# Course Information Sheet for entry in 2025-26: Fusion Power (EPSRC CDT)

## Course facts

| | | |
|---|---|---|
| **Mode of study** | Full Time | Part time |
| **Expected length** | 4 years | 8 years |

## About the course

The Fusion Power Centre for Doctoral Training (CDT) is provided by a collaboration between six UK universities (Durham, Liverpool, Manchester, Oxford, Sheffield, and York), other research organisations including Culham Centre for Fusion Energy, and industry such as Tokamak Energy, First Light Fusion and OxfordSigma.

The Fusion Power CDT provides training from world-leading experts in a range of fusion-relevant disciplines, focusing on the aspects of materials science, and plasma physics, required to make fusion power a reality.

You will be trained to PhD-level (a PhD is known as a DPhil at Oxford) in disciplines related to fusion power. A significant number of fully-funded four-year full-time and eight-year part-time doctoral studentships are expected to be available each year. The programme expects to train at least 80 students over five intakes from 2024 to 2028.

The majority of projects are expected to collaborate with the wider fusion industry.

You will have access to a range of fusion materials facilities within Oxford and across the UK, and international links provide access to many other fusion devices around the world.

The combination of world-leading experts and world-class facilities creates an outstanding training environment for the next generation of fusion scientists - the generation who may exploit STEP, ITER, NIF and other international experiments to make fusion energy a reality.

### Course outline

In Oxford, students will focus on materials for fusion power. You will train and study alongside students undertaking the DPhil in Materials, together forming an Oxford cohort of research students in materials.

The programme is normally carried out in four years of full-time study (or eight years of part-time study) under the supervision of an experienced member of staff. The first year (first two years for if you are studying part-time) will be focussed on training.

If studying full-time, you will spend the first eight months of the programme (the first 16 months if studying part-time), attending a number of technical fusion modules designed to provide the best possible platform for your substantial research project. Please note that the modules offered may change to reflect the latest academic thinking and expertise of staff. Some examples of modules include:

- Introduction to Fusion Plasmas
- Introduction to Materials
- Plasma Facing Technologies
- Irradiation Damage and Degradation
- Leadership and Research skills
- Tritium and the Fusion Fuel Cycle
- Plasma Surface Interactions Lab
- Functional and Superconducting Technologies
- Data Management and Software Skills
- Analytical Tools for Fusion Materials
- Manufacturing and Design Codes
- Multi-scale Computational materials engineering

Many of these modules take place at the University of York, and all students will be based at the York Plasma Institute to begin with, following registration at the University of Oxford. There will also be a number of intensive one-week modules based at the other collaborating universities. Travel and subsistence funds are provided for attending the different week-long courses.

During your first year if studying full-time (your first two years if studying part-time) , you will also attend 'Frontiers of Fusion and Interfaces', an annual workshop which features fascinating talks by well-known and internationally-respected external speakers. Students from all cohorts (and their supervisors) will gather for a scientific meeting exploring a range of fusion issues and how they link to related fields, such as fission, advanced instrumentation, technological plasmas, and more.

The remaining three years of the full-time programme (six years if studying part-time) will be spent conducting research. A wide range of exciting DPhil projects is available and they are listed on the Department of Materials website under *Fusion Power DPhil projects*.

### Fusion materials research at the University of Oxford

Research interests in Oxford's Department of Materials extend over most branches of materials science, as well as some aspects of solid state physics and chemistry. These include the study of a wide range of materials of relevance in advanced technological applications, including metals and alloys, composites, semi- and super-conductors, polymers, biomaterials, ceramics and materials for quantum information processing.

Much of the research is carried out in close collaboration with industry. World-leading research takes place on:

- the characterisation of materials, where there is emphasis on electron microscopy and related techniques
- processing and manufacturing of materials
- modelling of materials, where there is attention to both structures and processes
- properties of materials
- energy materials, including those for batteries, nuclear fusion and photovoltaics
- quantum information processing, which includes groups working on experimental studies, theory and modelling.

The plasma-facing components and breeding blanket of any future fusion tokamak will be subjected to one of the most extreme engineering environments possible. Materials will experience temperatures of up to 1500K in steady state and 3300K in transient events, and irradiation with 14MeV neutrons, causing displacement damage, transmutation giving rise to compositional changes, and internal H and He generation, plasma facing surfaces also can have high erosion rates due to interactions with the fusion plasma. Ideally, the materials should not retain tritium or themselves transmute to long-lived radioactive isotopes. For fusion to be feasible as an economic power source, the materials must be able to survive these conditions, retaining usable thermal and mechanical properties, for five years or more.

Materials of current interest include special 'reduced activation' steels, tungsten alloys and composites, ceramic composites for neutron shielding, silicon carbide and high-temperature superconductors.

The University offers a range of projects, both experimental and modelling, on the processing, joining, microstructure, mechanical properties, and resistance to radiation damage of these materials.

