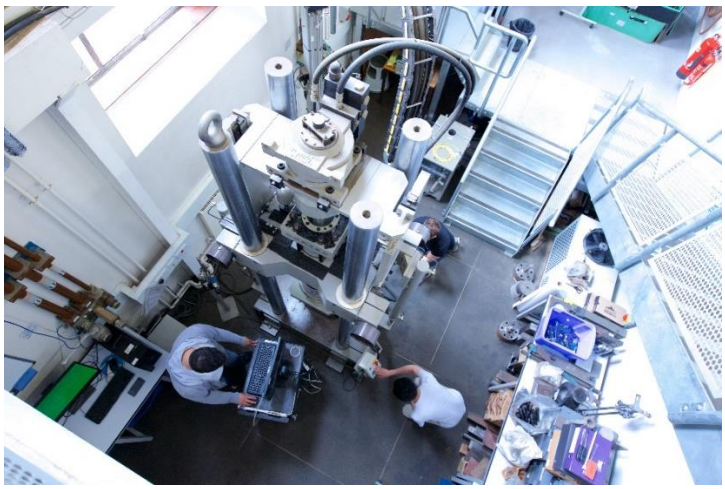

Solid Mechanics Research Group

The Solid Mechanics Research Group (SMRG), based in the Department of Mechanical Engineering at University of Bristol (UoB), has PhD positions available in the field of structural integrity for nuclear industry applications. These studentships provide an excellent opportunity to carry out research in close collaboration with industry supporting the low carbon energy sector in the UK.

The SMRG has a long-term research partnership with EDF Energy, who are responsible for operating the UK's Advanced Gas-cooled Reactor (AGR) nuclear power plants. This focuses on the behaviour of nuclear plant operating at high temperatures and has recently been extended for another 5 years, resulting in these new studentships becoming available. A related stream of research with UK Atomic Energy Authority (UKAEA) at Culham Centre for Fusion Energy has broadened SMRG's structural integrity activities to include nuclear fusion.

You will join a highly dynamic and well-resourced research group; you will receive excellent support for technical training and personal development and, should you want them, there are many opportunities for STEM outreach and public engagement. SMRG currently has nine academic staff and approximately twenty researchers (postdoctoral staff and research students). The group has substantial laboratory capabilities at Bristol, including the support of two full-time technicians. SMRG is also a regular user of international and UK central multiuser facilities such as Diamond Light Source and ISIS Neutron and Muon Source.

These PhD studentships offer an excellent platform for future career opportunities; many SMRG alumni have gone on to work in significant roles in academia and industry spanning a range of industrial sectors. SMRG is a key contributor to the UoB-led South West Nuclear Hub, which is gathering momentum in bringing about a step change in nuclear research, innovation and teaching activities across the wider south west region of the UK. This is an exciting time to be involved in nuclear industry-related activities at UoB and the structural integrity theme.

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