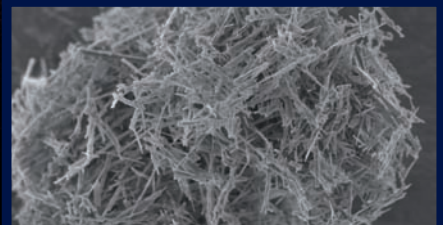
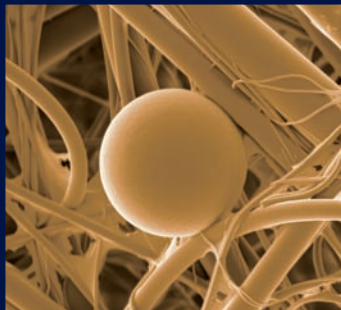
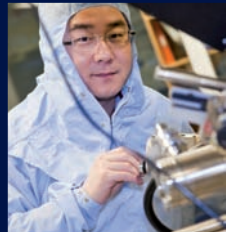
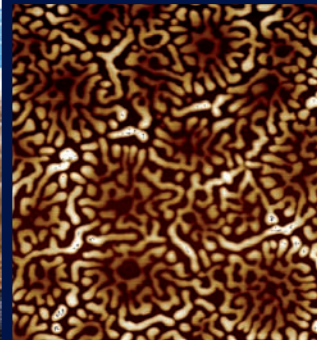
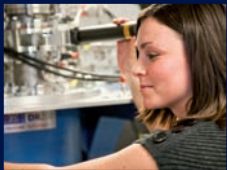


nanofolio

The Universities of Leeds and Sheffield
Nanotechnology Education Portfolio

Masters courses in Nanotechnology



The nanotechnology revolution

Nanotechnology is one of the newest and fastest growing areas in science and engineering. It is both controversial and exciting, and it is undoubtedly going to affect the way we live in the 21st century



Nick Hardman

Nick Hardman completed his MSc in Nanoelectronics and Nanomechanics in 2007. He now works for AGR Automation, based in Arbroath in Scotland. His role as a software engineer involves writing code to integrate manufacturing technology such as vision guided robots, rotary or linear drive based transport systems and feeding technology.

Nanotechnology brings together electronics, physics, chemistry, biology, and materials science to create new functional systems of nanoscale dimensions, offering new possibilities in electronics, medicine, and information technology, alongside more mundane but equally fascinating improvements in cosmetics, coatings, fabrics, and lubrication. The technological challenges range from finding out how nanoparticles can improve sun cream and how nanostructured surfaces can keep clothes clean, to learning how the revolutionary steps in quantum computing, smart drug delivery, and information storage may be achieved.

Governments across the world are investing in nanotechnology to harness its opportunities whilst making sure that the risks can be controlled. The challenge of nanotechnology lies in its interdisciplinary nature. To rise to this challenge, the world needs trained scientists to cross the traditional boundaries of disciplines. If you are ready to face the challenge of expanding your knowledge from your current discipline to another, then the Universities of Leeds and Sheffield offer a course tailored for you.

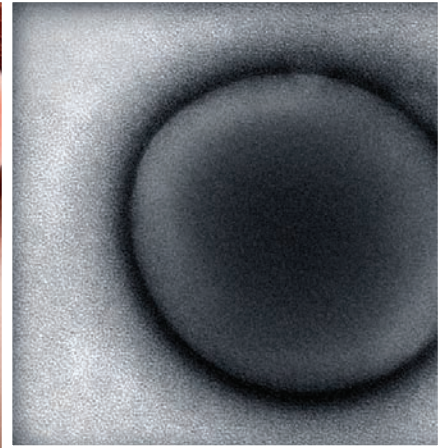
The Universities of Leeds and Sheffield are two of the world's leading research-based universities for nanoscience and nanotechnology, and different departments and faculties are collaborating to bring you this unique course portfolio, to allow you the opportunity to learn the skills needed to influence the technological direction of the world we live in.

By offering a split site portfolio you benefit from the best that these two great universities have to offer, with greater choice of projects, different teaching environments, and access to more teaching, research, and social facilities than you would get at one university.

Our credentials

The MSc courses outlined in this brochure are run jointly by the Universities of Leeds and Sheffield. Both universities are internationally acknowledged as pioneers in nanotechnology education. Together we deliver a portfolio of masters training in nanotechnology called Nanofolio.