Projects will use a range of specialised research techniques, usually in combination:

- advanced processing, coating and joining methods (mechanical alloying, rapid solidification, spray forming, additive manufacture, friction-stir welding)
- irradiation of materials by high-energy ion-beams, protons and neutrons.
- liquid metal corrosion
- characterisation of superconducting materials
- electron microscopy of microstructures, and radiation damage effects, including in-situ irradiations, and field-ion microscopy of radiation damage
- microanalysis by atom-probe tomography and electron-optical methods
- X-ray diffraction including use of the diamond light source mechanical testing, including micromechanics, over a wide temperature range
- computer modelling of radiation damage effects, deformation and microstructural development.

An overview of the provision for research students in the Department of Materials can be found at the Summary of Provision for Materials Research Students webpage. Also available is Guidance on Supervision Arrangements.

### Attendance

The course can be studied full-time or part-time with both modes requiring attendance in Oxford. Full-time students are subject to the University's Residence requirements. Part-time students are required to attend course-related activities in Oxford for a minimum of 30 days each year.

The full-time course is usually studied over four years. The part-time course is usually studied over eight years.

Provision exists for students on some courses to undertake their research in a ‘well-founded laboratory’ outside of the University. This may require travel to and attendance at a site that is not located in Oxford. Where known, existing collaborations will be outlined on this page. Please read the course information carefully, including the additional information about course fees and costs.

### Resources to support your study

As a graduate student, you will have access to the University's wide range of world-class resources including libraries, museums, galleries, digital resources and IT services.

The Bodleian Libraries is the largest library system in the UK. It includes the main Bodleian Library and libraries across Oxford, including major research libraries and faculty, department and institute libraries. Together, the Libraries hold more than 13 million printed items, provide access to e-journals, and contain outstanding special collections including rare books and manuscripts, classical papyri, maps, music, art and printed ephemera.

The University's IT Services is available to all students to support with core university IT systems and tools, as well as many other services and facilities. IT Services also offers a range of IT learning courses for students, to support with learning and research.
The department has excellent and wide-ranging research resources including:

- a world-class suite of electron microscopy facilities including a JEOL ARM analytical STEM and two Zeiss Merlin ultrahigh resolution SEMs optimised for EBSD and EDX analysis, together with a number of supporting and training instruments. Much of this equipment is installed in the David Cockayne Centre for Electron Microscopy;
- additional electron microscopy facilities are available at the national electron Physical Science Imaging Centre;
- extensive further facilities for characterising materials including, for example, AFM, XPS, and Raman microscopy;
- advanced sample preparation and micromachining facilities including a Zeiss NVision 40 FIB/SEM and three other FIB instruments;
- clean room facilities;
- microhardness measurement facilities (at high temperatures and at the nm scale);
- special processing or manufacturing facilities for ceramics, carbon nanomaterials, rapidly solidified materials and devices such as novel batteries
- superb facilities for 3-D atom probe analysis (including LEAP 5000XS and LEAP 5000XR);
- an alloy processing and mechanical properties laboratory, for aerospace and nuclear materials; and
- a wide range of specialist modelling software and if appropriate for your research project, access to Oxford's Advanced Research Computing facilities.

The department’s Institute for Industrial Materials and Manufacturing provides pilot scale facilities for the manufacture of alloys, polymer and ceramic coatings, prototype optoelectronic, semiconductor, superconductor and sensor devices and novel metallurgical nano-scale materials.

The Oxford Materials Characterisation Service provides a major suite of equipment for the characterisation of materials used in microtechnology and nanotechnology.

In addition to the excellent central and college library provision, there is a specialist Materials Science Library housed within the department.

### Supervision

The allocation of graduate supervision for this course is the responsibility of the Department of Materials and it is not always possible to accommodate the preferences of incoming graduate students to work with a particular member of staff. Under exceptional circumstances a supervisor may be found outside the Department of Materials.

You will usually meet with your supervisor approximately every two to three weeks.

### Assessment

All students will be initially admitted to the status of Probationer Research Student (PRS). Normally after six terms as a full-time PRS student (and normally by the fourth term), and 12 terms as a part-time PRS students, you will be expected to apply for transfer of status from Probationer Research Student to DPhil status.

A successful transfer of status from PRS to DPhil status will require completion of the taught aspects of the Fusion Power course and a report on the first six months of work on your DPhil project if studying full-time (first 12 months of work if studying part-time).

If successful at transfer, you will also be expected to apply for and gain confirmation of DPhil status within nine terms of admission (within 18 terms if studying part-time), to show that your work continues to be on track.

Both milestones normally involve an interview with two assessors (other than your supervisor) and therefore provide important experience for the final oral examination.

You will be expected to submit a substantial thesis after four years from the date of admission if studying full-time (eight years if part-time). To be successfully awarded a DPhil you will need to defend your thesis orally (viva voce) in front of two appointed examiners.

