FAME MASTER
Functionalized Advanced Materials and Engineering

INP Grenoble

Education and Culture
Erasmus Mundus

University website: http:// www.inpg.fr/
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Erasmus Mundus website : http://ec.europa.eu/education/programmes/mundus/index_en.html

Grenoble Institute of Technology (INPG)

Thanks to its outstanding scientific environment, Grenoble Institute of Technology (INPG) is a leader amongst European technology universities. Its high-quality engineering degree courses and doctorates and cutting-edge research put it firmly at the heart of European higher education.

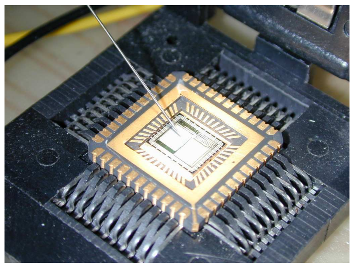
INPG trains dynamic, innovative engineers in 11 high-tech areas, including Information and Communications Science, Micro and Nanotechnologies, Energy, Materials, Environment, and Production Systems. With 38 specialized science laboratories, INPG is the second largest doctoral school in France, awarding an average of 170 doctorates every year.

The industrial fabric of Grenoble is steeped in the microelectronics and nanotechnology culture.
Major players in all sectors of the microelectronics and nano-technology field are present in the Grenoble area, within a worldwide renowned scientific and technological environment regrouping 6000 researchers.

Several engineering programs in the field of materials are present at INPG to address specific fields.

Besides the FAME program specialization for semester 3 in materials for micro and nanotechnologies, other diploma include structural materials, functional materials and nanophysics, the international Nanotech program, nuclear engineering, materials and biotechnologies, components physics, etc.

The constant interaction between the students of these various fields in the INPG laboratories is a major factor of innovation and success.



Disciplines

- Materials for microelectronics applications
- Materials for microsystems
- Functional materials for advanced optics, magnetic, supraconducting applications
- Hierarchically organized materials
- Structural materials
- Atomic scale modeling

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 Grenoble

As member of the FAME Erasmus Mundus Consortium, Grenoble Institute of Technology will admit students for Year 1 (General curriculum in Materials Science) and Year 2 (Specialization) of the FAME Master.

Students who will spend Year 2 (Semester 3) in Grenoble will choose the **Materials for Micro- and Nano- Technologies specialization** for the final part of their Master's program. They will graduate with obtain a **double-diploma**.

The following areas are specifically taught by Grenoble:

- Materials for the microelectronics industry
- Materials for microsystems
- Advanced functional materials for optical and magnetic properties

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 1) — 30 ECTS*

*ECTS: European Credit Transfer System

Fundamentals in Materials Science 1

-Introduction to materials (Seminar)	4 ECTS
-Material physics 1 (Structure, Defects, thermodynamics of materials)	6 ECTS
-Material chemistry	6 ECTS
-Characterization of materials	6 ECTS
-Method course 1 (Practical work accompanied by lectures)	8 ECTS

Course description (Semester 2) — 30 ECTS

Fundamentals in Materials Science 2

-Material physics 2 (Electronic properties)	6 ECTS
-Processing of materials (Metals, ceramics, polymers; coatings, thin films; structuring, electro chemical methods)	6 ECTS
-Surfaces and Interfaces	5 ECTS
-Numerical methods & simulation, theoretical concepts	5 ECTS
-Method course 2 (Practical work accompanied by lectures)	8 ECTS

Course description (Semester 3) — 30 ECTS

Mandatory courses — 24 ECTS

- Physics of Semiconductor Devices (PN Diodes, Heterojunctions, Metal - Semi-conductor Contacts, MOS Devices, Bipolar Devices)	6 ECTS
-Materials for Microelectronics an Microsystems (Substrates, Doping, Low and High k Dielectrics, Metallization, Diffusion Barriers)	6 ECTS
-Device Fabrication Technologies (Front-end and Back-end, Lithography, CMP…)	6 ECTS
-Practical Work (Fabrication of MOS Structure, XPS, Raman Spectroscopy, Electron Microscopy SEM and TEM)	6 ECTS