The Universities of Leeds and Sheffield are recognised world-wide for the quality of their teaching and research. Both are members of the elite Russell Group of UK research-led universities. All the departments taking part in these MSc



programmes are recognised for their internationally leading research according to the UK's independent research assessment exercise (2008). This expertise feeds directly into our research-led MSc programmes.

The combined reputations of two world-class universities mean that our graduates are in demand by companies and research institutions throughout the world.

State-of-the-art facilities

The University of Sheffield houses the UK Central Facility for III-V semiconductor growth. Sheffield and Leeds both have state-of-art clean rooms for nanotechnology processing, with equipment including electron beam and photolithography, focused ion beam processing, pulsed laser deposition, as well as dedicated laboratories for molecular electronics, scanning probe microscopy, electron microscopy, optical spectroscopy, terahertz imaging and nanoparticles processing. The MSc Major Project provides a unique opportunity for students to work in one of these facilities.

Your learning environment

Both universities have world-class credentials and excellent facilities, but what's it like to study at Sheffield and Leeds? Well, the atmosphere is very friendly and our approach to teaching is student-focused, which means all our staff have got time for you. We pride ourselves on the professionalism of our staff and the quality of our learning environment. Both cities and both universities have a tradition of warm welcomes.

Our programmes

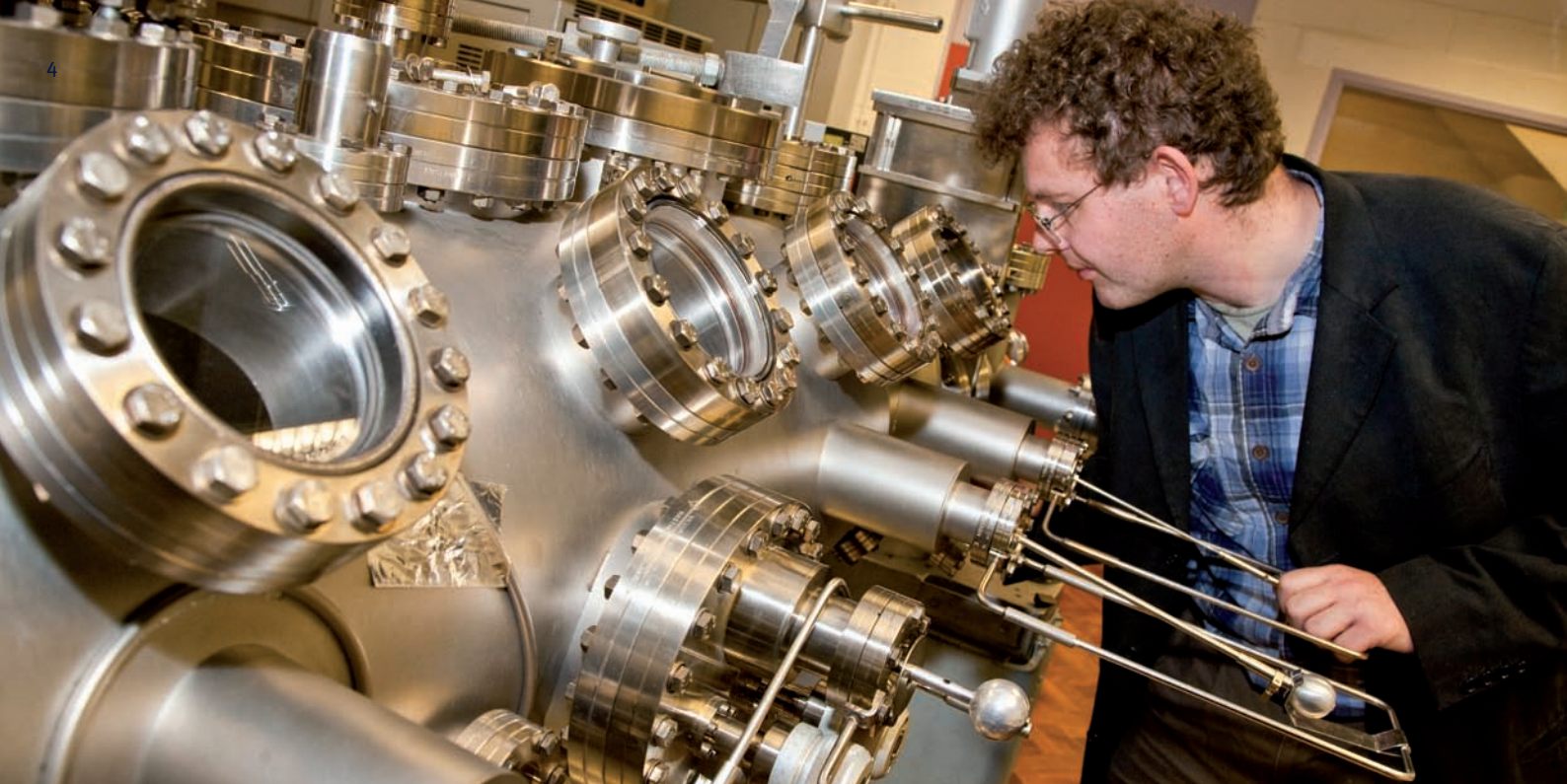
We offer four unique masters programmes which span the breadth of nanotechnology and the underpinning nanoscale sciences. The full-time MSc study period runs from late September to August of the following year. We also offer part-time MSc study, Postgraduate Certificate and Postgraduate Diploma qualifications, 1-2 week short courses, and one-day nanotechnology workshops.

