Université de Strasbourg

# MASTER - Chimie

# Chimie physique et matériaux (Chemical physics and materials)

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|---|---|---|---|
| Langue du parcours | | | Anglais |
| ECTS | | | 120 ECTS |
| Volume horaire | | | |
| TP : 0h | TD : 0h | CI : 0h | CM : 0h |
| Formation initiale | | | Oui |
| Formation continue | | | Non |
| Apprentissage | | | Non |
| Contrat de professionnalisation | | | Non |
| Stage : (durée en semaines) | | | 30 |

## Pré-requis obligatoires

**Recruitment of students and requested background** A committee decides on the specific criteria and the requested background for acceptance in the master program. This committee, the so called "Commission Pédagogique," includes professors involved in the first and second year of the master M1 teaching and M2, as well as the professors responsible for the master program.

Given the multidisciplinary nature of this master program, students from other universities or other master programs may be accepted after evaluation of their background. A valid M1 is necessary at any time. Students may be invited for an interview before each admission.
It is noted that sufficient command of English is necessary, knowledge of French is desirable. As already said, all lectures are performed in English, including evaluation

## Objectifs du parcours

This Master's degree offers a thorough training in Chemical Physics, Materials and Nanomaterials Chemistry, Biophysical Chemistry or Theoretical Chemistry. The academic training in the first year if followed by a salaried experimental internship in the second semester that can be performed either in academic laboratories or in industry. The M2 Master "Chemical Physics and Materials (CPM)" corresponds to the second year for the M1 Master "Physical Chemistry, Analytical Chemistry and Materials (CPAM)". It aims to provide students with the necessary theoretical and experimental knowledge and basic skills, for the understanding of matter. All lectures are performed in English, as well as the evaluation.

**Skills and Objectives of the program**
Students can join on the M2 level if they have a valid first year of a master, which gives the necessary background in physical chemistry. Usually students join after the M1 Master "Physical Chemistry, Analytical Chemistry and Materials (CPIAM)" but we also accept students from other master programs and countries (see below)
The master program include lectures in three main axes: "Physical Chemistry", "Chemistry of Materials" and "Theoretical Physical Chemistry", which lead to an excellent perspective for professional integration in research, industry or education
Depending on the choice of courses, students will acquire specific skills. More generally, students have the opportunity to develop skills in Research and Teaching.

- Design, synthesis and characterization of matter in connection with the excellence of the academic research laboratories in Strasbourg.
- understanding of the science of materials ranging from the nature of the materials, their preparation, their characterization to the study of their specific properties.
- Use of advanced spectroscopic and microscopic methods
- Skills in the main areas of physical chemistry: Thermody namics, kinetics, electrochemistry, theoretical chemistry.

The teaching should enable students to understand the science of complex matter, including biomolecules, supramolecular structures, polymers, nanomaterials, etc. By the variety of optional courses that are offered, students can define their own competence profile.
Lectures providing students the mastering of theoretical and technical skills that will enable the extensive use of computer codes for quantum chemistry, quantum dynamics and molecular modelling, are also suggested.

Holders of this diploma will be able to work in the fields of research and development. The specificity at the level of the chemistry allows them to facilitate interactions with teams of chemists involved in the synthesis of complex matter.

## Poursuite d'études

**Further studies**
The master degree gives successful students the possibility to apply for a PhD program, focus on research or join industry.
Within the master program there is a special training for professional integration in industry, public research.

## Contacts

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# Master 1 CPIAM - Chimie physique, informatique, analytique et matériaux

