PhD Studentships in the Dept of Materials Science University of Cambridge

This document lists project studentships which are fully funded and usually available immediately. The majority are available to 'home rate fee' paying students only.

For other information, please contact:

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Please include a CV and state your project(s) of interest.

PhD Studentships

PhD Studentship ('home fees' rate): Study of semi-polar and non-polar nitride based structures for opto-electronic device applications

Non- and semi-polar nitride materials have potential application in polarised light emitting diodes for future display technologies. This project will aim to reveal the fundamental issues that control the optical properties of non-polar and semi-polar nitride structures, and hence to develop highly efficient polarised light emitters. As part of a multi-disciplinary team, the student will study the impact of the microstructure of the light emitters on their properties, with a particular focus on the impact of defects such as stacking faults and dislocations, and on the impact of the nanoscale structure of the quantum wells which form the active region of the devices. This studentship is available at the 'home' fees rate, for UK and EU residents only. For further information, contact Dr Rachel Oliver, rao28@cam.ac.uk.

PhD Studentship ('home fees' rate): A Multi-Microscopy Approach to the Characterisation of Nitride Semiconductors (MACONS)

It is anticipated that a studentship will be available in October 2011 under the MACONS project. The commercial market for electronic and optoelectronic devices based on nitride semiconductors is growing extremely fast, but the fundamental science underlying these devices is lagging behind. This proposal aims to explore the vital link between structure and properties in nitride materials, in order to reveal the limitations of current devices and to pave the way for new, improved technology. The key strategy of the MACONS project is to combine multiple microscopy techniques to develop a comprehensive understanding of nanostructures and defects in the nitrides, and to link these discoveries to nanoscale measurements of the optical and electrical properties. This will require a synergy of different techniques, ranging from techniques commonly used on metals (such as atom-probe tomography) to techniques which focus exclusively on semiconductors (such as scanning capacitance microscopy). It will also require the development of new approaches to the application of these techniques, to allow the same nanoscale regions of material to be assessed in multiple microscopes, so that the structure and composition of a specific nanostructure may be linked directly and unambiguously to its electrical and optical properties. Overall, the aim is to provide a much more complete picture of nitride materials science than has ever previously been achieved, and to apply this new understanding to engineering improved materials for nitride optoelectronic devices. The student will join a team enacting this exciting vision and will focus on scanning probe and scanning electron microscopy and on the characterisation of electrical and optical properties. (supervisor: Dr Rachel Oliver: rao28@cam.ac.uk)

PhD Studentship (Rolls-Royce): Coating compatibility in shroudless blades

Environmental degradation is the most serious issue for turbine blades designed without an interlocking end piece or 'shroud'. These blades are lighter and hence less highly stressed. Rare earth additions can made to improve the oxidation performance of the substrate alloy but these cause changes in the phase stability. This project is part of a larger study looking at the effects of these additions on all aspects of behaviour with the emphasis on the possible interactions with coatings added for environmental protection. Also 'abrasive coatings' are under development to increase the hardness of the tip of the

blade and cut a groove as the blade lengthens thus maintaining a good pressure seal between the blade and the casing. We already know that the addition of Yttrium and Lanthanum can make the alloy itself less stable with respect to the precipitation of 'TCP' phases and this is very likely to impact on the interaction of the substrate with the coating and the length of time that the coating is able to protect the blade. You will be working with the team developing these coatings and using advanced electron microscopy techniques to characterise the coatings and their interaction with the blade alloy during prolonged exposure. (supervisor: Dr Catherine Rae: cr18@cam.ac.uk)

PhD Studentship (Rolls-Royce): Toughness & dislocation motion in creep-resistant phases

The development of the new metallic alloys requires creep-resistant phases, ideally at high volume fractions. These are normally very brittle, particularly at intermediate temperatures, substantially reducing the toughness of the overall alloy. Changes in toughness are known to occur with composition changes and the aim of this project is to investigate why this occurs and whether it is associated with changes in plastic flow behaviour using the body-centred tetragonal Me5Si3 compounds, being used elsewhere in the Strategic Partnership. Toughness will be measured using an in-situ rig in the SEM, allowing crack tip plasticity to be studied in situ using techniques such as electron back-scattered diffraction. Dislocation motion will be studied using controlled atmosphere micropillar compression. (supervisor: Dr Bill Clegg: wjc1000@cam.ac.uk)

PhD Studentship (Rolls-Royce): Atomistic modelling of faulted superlattice structures

The deformation mechanism in nickel-base single crystal superalloys are very sensitive to small changes in composition. In particular the elements Ti, Ta and W have a strong effect where the dislocations penetrate the gamma-prime as combinations of matrix dislocations separated variously as APB pairs and other complex combinations involving partial dislocations and stacking faults. There is also strong experimental evidence from HAADF TEM that the intrinsic and extrinsic superlattice stacking faults are segregated with heavy elements in different and characteristic patterns. Experiments are in progress to identify the elements segregating to the faults using the Atom probe. In this project, atomistic modelling using a state-of-the art quantum mechanical method (Density Functional Theory) will be used to investigate and rationalise the effect of minor alloying changes on these faults and the dislocations which cause deformation. (supervisor: Dr Paul Bristowe: pdb1000@cam.ac.uk)

PhD Studentship ('home fees' rate): Electrochemical thermammetry of metal interfaces

A PhD studentship is available for three years to investigate the role of temperature in electrochemical and corrosion processes using cyclic thermammetry and associated methods. The basic technique is new. In addition to investigating the fundamental aspects, new methods are to be developed based on these procedures. The research will focus on the passive state of metals against corrosion, and breakdown of passivity leading to localised corrosion. The technique will also be used to develop quantitative electrochemical sensors, particularly in relation to foodstuffs. Applicants should have a degree in metallurgy, materials science, chemistry or chemical engineering, and have a keen interest in electrochemistry, corrosion and passivation, or interfacial processes generally. This is an opportunity to develop something entirely new in the field which is scientifically fascinating and potentially of direct technological application. The project is fully funded for students who meet the residency criteria for 'home rate' fees. Students classified as 'overseas' will need to provide an additional fee from their own resources. Expressions of interest should be addressed to Professor Tim Burstein: qtb1000@cam.ac.uk.

PhD Studentship ('home fees' rate, Dept. Of Earth Sciences): Nuclear Waste disposal: Long term durability of UK spent nuclear fuel

A 3.5-year PhD studentship is available from October 2011 in the Mineral Physics Group (Department of Earth Sciences) as part of a large consortium research project funded by the Nuclear Decommissioning Authority and the Research Councils Energy Programme to examine the suitability of UK spent nuclear fuel for direct disposal. The student will examine actinide solid-solubility and radiation resistance in uranium minerals produced during the corrosion of spent nuclear fuel. The student will use a range of analytical techniques and international facilities for creating actinide-doped and/or ion-beam damaged material. The successful candidate will have a good degree in materials science, physics, earth

sciences or chemistry and an interest in solving the nuclear waste problem.

The studentship is subject to EPSRC eligibility rules and consists of a stipend of £13,590 pa, the cost of fees at the home (EPSRC) level will be provided.

Interested candidates should contact Dr Ian Farnan (if203@cam.ac.uk) in the first instance, with a CV and e-mail addresses of 2 referees.

Cambridge University is an Equal Opportunities Employer and aims to achieve excellence in teaching and research.