- MSc in Nanoscale Science and Technology
- MSc in Nanoelectronics and Nanomechanics
- MSc in Nanomaterials for Nanoengineering
- MSc in Bionanotechnology



Michael Measures

Michael Measures graduated with distinction from his MSc in Nanoscale Science and Technology in 2004. He now works as a Product Delivery Manager for Avacta Group Plc, a scientific company that provides innovative, high value technology and services for bioscience and diagnostics. His role is to manage a team of electronic, mechanical and software engineers, plus application scientists, to realise new and innovative products.



Full-time masters programmes

The MSc programmes are delivered by the academic departments of physics, chemistry, biology, electronic engineering, and materials. This unique interdisciplinary approach provides optimum coverage of the relevant subject areas.

The programmes comprise eight 15-credit lecture-based modules – usually four at the University of Leeds and four at the University of Sheffield – and a major research-type project of 60 credits, giving a total of 180 credits for the complete programme. The MSc degree is awarded either by the University of Sheffield, or the University of Leeds, depending on where your project is carried out.

MSc Nanoscale Science and Technology

An interdisciplinary learning experience enabling single-discipline graduates to contribute effectively to the research, development and commercial exploitation of nanotechnology. Introduced in 2001, this was one of the first taught postgraduate nanotechnology programmes in Europe and attracts students from all over the world.

MSc Nanoelectronics and Nanomechanics

This programme builds on the success of the MSc in Nanoscale Science and Technology. This course shares some modules with the other MSc programmes, and introduces new, custom-designed modules covering electronic and mechanical engineering aspects of nanotechnology.

MSc Nanomaterials for Nanoengineering

Strong student demand for a greater focus on nanomaterials resulted in this course which includes modules covering nanostructuring and nanopatterning, bionanomaterials and thin film technology. The entry requirements are the same as those of the Nanoscale Science and Technology course.

MSc Bionanotechnology

This latest addition to our portfolio is a cross-disciplinary course aimed at biological scientists who are interested in the application of biology to modern technology. The course brings to the fore important issues such as nanotoxicology, currently the subject of much public debate.

Your MSc project

All full-time students undertake a Major Project which runs throughout the study period. Projects are usually based in one of the many nanoscience/technology-related research groups at the Universities of Leeds and Sheffield, and involve structured experimental, computational or theoretical investigations of a research or development nature.

Your Major Project can be studied at either university, subject to availability of topics. Several research projects have led to the co-authorship, by our students, of scientific publications.

Recent projects include:

- Molecular electronics using surface acoustic waves
- Semiconductor nanowires
- The processing of nanosized piezoelectric particles
- High resolution TEM imaging and image process analysis of pore size distribution of activated carbons
- Phospholipid-peptide interactions
- Optimisation of electron beam lithography techniques
- Three dimensional stem cell growth on cell-instructive materials



Roland Gentemann

Roland Gentemann graduated from his MSc in Nanoscale Science & Technology in 2002 which he followed with a PhD which he completed in 2007.

Since then he has been working as a research and development engineer for Wilo in Germany, one of the leading manufacturers of pumps and pump systems for heating, cooling and air-conditioning technology and for water supply and sewage disposal.



