Diamond Science and Technology MSc

Full-time Taught Masters Programme
2016-17
The University of Warwick

The success and reputation of the University of Warwick lies in a unique blend of entrepreneurial spirit and commitment to absolute academic excellence.

Warwick's International Community contributes greatly to the vibrant, cosmopolitan atmosphere on campus. With over 100 different nationalities represented you will be working and living with people from all over the world.

Accommodation consists of modern, comfortable rooms on campus, mostly en-suite and with high-speed internet and network access. Residences are set in pleasant parklands close to all the campus facilities.

Warwick's Students' Union is one of the largest in the country with over 250 societies to choose from. Student events such as ‘one world week’ are internationally recognised and mirror the University’s reputation for innovation and dynamism.

Warwick Sport provides every opportunity for you to try something new or compete in your sport. It offers over 70 different sports clubs, a swimming pool, gym, indoor climbing wall, all-weather tennis courts, 60 acres of outdoor playing fields and much more.

Warwick Arts Centre houses two theatres, a cinema, a 1,400 seat concert hall, the Mead Art Gallery, and a specialised music centre. It is nationally recognised as an outstanding venue for both famous and new artists.

The International Office provides a wide range of services for both prospective and current students, including immigration advice, welfare support and an orientation programme for those new to the UK.

Warwick University's Campus is an award-winning 700 acre, self-contained campus in the heart of England yet just one hour from London. With fantastic facilities and excellent access to local towns, cities and countryside, it provides an attractive, safe and supportive environment in which to live and study.
The Library holds over 1 million printed titles and 16,000 electronic journals and offers outstanding resources. The University’s acclaimed ‘Learning Grid’ provides a 24/7 relaxed learning environment with an impressive range of multimedia equipment.

Warwick Careers Service gives students a real head-start in their job searches. Voted by students as the best in the country, the careers service provides outstanding guidance and support. Warwick University is widely recognised by employers as an ideal recruiting ground.

Language Support is offered by The Centre for Applied Linguistics. The Programme in English for Postgraduate Studies (PEPs) prepares students in academic English over 1, 2 or 3 terms. Six or ten week pre-sessional English courses may also be offered if you narrowly miss the English language criteria for Master’s study.

Worship is encouraged by the multi-faith Chaplaincy which welcomes all members of the University community. It is home to Christian, Jewish and Muslim chaplains who, as a valued part of the University’s welfare network, offer spiritual and emotional support.

A member of the Russell Group, Warwick has consistently been ranked within the UK ‘top ten’ and is positioned within the top 50 universities in the world.
About the Diamond Science and Technology MSc

The success and reputation of Masters study at Warwick is measured through track record; attracting the very best students for over ten years and having world leading academics in their fields.

General Overview
Following a significant investment from EPSRC, the Diamond Science and Technology Centre for Doctoral Training is the world’s first postgraduate training centre in Diamond Science and Technology. The centre brings together world leading academics drawn from eight universities across the UK, including Aberystwyth, Bristol, Cardiff, Imperial, Oxford, Newcastle, Strathclyde and Warwick.

The Diamond Science and Technology MSc takes place at the University of Warwick and is delivered by experts in diamond science and technology drawn from eight leading universities, and a number of industrial partners. Students will gain hands-on experience of a range of techniques and technologies available in research and commercial facilities, providing them with the transferable skills required to succeed in a rapidly changing field.

This comprehensive training package provides students with a skill set to exploit the unrivalled multi-functional properties of diamond, equipping them with expertise in materials synthesis, electronics, optics, photonics, quantum technologies, mechanics, modelling, defects and device engineering. Such skill sets are fundamental to many key industries both national and international.

Learning Style
The Diamond Science and Technology MSc comprises ten taught modules, covering a wide range of themes, and one twenty week or two ten-week research projects. Each module is typically taught over a two-week period and includes a blend of lectures, workshops and practical classes.

Assessment
Performance in modules is assessed by both module assignments and post module examinations. The research components are assessed through a poster presentation and written report.

The Diamond Science and Technology MSc is delivered by internationally leading experts from the UK diamond community, as well as guest lectures from national and international experts in diamond and related fields.
Diamond Science and Technology MSc Overview

Our integrated and flexible portfolio of modules is designed to give students the theory, experience and problem solving skills required to succeed in a rapidly changing field.

