PhD Studentships in the
Dept of Materials Science
University of Cambridge

This document lists project studentships which are fully funded and usually available immediately, if not then usually they are available from the start of the next academic year. The majority are available to ‘home rate fee’ paying students only.

For other information, please contact:
Dr Rosie Ward
Department of Materials Science and Metallurgy
University of Cambridge
27 Charles Babbage Road
Cambridge CB3 0FS

Tel:  +44 1223 331955
Email: remw2@msm.cam.ac.uk

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

Fully-funded PhD studentships

- PhD Studentship: Investigating Precious Metal Shape Memory Alloys
- PhD Studentship: Metallic glasses based on precious metals
- PhD Studentship: Towards Sustainable Plasmon-Enhanced Catalysis: Synthesis and Characterization of Earth-Abundant Plasmonic Nanoparticles
- PhD Studentship: Controlled Nanoscale Electrodeposition for Bimetallic Nanoparticle Synthesis
- PhD Studentship: Phase Change Kinetics in Chalcogenides for Devices
- PhD Studentship: Novel III-V materials for photovoltaic applications
- PhD Studentship: Neutron and synchrotron X-ray studies of local structure in metallic and intermetallic alloys

PhD projects for which funding is available from the Department on a competitive basis

- New oxide interface electronics
- Oxide memristors for next generation non-volatile memory in computing
- Three dimensional nanoscale structure of novel nitride materials and devices
- Time-resolved cathodoluminescence measurements of carrier drift and diffusion in semiconductors
- Structure-property relationships in nitride high electron mobility transistors
- Nitride materials and devices for transfer printing and heterogeneous integration

Fully-funded PhD studentships

PhD Studentship: Investigating Precious Metal Shape Memory Alloys

Supervisor: Dr N G Jones
Sponsor: The Worshipful Company of Goldsmiths
Starting date: April or October 2019
Length of studentship: 3 years (in the first instance)
Eligibility: UK/EU students only. Students liable for fees at the ‘overseas’ rate are not eligible.

Applications are invited for a PhD studentship investigating the transformational behaviour of precious metal containing shape memory alloys under the supervision of Dr Nicholas Jones, in the Department of Materials Science and Metallurgy at the University of Cambridge.

Shape memory alloys and materials that undergo related phenomena combine two key characteristic; being able to both sustain reasonable mechanical loads and offer functional behaviour through macroscopic movement. As a result, huge opportunities for these materials exist across a wide spectrum of industrial sectors but fundamental research is required to identify suitable alloy systems, understand their underlying behaviour and tailor their properties to a given application.

The shape memory world is dominated by binary NiTi alloys, which transform in the range of ~ 0 to 80°C. However, many potential applications require higher temperature capability, for example between 200 and 500°C, and so considerable effort has been spent investigating the effect of ternary additions on the transformation behaviour. Of the wide range of elements considered to date, only Hf, Pd and Pt achieved any significant elevating effect. However, little attention has been paid to higher order precious metal (PM) containing alloys and, there has also been relatively little information relating to potential PM-based alloys, despite some systems showing promise. As such, this project will enhance our understanding of theses alloys by investigating the influence of PM additions on transforming materials.

The research will require the preparation of selected compositions via vacuum arc melting followed by heat treatment. Alloys will be subject to detailed characterisation using scanning and transmission electron microscopy, differential scanning calorimetry and X-ray diffraction as well as an evaluation of their thermo-mechanical behaviour. It is also envisaged that the mechanics of their transformation behaviour will be studied in situ using high energy X-ray diffraction at international synchrotron facilities.
Applicants should have (or expect to be awarded) an upper second or first-class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for 'home rate' fees to be eligible for a studentship. The studentship is fully funded, covering fees and a tax-free stipend of at least £18500 per annum.

Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdmsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk). Informal enquiries may be made to Dr N G Jones by e-mail to ngj22@cam.ac.uk

PhD Studentship: Metallic glasses based on precious metals

Supervisor: Prof. A. L. Greer
Sponsor: The Worshipful Company of Goldsmiths
Starting date: April or October 2019
Length of studentship: 3 years (in the first instance)
Eligibility: UK/EU students only. Students liable for fees at the 'overseas' rate are not eligible.

