FAME MASTER Functionalized Advanced Materials and Engineering

UCL Université catholique de Louvain

Education and Culture
Erasmus Mundus

University website: http:// www.uclouvain.be
FAME Master website: www.fame-master.com
Email: master.fame@inpg.fr
Erasmus Mundus website : http://ec.europa.eu/education/programmes/mundus/index_en.html

University of Louvain

The University of Louvain in Louvain-la-Neuve (UCL) is one of the world oldest universities, founded in 1425. Renowned scholars such as Erasmus, Jansenius, Vesalius and Mercator worked or delivered classes in Louvain, and the Big Bang theory was formulated by one of its physicists, George Lemaître, in the first part of the 20th century. The Nobel Prize in medicine was awarded to Prof. De Duve of UCL in 1974.

In 1970, the Flemish- and French-speaking parts split into two different universities, with the French-speaking part moving to a new campus located only 25 km away from Brussels. This part benefits from the unique international environment of Europe's capital, and enjoys a cultural mix which is typical of multi-lingual Belgium. Currently, about 21,000 students originating from 120 different countries are studying at UCL, which also hosts 5,000 professors, researchers and collaborators.

The University Science Parks are host to companies such as Abbott, Albemarle, Basell, Boehringer Ingelheim, Carmeuse, Clariant, IBA, Kraton, Lhoist, Lilly, McKinsey, Magotteaux, Nissan Technical Center Europe, Omnichem, Pfizer, Realco, Shell Coordination Centre, Solutia Europe, Umicore Engineering, Whatman, and many others.

The University Engineering School offers many different Master's degrees, including ones in Chemical Engineering and Materials Science, and the one in Physical Engineering. It is the Physical Engineering course, from which modules have been selected for the FAME Master of Science. These masters are managed by the Commission for Applied Chemistry and Physics, which comprises about 20 teachers active in the fields of polymer science, solid state physics, nanotechnology, metals and ceramics, and chemical engineering.

About 50 PhD students and post-doctoral researchers are currently pursuing top-notch research in these specialized fields, a significant part of them belonging to the Research Centre in Micro- and Nanoscopic Materials and Devices of UCL, a newly-created interdisciplinary centre focusing on materials and devices.
(See http://www.cermin.ucl.ac.be/ for further information).

Disciplines

- Polymer Chemistry and Physics
- Solid-State Physics
- Metal and Ceramics
- Ab initio Simulations
- Nano- and Micro- fabrication
- Materials Processing
- Mechanical Properties
- Magnetic and Electrical Properties
- Bio-sensing

FAME Master format

Each year, 40 students will be recruited for Year 1 of the program and will start at INP Grenoble (France) or Augsburg (Germany). Half of the students will come from non-European countries and half from within Europe. Year 1 will provide a multidisciplinary teaching in the field of Functional Materials.

In Year 2 each student will specialize in scientific area offered by one of the 7 consortium universities. Students will have to study in at least two different universities and European countries.

Curriculum offered in Louvain

As member of the 7 Consortium universities, the Université catholique de Louvain will admit students for Year 2 of the FAME Master. These will be students who will choose the **Engineering of Materials and Nanostructures specialization** for the final part of their Master's program and will graduate with a **double-diploma**.

The specialization offered by the UCL intends to help the students acquiring an advanced knowledge of the relationships between function or properties of materials, their modeling, their processing and their subsequent morphology. This will include the materials use in micro- and nano-technology. To develop the practical, real-world skills of the students, the theoretical background is complemented by projects and laboratory work, and industrial visits.
The standard program comprises 4 compulsory courses, focusing on the engineering of polymers, metals and ceramics, and the mechanical and functional properties of materials.
It offers a series of elective courses in nano-science / nano-technology, in the characterization of materials or in advanced polymer materials.

Students who do not apply for the official Erasmus Mundus Master of Science curriculum and wish to attend Year 1 must have earned a Bachelor's degree in Science (Physics, Chemistry, Metallurgy, Materials Science, Electrochemistry).

Those who wish to attend Year 2 (Semester 3) must have passed Year 1 of a Master degree in the Materials Science area of a high-standing university.