The academic programme is both highly challenging and rewarding. Innovative teaching methods are used to ensure our students engage practically with their studies and are well equipped on graduation to apply this training to real world scenarios.

The Diamond Science and Technology MSc is structured so that each student takes a combination of ten taught modules and completes two 10 week, or one 20 week research project.

Help at hand
A personal tutor is assigned to you from the outset of your MSc, whose role is to provide general academic advice on: (i) progress/development; (ii) pastoral/non-academic matters; (iii) assist you with induction and orientation into university life at Warwick; and (iv) a range of other advice from course changes to financial and accommodation issues.

Modules
Modules consist of nominally 30 hours of directed tuition usually delivered in an intensive, fully immersive block. A variety of innovative teaching methods are used to maximise learning and ensure students are well equipped to apply their knowledge in the work place on completion of the course.

Core modules are compulsory and relate specifically to the Diamond Science and Technology MSc.

Research Projects
Research projects on the Diamond Science and Technology MSc are proposed by members of staff from across the consortium of universities and industrial partners associated with the centre. Projects cover a range of topics, from material characterisation and processing to applications. Industrial students sponsored by an employer can elect to undertake two ten-week research projects or one twenty-week research project, to suit their own and their company’s needs. The projects are carried out either at one of the partner universities or at the sponsoring company, after completion of the taught modules.

Additional costs will be covered by the student or sponsoring company.
Diamond Science and Technology MSc Modules

Core Modules

CH976 Novel and Efficient Methods of Material Synthesis
Students will gain a working knowledge of a range of advanced materials in use by UK science and technology industries, with an emphasis on diamond. The properties, fabrication processes and applications of these materials will be discussed. A visit to Element Six’s Global Innovation Centre at Harwell, is included.

PX904 Properties and Characterisation of Materials
This module provides an overview of important material properties, with a focus on three-dimensional crystals. Students will develop (i) an awareness of quantum mechanical theory of electronic structure and its role in determining material properties and (ii) an understanding of the electronic, mechanical, thermal, optical and magnetic measurements that can be used to investigate the properties of a material.

PX905 Defects and Dopants
This module covers the identification of intrinsic defects, dopants and impurities in semiconductors and insulators with a specific focus on diamond. Once the different types of defects have been introduced, characterisation techniques and the information they reveal on defect properties, will be discussed.

CH977 Computational Theoretical Material Modelling
In this module, students will be taken from the basic principles of bonding at the atomic scale, through molecular and crystalline systems, arriving at the macroscopic system in terms of elastic properties, implantation damage and electronic devices. Through a combination of theory presented in a lecture context and practical applications of computational simulation, the students will review the most commonly used theoretical approaches to modelling materials, and develop an understanding of the advantages and disadvantages of each method.

PX906 Manufacturing for Future: Industrial Diamond
This module introduces the students to polycrystalline diamond (PCD) composites and related materials, high pressure-high temperature synthesis and the importance of defects. The machining characteristics of PCD will be discussed along with tool fabrication, machining trials, wear and failure mechanisms.

CH978 Interfaces and Coatings
The focus of this module is surface-specific characterisation methods widely applied in research and industrial laboratories. The emphasis is on diamond surfaces, but the techniques discussed are relevant to other structurally related materials such as Si, Ge, III-V, II-VI semiconductors and the surfaces of other semiconductors, insulators and metals. A visit to the Diamond Light Source at Harwell, is included.

CH979 Device Fabrication and Processing
This module aims to cover the basics of clean room technologies and device fabrication. The specifics of diamond processing will be addressed in context with silicon technologies. Operation of basic semiconductor devices will be explained.
Diamond Science Modules

PX907 Photonics and Quantum Technologies
Students will achieve a basic grounding in the physics and application of diamond to photonics and quantum devices. They will learn about principles of operation; advantages and challenges of diamond; device design and manufacture. They will gain practical experience in optics and spintronics experiments, and in finite element modelling of relevant optical systems.