### Changes to this course

The University will seek to deliver this course in accordance with the description set out above. However, there may be situations in which it is desirable or necessary for the University to make changes in course provision, either before or after you commence your course. These might include significant changes made necessary by any pandemic, epidemic or local

health emergency. For further information, please see the University's Terms and Conditions (http://www.graduate.ox.ac.uk/terms) and our page on changes to courses (http://www.graduate.ox.ac.uk/coursechanges).

## Costs

### Annual fees for entry in 2025-26

#### Full-time study

| Fee status | Annual Course fees |
|---|---|
| Home | £10,070 |
| Overseas | £33,370 |

#### Part-time study

| Fee status | Annual Course fees |
|---|---|
| Home | £5,035 |
| Overseas | £16,685 |

### Information about course fees

Course fees are payable each year, for the duration of your fee liability (your fee liability is the length of time for which you are required to pay course fees). For courses lasting longer than one year, please be aware that fees will usually increase annually. Information about how much fees and other costs may increase is set out in the University's Terms and Conditions (http://www.graduate.ox.ac.uk/terms).

Course fees cover your teaching as well as other academic services and facilities provided to support your studies. Unless specified in the additional cost information (below), course fees do not cover your accommodation, residential costs or other living costs. They also don’t cover any additional costs and charges that are outlined in the additional cost information.

Graduate students who have reached the end of their standard period of fee liability may be required to pay a termly University and/or a college continuation charge.

The University continuation charge, per term for entry in 2025-26 is £672, please be aware that this will increase annually. For part-time students, the termly charge will be half of the termly rate payable by full-time students.

If a college continuation charge applies (not applicable for non-matriculated courses) it is likely to be in the region of £100 to £600. Please contact your college for more details, including information about whether your college's continuation charge is applied at a different rate for part-time study.

### Additional cost information

#### Full-time study

There are no compulsory elements of this course that entail additional costs beyond fees (or, after fee liability ends, continuation charges) and living costs. However, please note that, depending on your choice of research topic and the research required to complete it, you may incur additional expenses, such as travel expenses, research expenses, and field trips. You will need to meet these additional costs, although you may be able to apply for small grants from your department and/or college to help you cover some of these expenses.

#### Part-time study

Please note that you are required to attend in Oxford for a minimum of 30 days each year, and you may incur additional travel and accommodation expenses for this. Also, depending on your choice of research topic and the research required to complete it, you may incur further additional expenses, such as travel expenses, research expenses, and field trips. You will need to meet these additional costs, although you may be able to apply for small grants from your department and/or college to help you cover some of these expenses.

### Living costs

In addition to your course fees and any additional course-specific costs, you will need to ensure that you have adequate funds to support your living costs for the duration of your course.

If you are studying part-time your living costs may vary depending on your personal circumstances but you must still ensure that you will have sufficient funding to meet these costs for the duration of your course.

The likely living costs for the 2025-26 academic year are published below. These costs are based on a single, full-time graduate student, with no dependants, living in Oxford. We provide the cost per month so you can multiply up by the number of months you expect to live in Oxford.

**Likely living costs for one month**

| | Lower range | Upper range |
|---|---|---|
| **Food** | £330 | £515 |
| **Accommodation** | £790 | £955 |
| **Personal items** | £200 | £335 |
| **Social activities** | £45 | £100 |
| **Study costs** | £40 | £90 |
| **Other** | £20 | £40 |
| **Total** | £1,425 | £2,035 |

**Likely living costs for nine months**

| | Lower range | Upper range |
|---|---|---|
| **Food** | £2,970 | £4,635 |
| **Accommodation** | £7,110 | £8,595 |
| **Personal items** | £1,800 | £3,015 |
| **Social activities** | £405 | £900 |
| **Study costs** | £360 | £810 |
| **Other** | £180 | £360 |
| **Total** | £12,825 | £18,315 |

**Likely living costs for twelve months**

| | Lower range | Upper range |
|---|---|---|
| **Food** | £3,960 | £6,180 |
| **Accommodation** | £9,480 | £11,460 |
| **Personal items** | £2,400 | £4,020 |
| **Social activities** | £540 | £1,200 |
| **Study costs** | £480 | £1,080 |
| **Other** | £240 | £480 |
| **Total** | £17,100 | £24,420 |

When planning your finances for any future years of study at Oxford beyond the 2025-26 academic year, it is suggested that you allow for potential increases in living expenses of 4% each year – although this rate may vary depending on the national economic situation.

More information about how these figures have been calculated is available at www.graduate.ox.ac.uk/livingcosts.

## Document accessibility

If you require a more accessible version of this document please contact Graduate Admissions and Recruitment by email (graduate.admissions@admin.ox.ac.uk) or via the online form (http://www.graduate.ox.ac.uk/ask/form).