Sustainable Chemistry for Advanced Materials: Environment & Health (IDIMAT)



Explore this IDIL Master's track in detail, including its academic objectives, curriculum, research opportunities, admission requirements and career prospects.

TRACK OVERVIEW & LEARNING OBJECTIVES

The **"SustaInable Chemistry for Advanced MaterIals: EnvironMent and HeAlTh" (IDIMAT)** track is an international Master's program in Chemistry at the University of Montpellier, developed within the framework of the IDIL (Interdisciplinary In-Lab) Graduate Program. Hosted by the Chemistry Department of the Faculty of Science, it offers interdisciplinary training in sustainable chemistry and materials science at the intersection of environmental and health challenges.

The track is based on a research-driven learning approach founded on students' early and immersive integration into research laboratories. Its goal is to offer an educational experience distinct from traditional Master's programs by placing students at the center of their learning process and progressively fostering their scientific autonomy, initiative, and interdisciplinary perspective. This approach aligns fully with the objectives of the IDIL program, which aims to train students through and for research while developing transferable skills applicable to various professional environments.

IDIMAT focuses on contemporary challenges in sustainable chemistry applied to advanced materials, including their design, synthesis, characterization, and application in fields related to environmental protection and health. The program draws upon knowledge and methodology from several areas of chemistry and materials science while encouraging cross-disciplinary interactions with other scientific fields. This interdisciplinary framework enables students to address complex issues from multiple analytical perspectives and develop a comprehensive understanding of the systems studied.

A core feature of the track is the development, starting at the beginning of M1 (Master 1), of an individual research project that serves as a guiding thread throughout the degree. Students are encouraged to identify a scientific research topic aligned with their interests and career goals, and to build on this project progressively over the two years of the Master's program. Whenever possible,

projects are co-developed with an academic laboratory in Montpellier and an international partner laboratory, fostering scientific continuity and international mobility.

Throughout their studies, students receive personalized guidance from an academic tutor and a research mentor. This mentorship helps direct their academic and scientific choices, build their professional plan, and ensure alignment between coursework, laboratory experience, and individual career goals. As a result, the curriculum can be tailored to each student's specific interests and aspirations.
The pedagogy relies heavily on hands-on learning and practical laboratory experience. Students work directly with the methods, instruments, experimental approaches, and analytical frameworks used in active research. Laboratory immersion periods in M1 and M2 constitute a structural element of the program, enabling students to acquire scientific skills within an authentic research context. This structure aims to cultivate not only solid scientific knowledge, but also a true research mindset: the ability to formulate scientific questions, search and analyze literature, build and test hypotheses, interpret results, adapt experimental strategies, and communicate findings. Students are gradually empowered to take ownership of their education and research projects, developing independence, critical thinking, creativity, and the ability to collaborate in interdisciplinary settings. Finally, an international outlook is an essential dimension of the track. With instruction provided in English, an international scientific environment, and opportunities for mobility and collaboration with foreign partners, students develop their capacity to thrive within international research teams and multicultural scientific and professional environments.

Thus, IDIMAT aims to train graduates who can apply their knowledge and skills in diverse professional contexts. Research training serves not only as preparation for doctoral studies, but also builds scientific, methodological, organizational, and cross-functional skills directly transferable to academic research, public research bodies, industry, and innovative sectors. The overarching goal is to graduate autonomous scientists capable of tackling complex issues, working at the interface of multiple disciplines, and shaping their own career paths.

KNOWLEDGE, SKILLS & COMPETENCIES

The IDIMAT program enables students to acquire a comprehensive interdisciplinary scientific foundation at the intersection of chemistry, materials science, nanoscience, environment, and health. Knowledge and skills are progressively built through core coursework, practical training, research projects, and extended laboratory immersions.

Knowledge

By the end of the program, students will have mastered the fundamental and advanced concepts required to understand, design, and study advanced materials and functional systems. Specifically, they develop expertise in the following areas:

- Organic, inorganic, and coordination chemistry applied to materials;
- Chemistry of polymers, biopolymers, and hybrid materials;
- Solution chemistry, colloidal systems, interfaces, and dispersed systems;
- Synthesis, structure, and properties of nanomaterials and advanced materials;
- Functional and high-performance materials;
- Spectroscopic, structural, and physicochemical characterization techniques;
- Solution-state Nuclear Magnetic Resonance (NMR) and X-ray diffraction;
- Relationships between composition, structure, morphology, properties, and functionality of materials;
- Sustainable chemistry, green chemistry, eco-design, and Life Cycle Assessment (LCA);
- Catalysis and photocatalysis;
- Functional membranes and materials for environmental and health applications;
- Nanomaterials, nanotechnologies, and multifunctional systems for health;
- Materials and sensors for environmental and biological monitoring;
- Valorization, recycling, degradability, and lifecycle management of materials.

Students also gain a deep understanding of the interactions between different disciplines and the scientific, environmental, and societal stakes involved in developing sustainable and functional materials.