Students on the MSc programmes also benefit from regular nanotechnology-related seminar series at the Centre for Molecular Nanoscience in Leeds, and participation in Nanoscale Science Technology one-day workshops.

Scholarships

Scholarships may be available each year for those taking the full-time MSc. Scholarships are awarded on a competitive basis only to candidates who are both UK/EU nationals and residents and may pay all or part of their tuition fees. On occasion, small scholarships are offered to overseas applicants. These will not exceed £1500.

International students

Overseas students from outside the EU are advised that they will be required to prove that they have secured sponsorship to cover both tuition fees and living costs before commencing study.

Postgraduate Certificate and Postgraduate Diploma

If you don't want to attend the full MSc you can study four lecture-based modules (60 credits) from the above to attain the Postgraduate Certificate in Nanoscale Science and Technology or Nanoelectronics and Nanomechanics. If you complete 120 credits you will be eligible for the Postgraduate Diploma.

Part-time study

The modular nature of our courses means that any of our programmes – the MSc, the Postgraduate Certificate or the Postgraduate Diploma – can be studied part-time.

We recommend that part-time study is taken over a two-year period, though this can be extended to a maximum of three years.

Part-time students can take any combination of 30-credit Minor Projects or 30-credit non-laboratory-based Case Studies in place of the 60-credit Major Project.

If you are working in industry and register for part-time study you can conduct your projects in your place of work, subject to the availability of appropriate topics and supervision arrangements.

Part-time students are normally required to attend the Generic Methodologies for Nanotechnology module before attending any other modules.

Short courses

Selected modules are sometimes available in a short-course format of between one and two weeks. This means that industrial delegates and other students can attend modules on a stand-alone basis.

One-day workshops

Our training portfolio includes an ongoing workshop programme. The workshops are open to anyone. Their main aim is to increase national awareness of the significance of nanotechnology by providing an overview of particular thematic areas.

Seminars are led by leading academics and industrialists working in nanotechnology.

The workshops are relevant to new and established scientists in the field; as well as industrial managers and investors who want to keep up-to-date with new technological developments and business opportunities becoming available through nanotechnology.

The workshops also form a valuable part of our nanotechnology MSc programmes. Recent workshops include:

- Engineering New Futures – Nanoscale Science and Technology
- Enterprise in Nanotechnology
- Nanotechnology in Society: the wider issues.

Nanoscale Science & Technology	Nanomaterials for Nanoengineering	Nanoelectronics & Nanomechanics	Bionanotechnology
Generic methodologies for nanotechnology			Generic methodologies for bionanotechnology
Inorganic semiconductor nanotechnology			Biophotonics and bioimaging
Nanoscale magnetic materials and devices			Physical concepts in bionanotechnology
Processing & properties of inorganic nanomaterials		Microfluidics	Biosensors
Self-assembling nanostructured molecular materials and devices		Next generation silicon Technologies	Self-assembling nanostructured molecular materials and devices
Macromolecules at interfaces and structured organic films	Nanopatterning		Macromolecules at interfaces and structured organic films
Organic semiconductors	Thin films	Organic semiconductors	Nanotoxicology
Bionanotechnology	Bionanomaterials	Quantum computing	Bionanomaterials
		Micro and nano-electromechanical systems	

MODULE OUTLINES

Semester one

Generic methodologies for nanotechnology, Generic methodologies for bionanotechnology (Leeds)

Including nanoscale fabrication and characterisation technologies, and commissioning and working in ultra-clean environments. The Generic methodologies for bionanotechnology module includes technologies more relevant for those working in the biological sciences.

Inorganic semiconductor nanotechnology (Sheffield)

Including ultra-small and low dimensional devices (quantum wire and quantum dot lasers, single electron devices); self-assembly of semiconductor nanostructures; physical processes in semiconductor nanostructures; electronic and optical characterisation techniques for semiconductor nanostructures.

Nanoscale magnetic materials and devices (Sheffield)

Including magnetic properties of ultrathin films and nanoscale clusters; preparation and characterisation techniques; devices and applications.

Processing and properties of inorganic nanomaterials (Leeds)

Including preparation, properties and characterisation of nanostructured materials and nanoparticles; interaction with surfaces; catalysis; applications.

Microfluidics (Leeds)

Including fluid dynamics of microchannel flows and thin liquid films; capillarity, surface tension, wetting and electrokinetics; microflow sensors and actuators, micro-mixers, micro-droplet generation and micro-pumps.