Applications are invited for a PhD studentship within the Microstructural Kinetics Group in the Department of Materials Science & Metallurgy. The project focuses on the development and characterization of metallic glasses based on precious metals, particularly gold. Precious metals, in their usual polycrystalline form, have desirable properties for application in jewellery and electronics, but they are soft and lack scratch resistance. Metallic glasses have exceptionally high hardness and scratch resistance [1], and furthermore are susceptible to thermoplastic forming, rather like polymers [2,3]. It is now well established that precious metals can be the basis for glass-forming compositions [4], and that bulk glass formation (minimum dimension mm to cm) is possible. However, much remains to be done to explore the properties and potential applications of precious-metal glasses.

This project will be primarily experimental, but can involve atomistic modelling. It will focus on: the search for better glass-forming alloys; characterization of the structure and stability of the glasses, including the possibilities to obtain crystallized products that have good mechanical properties, and possibly decorative patterns; optimization of the mechanical properties; studies of chemical stability including tarnish-resistance.

Applicants should have (or expect to be awarded) an upper second or first-class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for 'home rate' fees to be eligible for a studentship. The studentship is fully funded, covering fees and a tax-free stipend of at least £18500 per annum.

Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdmsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk). Informal enquiries may be made to Prof. A. L. Greer by e-mail to alg13@cam.ac.uk

PhD Studentship: Towards Sustainable Plasmon-Enhanced Catalysis: Synthesis and Characterization of Earth-Abundant Plasmonic Nanoparticles

Supervisor: Dr Emilie Ringe
Sponsor: ERC
Start date: October 2019
Full studentship, available to ‘home rate’ fee payers only

Industries creating inorganic, organic, and agricultural chemicals use a staggering 4.2% of the worldwide delivered energy, mainly from unsustainable fossil fuels. Meanwhile, the sun provides energy that could be utilized to power photochemical reactions sustainably and cleanly. Recent advances revealing how localized surface plasmon resonances (LSPRs), light-driven electron oscillations in metal nanoparticles, can concentrate light at the molecular scale made the dream of efficient photochemistry one step closer [1-3]. However, plasmonic materials are almost exclusively constructed from the rare and unsustainable metals Ag and Au. In addition to being incompatible with current industrial practices relying on catalytic surfaces to lower energy barriers and guide reactions, Ag and Au cause prohibitive cost challenges for real-world applications. But there is hope: several of the few metals predicted to sustain LSPRs and become potential alternatives to Ag and Au are amongst the most abundant, i.e. sustainable, elements on Earth (Al, Mg, Na, K).

The plasmonic behavior of Al has been experimentally demonstrated over a decade ago, and created a new era for high energy plasmonics. Last year, we have published the first report on the plasmonic properties of colloidal synthesized Mg nanoparticles [4] and envision a plethora of discoveries and applications for this exciting new materials.

The goal of this project is to unravel and control the fundamental plasmonic properties of magnesium nanoparticles and decorated nanoparticles. As this is a completely new tool in the plasmonics toolbox, questions to answer range from very fundamental (how do we control particle shape?) to very applied (how does the plasmon-enhanced reaction rate vary with decoration by a platinum-group metal?).

A background in materials science, chemistry, experimental physics or closely related disciplines is required, however previous experience on plasmonic nanostructures is not. The student selected for this project will be trained on air-free chemical techniques, optical spectroscopy, and electron microscopy, and join a growing interdisciplinary group. Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) and should be eligible for ‘home rate’ fees.


For more information contact Emilie Ringe (er407@cam.ac.uk)

Application forms and the Graduate Studies Prospectus are available from the Graduate Admissions Office at https://www.graduate.study.cam.ac.uk/. Further information on the application process is available from Rosie Ward (remw2@cam.ac.uk).