Practical Skills / Know-How

The program equips students with a complete scientific approach, from problem formulation to the analysis and dissemination of results. Specifically, students will be able to:

- Search, select, analyze, and synthesize scientific information from literature;
- Formulate scientific questions and define research objectives;
- Design an experimental strategy tailored to a given research problem;

- Select and implement appropriate synthesis, preparation, and characterization techniques;
- Operate and interpret structural, spectroscopic, physicochemical, and morphological characterization tools;
- Analyze, process, and interpret experimental data;
- Utilize digital tools and artificial intelligence approaches for scientific data processing and analysis;
- Compare experimental findings against theoretical models, existing literature, and initial hypotheses;
- Identify limits, sources of uncertainty, and result reproducibility;
- Adapt experimental strategies based on observed outcomes;
- Lead a research project autonomously and progressively;
- Present and discuss scientific findings orally and in writing;
- Write scientific reports, literature reviews, and research documentation;
- Address interdisciplinary challenges involving multiple areas of chemistry and materials science.

Laboratory immersion and the individual research project allow students to work in conditions that closely mirror those of academic laboratories and industrial R&D environments.

Soft Skills / Professional Conduct

The educational structure fosters a professional and scientific posture built on autonomy, initiative, and responsibility. Students learn to:

- Take active ownership of their training and scientific projects;
- Demonstrate scientific curiosity, initiative, and creativity;
- Develop independence in information retrieval and problem-solving;
- Exercise critical thinking regarding experimental results and scientific literature;
- Embrace uncertainty and unexpected results as intrinsic components of the research process;
- Show rigor, reliability, and responsibility in conducting experimental work;
- Collaborate effectively within interdisciplinary teams;
- Communicate across different scientific disciplines and cultural backgrounds;
- Manage long-term projects by structuring key stages and meeting established milestones;
- Integrate ethical, environmental, and societal considerations into scientific activities;
- Adapt flexibly to new scientific, technical, and professional environments.

Other Developed Skills

The IDIMAT track also develops cross-functional skills to facilitate further study or entry into diverse academic and industrial career paths. Students acquire competence in:

- Scientific project management and organization;
- Teamwork and team management;
- Scientific communication in English;
- Oral presentation and science outreach to broader audiences;
- Scientific and professional writing;
- Critical literature analysis and scientific monitoring (*veille scientifique*);
- Informed use of digital tools and artificial intelligence in scientific work;
- Planning and evolving a personal and professional career roadmap;
- Operating in international and multicultural environments;
- Collaborating with academic and socio-economic partners;
- Incorporating principles of sustainability and responsibility into materials design and application.

In summary, the track delivers an integrated set of scientific knowledge, experimental methodology, and transferable skills. Combining taught modules, individual research, multidisciplinary team projects, and lab immersions allows students to progressively adopt a researcher's mindset and adapt flexibly to various professional settings—whether continuing to a PhD, entering academic or industrial R&D, or pursuing other high-level scientific and technical careers.

DETAILED CURRICULUM

Semester 1 (S7)

- **HBC704C** Colloidal Solutions, Interfaces, and Dispersed Systems (2 ECTS)
- **HBC710C** Polymers (2 ECTS)
- **HBC708C** Coordination and Organic Chemistry (2 ECTS)
- **HBN714C** Methodology for Materials Characterization (2 ECTS)
- **HBC711C** Solution-State NMR Spectroscopy and X-ray Diffraction (2 ECTS)
- **HBC702C** Advanced (Nano)Materials (2 ECTS)
- **HBN713C** Advanced Inorganic Materials **OR HBC703C** Hybrid and Structured Materials (2 ECTS)
- **In-Lab Teaching Unit** (Experiments + Data Analysis with AI) (2 ECTS)
- **Personal Project** (10 ECTS total):
  - **HAC727C** Professional Project (8 ECTS)
  - **Supervised Research Project** (2 ECTS)
- **Transversal Training Unit** – Team Management (2 ECTS)
- **Non-Core Teaching Unit** (2 ECTS)

Semester 2 (S8)

- **HBC804C** 6-Month Internship (30 ECTS)

Semester 3 (S9)

- **Multidisciplinary Team Project** (10 ECTS)
- **HBC915C** Life Cycle Assessment and Eco-Design (2 ECTS)

- **HBC922C** Functional Membranes for Environment and Health (2 ECTS)
- **HBC906C** Biopolymers for Health and Environment (2 ECTS)
- **HBC907C** Advanced Materials for Environmental & Health Sensors (2 ECTS)
- **HBC909C** High-Performance Materials (2 ECTS)
- **Health Track / Elective (6 ECTS):**
  - **HBV707V** Hub Research Module (4 ECTS)
  - **HBC927C** (Nano)materials for Health (2 ECTS)
  - **HBC929H** Nanotechnologies and Multifunctional Systems for Therapeutic Applications (2 ECTS)
- **Environment Track / Elective (6 ECTS):**
  - **HBC910C** Green Chemistry (2 ECTS)
  - **HBC908C** Catalysis / Photocatalysis (2 ECTS)
  - **HBCXXXC** Eco-designed (Bio)materials: Valorization, Recycling, and Degradability (2 ECTS)
- **Transversal Training Unit** (2 ECTS)
- **Non-Core Teaching Unit** (2 ECTS)