Optional courses (2 choices) — 6 ECTS

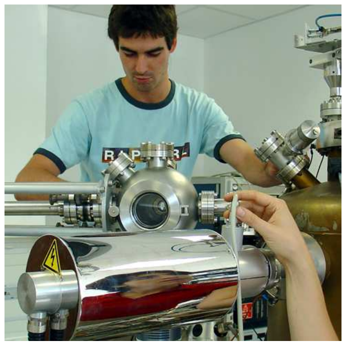
Packaging	3 ECTS
Failure Analysis and Yield Optimization	3 ECTS
Microsystems	3 ECTS
Modeling of Semiconductor Device	3 ECTS
Conception of Circuits (Basics)	3 ECTS

Staff involved in the FAME Master

- Prof. Yves Bréchet
- Prof. Alexis Deschamps
- Dr. Ulrich Gottlieb
- Prof. Françoise Hippert
- Dr. Jens Kreisl
- Dr. Muriel Véron
- Dr. Fabien Volpi

Selected industry partners

- ST Microelectronics
- Freescale Semiconductors
- Philips Semiconductors R&D
- Applied Materials
- ATMEL
- SOITEC
- NOVASIC
- NEXANS
- Photowatt Solar Energy
- Schneider Electric
- TRIXELL
- Thales Electron Devices



Research partners

International partners:

- FAME European partners (Germany, UK, Belgium, Spain, Portugal)
- SINANO (SI-based nanostructures and nanodevices)
- ESONN (European School on Nanosciences and Nanotechnologies)
- HERCULES (European School on Synchrotron radiation and neutron Characterizations)

Local partners:

- DRFMC (Laboratory of Fundamental Research on Condensed Matter)
- ESRF (European Synchrotron Radiation Facility)
- ILL (Institut Laue-Langevin)
- IMEP (Institute of Microelectronics, Electromagnetism and Photonics)
- Institut Néel (Néel Institute)
- LEPMI (Laboratory of Electrochemistry & Physico- Chemistry of Materials & Interfaces)
- LETI (Laboratory of Electronics and Information Technologies)
- LMGP (Laboratory of Materials and Engineering Physics)
- SIMAP (Science & Engineering of Materials & Processes Laboratory)

Facilities used for research

In the field of functional materials for nanomaterials and microelectronic applications, the following instruments are routinely used in the INPG laboratories:

- Process reactors for thin films: MOCVD, Pyrosol
- Atomic Layer Deposition reactors
- Molecular Beam Epitaxy
- Sublimation reactors for SiC processing
- Electron Microscopes : FEG-SEM, analytical TEMs
- Near-Field microscopy: AFM, MFM
- Spectroscopies (Raman, IR, UV/Visible)
- Laboratory X-rays (diffraction, GISAXS, reflectometry, …)
- Wide access to the European Synchrotron Radiation facility (ESRF)
- Simulation tools (ab initio calculations, mesoscale)

Other equipment used at INPG

- Access to world-class clean rooms within the MINATEC platform
- Wide range of equipments for thermodynamic studies (high temperature DSCs, DTAs, TGAs, high temperature mass spectrometer, …)
- Mechanical testing (nano-indentation, high speed mechanical testing, …)
- Equipments for the study of sintered materials (metals & ceramics) and functionally gradient materials
- Equipments for the large strain deformation of metallic materials (ECAE)
- Magnetic properties measurements (e.g. Hall effect mapping for supra conducting materials)

Typical Master Thesis projects/subjects

- Structural study of ultra-low K dielectrics for microelectronic applications
- 3D numerical simulation of dislocation dynamics : application to nanometric layers
- Study of oriented growth of carbon nanotubes from nanoparticles deposited on singe crystalline surfaces
- Measurement of adhesion energy of multilayers for microelectronic applications
- Development and processing of thin layers of novel transparent type P conducting oxides
- Electrical detection of DNA sequences
- Structural defects in single crystals of SiC
- Processing of aluminum nitride single crystals as substrates for epitaxial growth of GaN
- Characterization of semi-conducting properties of passive oxide layers