PhD Studentship: Controlled Nanoscale Electrodeposition for Bimetallic Nanoparticle Synthesis

Supervisor: Dr Emilie Ringe
Sponsor: ERC, ‘home fee’ EU/UK nationals only
Start date: October 2019
Full studentship, available to ‘home rate’ fee payers only
Combining the light-harvesting power of plasmonics and the favorable surface chemistry of catalytic metals provides exciting opportunities to create multifunctional NPs that enhance and control light-driven chemistry. Recently, work on new Al/Pd plasmonic-catalysts hybrids has been published [1], followed by the expansion of these solution-based syntheses to 8 different transition metal clusters, providing exquisite composition flexibility for multifunctional nanoparticles [2]. However, these synthetic approaches provide little control over the distribution of catalytic metal on the plasmonic particles owing to their essentially random nucleation and aggregation.

In this project, we aim to use electrodeposition, aka electroplating, as a new nanoscale surface synthesis tools capable of achieving a superior control over surface composition. This will readily provide multifunctionality to nanostructures, for applications in plasmon-enhanced catalysis and beyond. Specifically, metals will be electrochemically deposited onto plasmonic nanoparticles supported on a conductive substrate, and we will study how electrochemical behavior changes at the nanoscale due to undercoordination and plasmonic effects. The optical properties of the particles undergoing this driven electrochemical reaction will be tracked in-situ using single particle spectroscopy [3-4], while the deposition specificity will be analyzed using atomic resolution electron microscopy and spectroscopy.

The results of this work will provide new tools for particle synthesis, as well as new fundamental understanding of how crystallographic orientation and undercoordinated sites (such as corners and edges) affect the surface electrochemical potential in nanoparticles will be unraveled, answering fundamental questions and providing guidance in the design of complex surface composition patterns. The understanding of the surface deposition control achieved with electrochemistry, and of nanoscale effects in electrodeposition, will unlock a new synthetic toolbox for the manipulation and fabrication of multifunctional NPs for sensing and catalysis. Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) and should be eligible for ‘home rate’ fees.


For more information contact Emilie Ringe (er407@cam.ac.uk)

Application forms and the Graduate Studies Prospectus are available from the Graduate Admissions Office at https://www.graduate.study.cam.ac.uk/. Further information on the application process is available from Rosie Ward (remw2@cam.ac.uk).

PhD Studentship: Phase Change Kinetics in Chalcogenides for Devices

Sponsor: Micron Foundation
Supervisor: Prof. A. L. Greer (alg13@cam.ac.uk)
Starting date: October 2018
Eligibility: UK/EU students only. Students liable for fees at the ‘overseas’ rate are not eligible.

Applications are invited for a PhD studentship (funded for 3 years in the first instance) within the Microstructural Kinetics Group in the Department of Materials Science & Metallurgy. The project focuses on chalcogenide materials (e.g. Ge$_2$Sb$_2$Te$_5$) of interest for phase-change memory (PCM). In this technology a sub-micrometre memory cell is switched reversibly between glassy and crystalline states by applying short (~10 ns) electrical pulses. The glassy state has a higher resistivity than the crystalline;
the state of the cell is thus easily detected. PCM has several advantages for memory, in particular its scalability — the prospect to achieve higher data-storage densities [1].

The project focuses on the kinetics of the crystallization of the chalcogenides, as this is the rate-limiting step for memory performance. We have shown that the kinetics can be studied in detail using ultra-fast differential scanning calorimetry [2], a now widely applied technique. The crystallization kinetics can deviate markedly from Arrhenius temperature dependence [3,4], and the project will examine how the extent and nature of this deviation depends on the chalcogenide system and on its processing. The project will also consider how the deviation must influence PCM switching and device performance [5], and will look toward future systems, possibly metallic [6].

Applicants should have (or expect to be awarded) an upper second or first-class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry,) and should be liable for 'home rate' fees. The studentship is fully funded, covering fees and a tax-free stipend (currently set at £14,777 per annum).

Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk). Informal enquiries may be made to Prof. A. L. Greer by e-mail to alg13@cam.ac.uk


PhD Studentship: Novel III-V materials for photovoltaic applications

Sponsor: EPSRC PhD studentship – see below for exact detail of the award available
Supervisor: Dr Louise C. Hirst, Department of Materials Science
Start date: October 2018

The space industry has expanded rapidly in recent years, driven by a boom in demand for satellite bandwidth and new capabilities. Many aspects of modern life including agriculture, emergency services and individual mobile connectivity are dependent on space technologies to provide ubiquitous functionalities such as communications, navigation, precision timing, meteorological data and real-time imaging. Space technologies are primarily powered by photovoltaic (PV) solar cells, most of which are III-V multi-junction devices. These devices have high solar energy conversion efficiency and reasonable tolerance to harsh radiation environments found in space, compared with other materials such as silicon. However, satellite services and the scope of space missions are still limited by the restrictions of the PV power supply.

In theory, the bandgap and band alignment design space offered by novel quaternary III-V alloys enables enhanced solar energy conversion efficiency of multi-junction devices, however, in practice the growth of these alloys is extremely challenging, due to the immiscibility of constituent components, which leads to inhomogeneities in the solid, severely degrading optical and electrical properties.
Understanding these effects is the first step towards mitigating them and this studentship would focus on the characterization of these novel alloys by integrating nanoscale imaging and ultra-fast luminescence techniques, with computational analysis to determine the atomic arrangement of the solid and map the transport of photogenerated carriers. In this way, material properties can be re-engineered to improve device performance and enable new functionality.

The minimum academic requirement for admission is an upper second class UK honours degree at the level of MSci, MEng, MPhys, MChem etc, or a lower second with a good Master's, (or overseas equivalents) in a relevant subject.

The studentship provides a maintenance grant at the minimum Research Council UK rate and tuition fees at the UK/EU rate for students who fully satisfy the residence requirements of the UK Research Councils. A fees-only award will be available to EU nationals who are not ordinarily resident in the UK. Students who are liable for fees at the ‘overseas’ rate are not eligible for these studentships.

An on-line application form is available at https://www.graduate.study.cam.ac.uk/. Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

Informal enquiries may be made to Dr Louise Hirst by email to lh619@cam.ac.uk

**PhD Studentship: Neutron and synchrotron X-ray studies of local structure in metallic and intermetallic alloys**

Sponsor: fully funded for a UK student and will run for up to four years from October 2018.
Supervisor: Dr Howard Stone (hjs1002@cam.ac.uk)

Applications are invited for a PhD studentship studying the local structure in metallic and intermetallic alloys using neutron and synchrotron X-ray scattering. The studentship is fully funded for a UK student and will run for up to four years from October 2018. It will be co-located between the Rolls-Royce University Technology Centre in the Department of Materials Science and Metallurgy at the University of Cambridge and the ISIS Neutron Source at the Rutherford Appleton Laboratory in Oxfordshire.

The majority of commercially available alloys rely on solid solution strengthening, by which atoms of different size are embedded within and distort the crystal structure, in order to improve the alloy’s mechanical properties. Historically, it has been assumed that solid solutions contain a random mixture of the constituent elements. However, this is an oversimplification and regions of short-range order may form under certain conditions that can have an enormous influence on material properties. Despite its importance, such short range order is rarely characterised, owing to the challenges in performing the necessary experiments and analysing the data.

Recently, total scattering, a powder-diffraction based technique in which both Bragg and diffuse scattering are measured and analysed simultaneously, has been developed to provide detailed measurements of short-range order in alloys. This PhD studentship will build upon this research to study local order in solid solutions, precipitation of superlattice compounds and order-disorder transitions in alloy systems. The research will require the development of the existing tools to enable the analysis of systems containing preferred crystallite orientations and multiple phases. This will require the creation of simple programs (using, for example, Python or Fortran). In parallel, experimental studies of alloys will be performed using international neutron and synchrotron facilities. These will initially focus on studying model alloy systems, before extending these techniques to commercial alloys with more complex chemistries. In addition to neutron and synchrotron X-ray scattering, this work will also require metallurgical sample preparation and both scanning and transmission electron microscopy.