Semester 4 (S10)

- **HAC016C** 6-Month Internship (30 ECTS)

Non-Core Units:

- *Introductory course option for external students (e.g., General / Fundamental Chemistry)*

In-Lab Units:

- *Laboratory Immersion Modules (S7 & S9)*

ADMISSION REQUIREMENTS & STUDENT PROFILE

The IDIMAT Chemistry of Materials track is primarily intended for students holding a Bachelor's degree (Licence / L3) in Chemistry, Physical Chemistry, or an equivalent degree. Access is also open to applicants from other scientific backgrounds with the required prerequisites in chemistry, subject to application review.

Applicants should possess a strong foundation in core chemistry, particularly general and physical chemistry. Background knowledge in solution chemistry, organic chemistry, and inorganic chemistry is a distinct asset for starting the program under good conditions.

The program seeks students interested in materials science and experimental approaches who wish to develop their scientific capabilities and independence.

Scientific curiosity, analytical reasoning, critical thinking, aptitude for laboratory work, and strong motivation for research are particularly well-suited qualities. Teamwork abilities, good communication skills for presenting scientific results, and self-directed learning skills are also expected. English proficiency is required to follow coursework; a good reading knowledge of scientific English is an advantage, notably for literature reviews and research activities.
Special attention is given to the alignment between the applicant's prior academic pathway, acquired skills, and personal study plan—especially for candidates planning to pursue research careers and a PhD.

CAREER OPPORTUNITIES

The IDIMAT Chemistry of Materials track primarily prepares students for PhD studies and research careers in chemistry of materials and their interfaces.

Main Career Paths & Outcomes:

- Doctoral studies (PhD) in chemistry, materials chemistry, nanoscience, physical chemistry, or related interdisciplinary fields;
- Scientific research and development (R&D) roles, particularly in materials, nanomaterials, environmental science, and healthcare;
- Research Engineer / Study Engineer (*Ingénieur d'études / de recherche*);
- R&D Project Leader / R&D Scientist (*Chargé de R&D*);
- Assistant Engineer / Materials Characterization & Development Engineer;
- Materials synthesis, characterization, development, and optimization roles;
- Scientific analysis and expertise positions in public or private analytical laboratories.

Primary Work Environments:

Public research laboratories, universities, national research institutes, research and development centers, as well as private sector companies with active R&D divisions in materials science.
The curriculum provides a solid stepping stone toward an academic research career while opening up strong prospects in industrial research and development.

RESEARCH LABORATORIES & ACADEMIC PARTNERS

The IDIMAT track benefits from the vibrant scientific and educational ecosystem of the University of Montpellier and its integration within the IDIL (Interdisciplinary In-Lab) Graduate Program. This program strengthens ties between education and research, promotes interdisciplinary approaches, and offers students immersive experiences within research laboratories.

Academic & Institutional Partners

The track belongs to a network of schools and faculties within the University of Montpellier involved in the IDIL program, including:

- Faculty of Science (*Faculté des Sciences*)
- Faculty of Medicine (*Faculté de Médecine*)
- Faculty of Pharmacy (*Faculté de Pharmacie*)
- National Superior School of Chemistry of Montpellier (*ENSCM*)
- Polytech Montpellier
- Institut Agro Montpellier

These inter-institutional links encourage cross-disciplinary exchange and open opportunities at the interfaces of chemistry, materials, biology, and health.

Associated Research Laboratories & Institutes

The program relies on research laboratories at the University of Montpellier and its partner institutions, notably:

- **ICGM** – Charles Gerhardt Institute of Montpellier (UMR 5253)
- **IEM** – European Institute of Membranes
- **IBMM** – Max Mousseron Institute of Biomolecules
- **ICSM** – Marcoule Institute for Separation Chemistry

...as well as other laboratories within the IDIL network operating in chemistry, materials, environment, and health.

These collaborations enable students to carry out research projects and internships in active labs, explore diverse scientific methodologies, and gain autonomy as part of their training through research.

International Outlook

The track builds on the international dimension of the IDIL program, where courses are taught in English and international students are welcomed from around the world. This fosters scientific and cultural exchange, provides access to international literature, and prepares students for global research environments.

International collaborations can also be leveraged through the global networks of the University of Montpellier and its partner schools, particularly in health sciences, chemistry, and materials.

Collectively, these partnerships enhance program quality, foster interdisciplinarity, and provide comprehensive preparation for doctoral studies.

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