Biophotonics and bioimaging (Sheffield)

Fundamentals of lasers and optics in biology and medicine, in vivo microscopy, in vivo spectroscopy, and diagnosis and treatment biophotonic techniques. Particular emphasis will be given on the use of nanoparticles as contrast agents and how lasers technology has benefited by the advent of nanotechnology.

Physical concepts in bionanotechnology (Sheffield)

Introduction to biophysics, thermodynamics, intra- and inter-molecular interactions, transport phenomena, nanoscale fluid-dynamics, protein folding, biological energy, and molecular motors.

Biosensors (Leeds)

Introduction to sensing substrates/inhibitors, immobilization techniques, micro and nano arrays, optical sensors, electrochemical sensors, mechanical sensors, and other sensor formats.

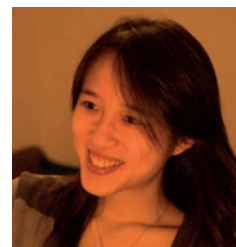
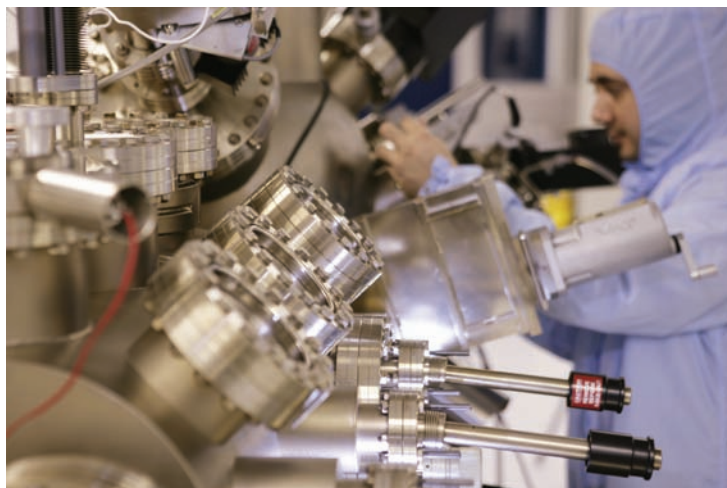


Mikael Khan

Dr Sahibzada Mikael Ali Khan graduated with distinction from his MSc in Nanoscale Science and Technology in 2004, going on to complete a PhD at the University of Leeds.

Mikael completed his PhD thanks to a prestigious Overseas Research Scholarship. He was also awarded the Peter Wilson Gold medal for his PhD, which is co-sponsored by British Nuclear Fuels Limited.

He is now working in research and development in the solar industry as a Manager of Current Collection Systems at Dyesol in North Wales. His current focus is a project with Corus Tata to improve the production process of photovoltaic panels.



Sarah Pan

Sarah Pan completed her MSc in Nanoscience and Technology in 2003. After completing her PhD, she now works in Copenhagen as a research scientist at Haldor Topsøe A/S, a Danish company specialising in catalysis and technology optimisation.

Semester two

Self-assembling nanostructured molecular materials and devices (Leeds)

Including principles of molecular self-assembly and self-organisation; surfactant solutions, polymers, biological systems and liquid crystals; device architectures and processing.

Macromolecules at interfaces and structured organic films (Sheffield)

Including properties and problems of inorganic/organic interfaces; interaction of fluids with natural and patterned surfaces; structures, devices and applications.

Organic semiconductors (Sheffield)

Including polymer surfaces and interfaces, preparation, properties, electroluminescent organic materials, liquid crystals, photonic band-gap systems; hybrid organic/inorganic structures; applications and devices.

Bionanotechnology (Leeds)

Including interaction of biological molecules with surfaces; manipulation of bio-molecules on surfaces; transduction and control of materials and information through biological interfaces; bilayers, bioelectronics and biosensors.

Quantum computing (Leeds)

Including quantum implementations of classical logic; all optical; universal and reversible logic gates; qubits; algorithms; implementations; progress in solid state devices; entanglement and single quantum devices.

Micro and Nano-electromechanical systems (Leeds)

Microsensors including thermal, radiation, magnetic, chemical and mechanical; microactuators; extension to the nanoscale, microcomponent assembly and packing.

Next generation silicon technologies (Leeds)

Including Moore's law and fundamental limits, the semiconductor roadmap, lithography, quantum and discrete doping effects, short channel effects and new device geometries, high k dielectrics, heat dissipation, metallisation, design rules, packaging and yield.