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant science subject (Physics, Chemistry, Materials Science) and should meet the EPSRC criteria for UK/EU residency and liability for ‘home rate’ fees (<https://www.epsrc.ac.uk/skills/students/help/eligibility/>)) to be eligible for a studentship.
Application forms and the Graduate Studies Prospectus are available from the Board of Graduate Studies web site and copies of these documents are available via www.admin.cam.ac.uk/univ. Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

Informal enquiries may be made by email to either Dr Howard Stone (hjs1002@cam.ac.uk) or Dr Helen Playford (helen.playford@stfc.ac.uk).

**PhD projects for which funding is available from the Department on a competitive basis**

**New oxide interface electronics**
In the last few years, there have been very exciting reports about the new functional properties which can be achieve at the interface between oxide films, e.g. there is the possibility to achieve new kinds of fast, energy efficient semiconductor processors and even possibly room temperature superconductors. This project involves exploring such phenomena. It will involve growth of ultrathin, single crystal thin films using a world leading, state-of-the-art advanced pulsed laser deposition system with in-situ diagnostic tools (XPS, UPS), followed by their measurement using a variety of means including electrical measurements, synchroton studies, and atomic force microscopy (scanning probe) techniques.

For further information contact Prof J Driscoll (jld35@cam.ac.uk).

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for 'home rate' fees to be eligible for a studentship from the Department. Other competitive studentship schemes available to overseas fee paying students, deadline 5 December 2018, are described at https://www.graduate.study.cam.ac.uk/finance/funding/graduate-funding-competition.

Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdmsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

**Oxide memristors for next generation non-volatile memory in computing**
Non-volatile memory (NVM) is critical for all aspects of modern computing, as well in future generation digital technologies like the Internet of Things (IoT) and neuromorphic computing—technologies that will penetrate into many realms of society. Among NVM technologies, resistive random access memory (RRAM) based on metal oxide (MO) films as the resistive switching (RS) layers has the potential of high-speed, low operation voltage, low power consumption, and good endurance that enables the highest performance at the lowest cost possible. There are a number of challenges which need to be addressed with these materials, relating to their nanostructuring and composition. We have solved these problems in a model system and now wish to take this forward to more simple systems. This project will develop such systems. We will collaborate with a number of groups on testing and implementation of industry prototypes.

For further information contact Prof J Driscoll (jld35@cam.ac.uk).

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for 'home rate' fees to be eligible for a studentship from the Department. Other competitive studentship schemes available to overseas fee paying students, deadline 5 December 2018, are described at https://www.graduate.study.cam.ac.uk/finance/funding/graduate-funding-competition.
Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdmsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

**Three dimensional nanoscale structure of novel nitride materials and devices**
The Cambridge Centre for Gallium Nitride is developing a range of photonic devices which exhibit complex three-dimensional structure. These include micro- and nano-cavities for the confinement of light and the exploration of light-matter interactions. Furthermore, we are developing nanoporous gallium nitride and incorporating it into a range of photonic architectures. For these photonic device developments to succeed, it is vital that we fully understand the three-dimensional (3D) structure of these materials and devices at the nanoscale, and this represents an exciting and challenging microscopy problem. In this project, the student will develop characterisation techniques based on focused ion beam microscopy and transmission electron microscopy which provide detailed quantitative insight into the 3D structures of such devices. The structural insights will be incorporated into models of materials and device properties to understand what structural factors enhance or limit the performance of photonic devices and to drive the future development of improved fabrication techniques.

For further information contact Prof RA Oliver (rao28@cam.ac.uk).

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for 'home rate' fees to be eligible for a studentship from the Department. Other competitive studentship schemes available to overseas fee paying students, deadline 5 December 2018, are described at https://www.graduate.study.cam.ac.uk/finance/funding/graduate-funding-competition.

Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdmsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

**Time-resolved cathodoluminescence measurements of carrier drift and diffusion in semiconductors**
Time-resolved cathodoluminescence imaging in the scanning electron microscope is an exciting new technique for assessment of the properties of light emitting materials at the nanoscale. It gives access to the time-scales on which the process of light emission occurs, down to resolutions of a few tens of picoseconds, whilst providing a spatial resolution down to about 10 nm. In this project, we plan to extend this astounding capability still further by developing methods to allow the measurement of carrier diffusion lengths and drift velocities and the impact of local nanoscale features such as defects on these processes. The aim is for the project to assess a range of semiconductor materials, starting by using materials whose properties are well known and whose diffusion lengths are relatively large as a test system for the new technique. Thereafter – having validated the technique - the student will apply the same methodology to poorly understood semiconductor systems and push the limits of its resolution in materials with short diffusion lengths.

For further information contact Prof RA Oliver (rao28@cam.ac.uk).

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for 'home rate' fees to be eligible for a studentship from the Department. Other competitive studentship schemes available to overseas fee paying students, deadline 5 December
Applications can be made on-line via
http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

**Structure-property relationships in nitride high electron mobility transistors**

Power switching devices based on gallium nitride have the potential to offer much greater efficiency than well-established silicon-based devices and to handle higher powers. However, the performance of such devices is limited by the defects and inhomogeneities arising in the nitride materials on which they are based. Device processing and the overall device architecture are also key to achieving optimal device characteristics. This project will use a range of microscopy techniques including electrical characterisation in the atomic force microscope, cathodoluminescence in the scanning electron microscopy and advanced transmission electron microscopy to explore the vital structure property relationships in nitride high electron mobility transistors intended for power switching applications. A range of device architectures will be addressed including devices transferred from their original substrates onto diamond heat sinks to reduce the negative impacts of device heating on performance.

For further information contact Prof RA Oliver (rao28@cam.ac.uk).

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for ‘home rate’ fees to be eligible for a studentship from the Department. Other competitive studentship schemes available to overseas fee paying students, deadline 5 December 2018, are described at https://www.graduate.study.cam.ac.uk/finance/funding/graduate-funding-competition.

Applications can be made on-line via
http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

**Nitride materials and devices for transfer printing and heterogeneous integration**

The rapidly developing technique of transfer printing on the micro and nanoscales allows the manufacture of high quality, high performance devices on a wide range of substrates in almost any location. This highly versatile capability features a high-precision mechanical pick-and-place assembly technique that utilises the adhesive properties of soft stamps. In the context of nitride devices, micro-transfer printing has recently delivered micro-LED arrays that feature in flexible displays and provide inorganic analogues of flexible organic light-emitting diodes (OLEDs) - something that was previously thought to be extremely challenging if not impossible. However, to optimise devices and systems based on transfer printing of nitride materials, it is necessary to both optimise the nitride material for separation from its original substrate and optimise the device design so that its performance is unaffected or even improved by its integration into a heterogeneous system. This project will explore both the development of materials which allow the transfer printing of a wide range of different nitride devices, both electronic and optoelectronic, and the design of those devices to achieve enhanced performance.

For further information contact Prof RA Oliver (rao28@cam.ac.uk).

Applicants should have (or expect to be awarded) an upper second or first class UK honours degree at the level of MSci, MEng (or overseas equivalents) in a relevant subject (Materials Science, Physics, Chemistry) and should be liable for ‘home rate’ fees to be eligible for a studentship from the Department. Other competitive studentship schemes available to overseas fee paying students, deadline 5 December
2018, are described at https://www.graduate.study.cam.ac.uk/finance/funding/graduate-funding-competition.

Applications can be made on-line via http://www.graduate.study.cam.ac.uk/courses/directory/pcmmpdsm.

Further information on the application process is available from Dr Rosie Ward (remw2@cam.ac.uk).

*The University of Cambridge and the Department of Materials Science & Metallurgy value diversity and are committed to equality of opportunity.*