At the end of their studies, such students will only be awarded a national diploma and not the official Erasmus Mundus FAME Master of Science label.

Course description (Semester 3) 30 ECTS*

*ECTS: European Credit Transfer System

Compulsory courses	**20 ECTS**
Polymer Science and Engineering	5 ECTS
Physical Chemistry of Metals and Ceramics	5 ECTS
Physics of Functional Materials	5 ECTS
Deformation and Rupture of Materials	5 ECTS
Elective courses (2 courses to be selected)	**10 ECTS**
Polymer Materials	5 ECTS
Methods of Characterisation of Inorganic Materials	5 ECTS
Physics of Nanostructures	5 ECTS
Design of Micro- and Nano-Systems	5 ECTS

Staff involved in the FAME Master

- Prof. Christian Bailly
- Prof. Vincent Bayot
- Prof. Jean-Christophe Charlier
- Prof. Francis Delannay
- Prof. Jacques Devaux
- Prof. Sophie Demoustier
- Prof. Denis Flandre
- Prof. Xavier Gonze
- Prof. Pascal Jacques
- Prof. Alain M. Jonas
- Prof. Roger Legras
- Prof. Thomas Pardoen
- Prof. Luc Piraux
- Prof. Jean-Pierre Raskin

Research partners

UCL cooperates with the following partners:

Selected collaborating labs outside Europe:

- MIT, Department of electrical engineering and computer science, USA (Prof. M.S. Dresselhaus)
- Renselaer Polytechnic Institute, Department of Materials Science and Engineering, USA, (Prof. P.M. Ajayan)
- University of Massachusetts at Amherst, Polymer Science and Engineering (Prof. Thomas P. Russell)
- Instituto Potosino de Investigación Científica y Tecnológica (IPICYT), Mexico (Prof. M. Terrones)

Selected collaborating labs in Europe:

- FAME European partners (Germany, UK, Belgium, Spain, Portugal)
- Université Claude-Bernard, Laboratoire de physique de la matière condensée et des nanostructures, Lyon, FR (Dr. Xavier Blase)
- Commissariat à l'Energie Atomique, Grenoble, FR (Dr. Stephan Roche)
- King's college London, London, UK (Dr. A. De Vita)
- University of Cambridge, Department of Chemistry, UK (Prof. W.T.S. Huck)
- Université de Rouen, Département de chimie, FR (Dr. K. Glinel)
- Fraunhofer Institute for Polymer Research, Potsdam, DE (Prof. A. Laschewsky)

Selected industry partners

- Arkema, BE
- CerTech, BE
- Clariant, BE
- EADS, FR
- NANOCYL-Belgium
- Solvay, BE
- Thomson, FR
- TIMCAL-Belgium
- Whatman, BE

Facilities used for research

Students have access to four technological platforms

1. micro- and nano-fabrication: a clean room equipped with state-of-the-art silicon processing technologies including nano-imprint and electron beam nanolithography;
2. materials characterization: NMR's, XPS, X-ray diffraction, X-ray reflectometry, ellipsometry, many AFM's, TEM, SEM, ToF-SIMS, FTIR, UV-vis, cyclic voltammetry, ^{4}He cryostats, dilution fridge, electrical and magnetic measurements, tensile tests, impact tests, etc.;
3. materials processing: injection machine, extruders, presses, sinterers, etc.;
4. high-performance computing and mass storage.

Typical Master Thesis projects/subjects

Typical recent master thesis projects are in nanotechnology (Micromachines and MEMS; self-assembled organic multilayers; magnetic or super-conducting nanowires; carbon nanotubes; etc.), polymer and composite science (carbon nanotube-, cellulose fiber-, or clay-based nano-composites; polymer rheology; polymer crystallization; etc.), metals and ceramics (electroceramics; metastable and TRIP steels; Ti alloys for aeronautics; joint fracture; etc.), bio-materials (dental resists; bio-active coatings; antigen-based nano-bio-sensors; bio-fouling; interaction between hair surface and surfactants; etc.), or modeling (*ab initio* study of fracture; quantum transport in nanostructures; ferroelectricity; etc.). Depending on the student preference, master theses may be basic or applied, and be partly led in collaboration with an industrial company.