Nanoparticle and thin film technology (Leeds)

Provides an understanding of methods for producing and characterising nanoparticles and thin films of inorganic materials, hands-on training in synthesising nanoparticles and films, and an appreciation of their potential applications in electronic, biomedical and structural engineering.

Bionanomaterials (Sheffield)

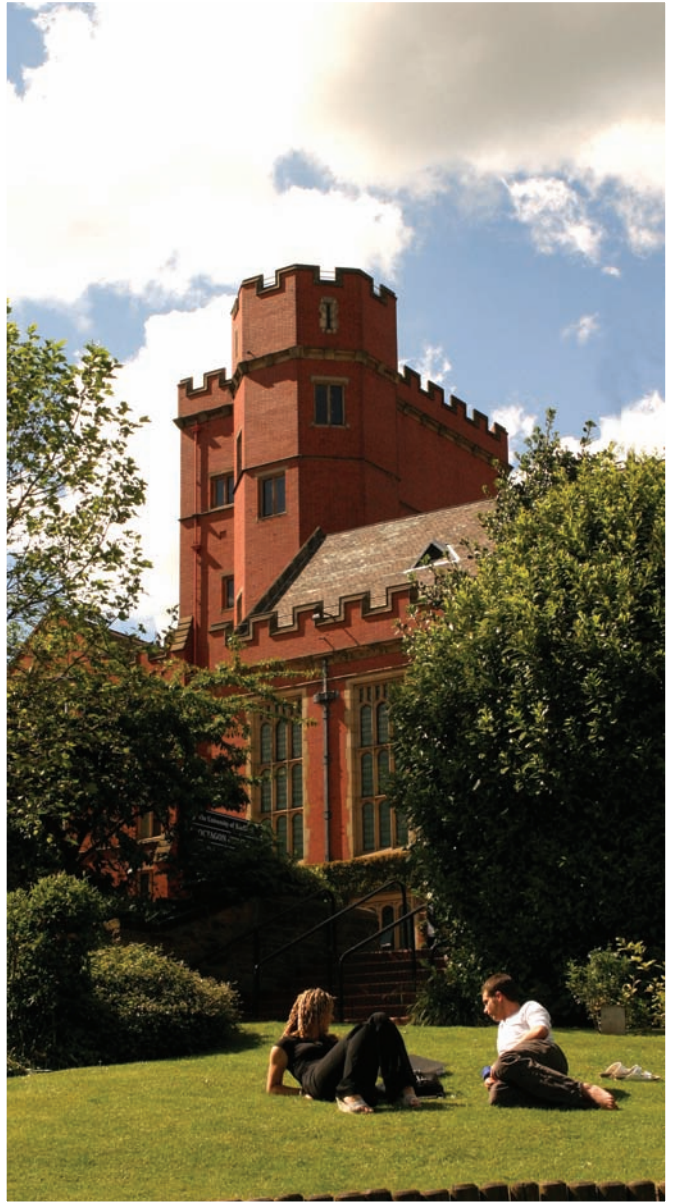
Introduces basic concepts of cell and molecular biology, before looking at examples of how biomolecules can be used for designing nanostructures, and the use of these nano-structures in biological and medical applications.

Nanostructures, nanopatterning and nanomechanics (Sheffield)

Introduces nanostructures, such as free-standing nanoobjects or assemblies of these, or nanopores in porous materials, with methods of nanopatterning and nanocharacterisation, including nano metrology and nanomechanical testing.

Nanotoxicology (Leeds)

Provides information on principles of toxicology and biocompatibility. These principles are specifically applied to the understanding of the interactions between nano-structured materials and living matter.



Careers and further study

Our MSc programmes are an excellent foundation for students pursuing an industrial or academic career.

Many major companies in the physics, chemistry, chemical engineering, electronics, materials and pharmaceuticals sectors have an active interest in nanotechnology.

The governments of most of the major industrialised nations have announced substantial nanotechnology investment programmes.

There is already an array of emerging opportunities in research, development, design, manufacturing, management, investment and policy-making. Demand for well-trained nanotechnology professionals is only expected to increase.