CH980 Applications of High Performance Materials
This module aims to promote an appreciation for the wider context of diamond science and technology: the applications, the alternative materials, and the competitor technologies. Students will be encouraged to collate and critically analyse a body of scientific work and practice presenting this information to a variety of audiences. During the course of the module, students will be exposed to seminars from world-leaders in both academic and industrial diamond science and technology and related fields.
Diamond Science Modules

Elective Modules

**CH914 Electrochemistry & Sensors**
This module provides a grounding in the fundamentals of electrochemistry, electroanalytical techniques and sensor technology. The module encompasses potentiometry, voltammetric and amperometric techniques, microfluidic devices, lab-on-a-chip methods, and electronic noses and tongues. The course draws on Warwick’s major strengths in this area and covers developments in ion selective electrodes, electrode kinetics, mass transport and key techniques, such as linear sweep and cyclic voltammetry, hydrodynamic electrodes, stripping voltammetry, ultra-microelectrodes and array devices.

**PX908: Biomedical Optics and Applications**
This module aims to provide students with a basic understanding of biomedical optical imaging and spectroscopy and an understanding of the potential biomedical applications of diamond. Students are introduced to a variety of optical microscopy techniques including wide-field, confocal, fluorescence and advanced optical microscopy. Tissue optics (absorption, scattering, spectroscopy), imaging in biological tissue (OCT, multi-photon) and an overview of labels and probes for optical imaging will also be discussed.

Research Project

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Example projects include:
- Superconducting diamond growth for quantum bits
- Accurate electronic structure calculations of diamond: quantum dots and defect energies
- Investigations of catalytic and optical behaviour of nanodiamond aerosols and thin aerosol films
- Experimental and computational studies of CVD diamond growth
- Optical properties of large-area CVD diamond
After you graduate

The diverse skills-set that you acquire during your Masters Course will help shape your career. Former graduates have secured PhD studentships or positions within industry, the latter leveraged by our strong industrial links with some of the leading chemical companies.

Finding a job

Our greatest resource is the knowledge and network base of our world leading academics, which they have built over many years. They will provide you with guidance in making sure you utilise your skills-set to your fullest potential. The well established links with leading research groups, both in the UK and worldwide, along with the strong links with chemical and pharmaceutical industries will ensure that a career path in academia or industry is well within your grasp. Our academics will assist you in many aspects of career advice including preparing your CV to providing you with practice interviews. Our track record of success speaks for itself!
“I like that Warwick is a spread out campus, and quickly found myself booking tickets to events held at the Arts Centre. Aside from the lovely campus, I felt at home in the lecture room and secure in the knowledge that if I found a topic challenging, I could revisit the lecture through the electronic resources that day.”

Phil Diggle
2015 Graduate
Entry Requirements and Application

Warwick is a world class university that will provide you with a qualification that is recognised internationally. While our standards are very high, we encourage you to contact us to discuss your potential study with us.

Entry Requirements
Admission onto the Diamond Science and Technology MSc programme requires at least a British Second Class Honors Degree or Overseas equivalent. The Diamond Science and Technology MSc programme requires a physical sciences background but candidates from other disciplines may also be considered - please feel free to contact us if you have any questions.

English Language Requirements
Non-native speakers of English must satisfy the English language requirements:
- IELTS 6.5*
- PTE (Pearson) 62*
- Three years of UG study in an English speaking country
*minimum element scores apply

Course Duration
- 12 months duration
- Start date: 26 September 2016

How to Apply
Applications are made online at: www2.warwick.ac.uk/pgapply

The cost of a single application is £50.

The following supporting documents are required:
- Academic transcripts and certificates
- Two academic references
- English language qualifications

Tuition Fees (2016-17)
- UK and EU fee payers £7,780
- Overseas fee payers £22,340
- New PGT loans information at: www.warwick.ac.uk/chemistry/masters/fees

Scholarships
The Department of Chemistry will be awarding scholarships for the October 2016 intake. For more details, www.warwick.ac.uk/chemistry/masters/fees

Contact us at: DST.admin@warwick.ac.uk

Prof Julie Macpherson
Diamond Science and Technology Course Director

Dr Claire Hurley
Diamond Science and Technology Teaching Fellow

Yasmin Kosar
Diamond Science and Technology Course Administrator
Getting to Warwick

Warwick is located in central England, making it easy to reach by road, rail or air. Public transport links are plentiful, with bus stops across campus, train stations a short distance away and a national coach service operating close to our campus.

- 1 hour to London by train
- Nearest airport: Birmingham International 20 minutes
- Nearest train: Coventry
Getting in touch

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