Two top universities; two great cities

Both universities are truly multi-cultural, with students from all over the world representing many different nations and religious faiths. They integrate easily into the friendly and welcoming, vibrant, modern cities of Leeds and Sheffield where many different communities contribute to the cosmopolitan life in the historic county of Yorkshire. The Universities of Sheffield and Leeds are among the top ten universities in England and both are members of the Russell Group, the association of leading UK research-intensive universities. Leeds and Sheffield contain two of the largest and finest academic libraries in the country. Unusually for a campus university Leeds is just a 10 minute walk away from the city centre, whereas the University of Sheffield is centrally located.

The Natwest Student Living Index 2008 finds that Sheffield is one of the top three cities for low student cost of living in the UK. The cultural and architectural heritage of Leeds is well represented by a host of museums, theatres, stately homes and art galleries. Both Leeds and Sheffield have excellent shopping; Leeds has one of the best town centre shopping centres in the UK,

whilst Sheffield has the huge Meadowhall Shopping Centre located just outside the city.

Sheffield is at the heart of the country, on the edge of the Peak District National Park whilst Leeds is close to the beautiful Yorkshire Dales with easy access to the North Yorkshire Moors. Both cities are approximately 2 hours by train from London.

Both universities have outstanding sporting facilities as well as the opportunity to watch football with major clubs in both Sheffield and Leeds. Leeds is home to the celebrated Yorkshire County Cricket Club as well as the Leeds Rhinos rugby league team, 2005 and 2008 World Club Champions.

The two universities are just 34 miles (54 km) apart and well served by excellent road and rail transport facilities. Our timetables are carefully designed in order to minimise travel between sites.

Entry requirements

MSc Nanoscale Science and Technology

MSc Nanomaterials for Nanoengineering

Second-class honours degree or equivalent in Physics, Chemistry, Materials Science, or a related discipline. An upper second class degree in Electronic Engineering is also acceptable.

MSc Nanoelectronics and Nanomechanics

Second-class honours degree or equivalent in Electronic Engineering, Mechanical Engineering, Physics or a related discipline.

MSc Bionanotechnology

Second-class honours degree or equivalent in Chemistry, Biology, Biochemistry, Biomedicine, or a related life-sciences discipline.



Jamie Fox

Jamie Fox was one of the early pioneers of the Nanofolio programme and graduated in 2003. Jamie is now a market analyst at IMS Research specialising in the electronics and semiconductor industries. He is involved in producing detailed quantitative assessments of current and future market revenues and shipments of components and devices, in order to analyse and forecast the market.

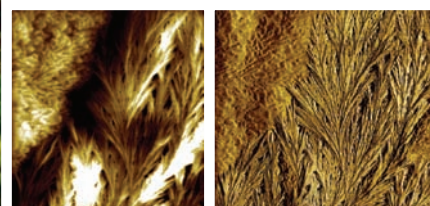
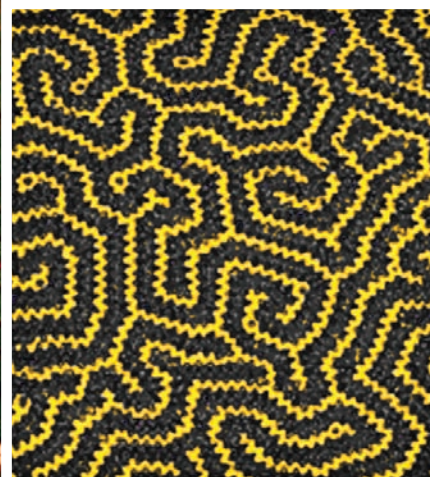


Cheen Cheen Dang

Cheen Cheen Dang completed her MSc in Nanoscale Science and Technology in 2005.

She now works back in her native Malaysia as a Senior Marketing Executive for SumiMa Sdn Bhd, a Malaysian-based company that trades organic chemicals.

Her role is to trade petrochemical products in Malaysia and International markets such as Singapore, Vietnam and China. She is responsible for ensuring the smooth execution of the entire business transaction at various levels, bringing the petrochemical products from the manufacturer or supplier through to the client.



How to apply

You should apply to either the University of Leeds or the University of Sheffield (not both) using the online application form provided by the institution of your choice. The forms can be reached from www.nanofolio.org/courses/how.php

Every effort has been made to ensure the accuracy of information in this brochure. However, courses and modules are subject to review. There may be some changes between the time of going to press and the time you begin your studies. For the latest information see our web pages or contact us directly.



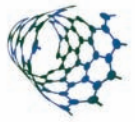
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EPSRC

Engineering and Physical Sciences
Research Council