## Semestre 1 CPIAM - Chimie physique, informatique, analytique et matériaux

| | ECTS | CM | CI | TD | TP | TE | Stage |
|---|---|---|---|---|---|---|---|
| TP transverses | 4 ECTS | | | | | | |
| TP transverses | | | | | 72 h | | |
| Electrochemistry | 3 ECTS | | | | | | |
| Electrochemistry | | | 24 h | | | | |
| Spectroscopies optiques | 3 ECTS | | | | | | |
| Spectroscopies optiques | | | 24 h | | | | |
| Modélisation - introduction | 5 ECTS | | | | | | |
| Basics of electronic structure calculations and introduction to DFT | | 18 h | | | 9 h | | |
| Molecular modelling | | 10 h | | | 8 h | | |
| Chemoinformatics | | 10 h | | | 10 h | | |
| Cinétique et thermodynamique | 3 ECTS | | | | | | |
| Cinétique et thermodynamique | | | 24 h | | | | |
| Matériaux - introduction | 3 ECTS | | | | | | |
| Matériaux - introduction | | | 24 h | | | | |
| Méthodes statistiques | 3 ECTS | | | | | | |
| Méthodes statistiques | | 16 h | | 8 h | | | |
| CPIAM-M1S1 Bloc d'UEs à choix (pour un total de 6 ECTS) | | | | | | | |
| Chimie organique | 3 ECTS | | | | | | |
| Chimie organique | | | 24 h | | | | |
| Chimie inorganique | 3 ECTS | | | | | | |
| Chimie inorganique | | | 24 h | | | | |
| Structure et diffraction | 3 ECTS | | | | | | |
| Structure et diffraction | | | 24 h | | | | |
| Chimie analytique au service de la science et de la société | 3 ECTS | | | | | | |
| Chimie analytique au service de la science et de la société | | | 24 h | | | | |
| Algorithmique et programmation | 6 ECTS | | 38 h | | 22 h | | |

## Semestre 2 CPIAM - Chimie physique, informatique, analytique et matériaux

| | ECTS | CM | CI | TD | TP | TE | Stage |
|---|---|---|---|---|---|---|---|
| NMR spectroscopy | 3 ECTS | | | | | | |
| NMR spectroscopy | | 16 h | | 8 h | | | |
| Complex systems and non-equilibrium kinetics | 3 ECTS | | | | | | |
| Complex systems and non-equilibrium kinetics | | | 24 h | | | | |
| Pratique expérimentale en laboratoire de recherche ou stage en entreprise | 9 ECTS | | | | | | |
| Pratique expérimentale en laboratoire de recherche ou stage en entreprise | | | | | | | 10 sem |
| Préparation à l'insertion professionnelle | 3 ECTS | | | | | | |
| Préparation à l'insertion professionnelle | | | 28 h | | | | |
| CPIAM-M1S2 Bloc d'UEs pour orientation M2 (pour un total de 12 ECTS) | | | | | | | |
| Chimie physique et matériaux | 12 ECTS | | | | | | |
| Matériaux nanostructurés | | | 24 h | | | | |
| Chimie moléculaire de l'état solide | | | 24 h | | | | |
| TP Chimie physique | | | | | 40 h | | |
| TP Chimie des matériaux | | | | | 40 h | | |
| Sciences analytiques | 12 ECTS | | | | | | |
| Méthodes séparatives et spectrométrie | | 22 h | | 6 h | | | |
| Métrologie et validation des méthodes d'analyse | | 20 h | | 8 h | | | |
| TP Instrumentation | | | | | 40 h | | |
| TP Chimie analytique | | | | | 40 h | | |
| Informatique | 12 ECTS | 54 h | 48 h | 12 h | 10 h | | |
| Systèmes d'exploitation et réseaux | | | 24 h | | | | |
| Chemical databases and introduction to data sciences | | | 24 h | | | | |
| Modeling of supramolecular architectures | | | 16 h | | | | |
| Electronic structure and DFT | | 26 h | | | | | |
| Programmation orientée objets | | 12 h | | 12 h | 10 h | | |

# Master 2 - Chimie physique et matériaux

## Semestre 3 - Chimie physique et matériaux

| | ECTS | CM | CI | TD | TP | TE | Stage |
|---|---|---|---|---|---|---|---|
| Nanosciences and functional materials | 3 ECTS | | | | | | |
| Nanosciences and functional materials | | 20 h | | 4 h | | | |
| Microscopy and nanoscopy | 3 ECTS | | | | | | |
| Microscopy and nanoscopy | | 20 h | | 4 h | | | |
| Energy conversion | 3 ECTS | | | | | | |
| Energy conversion | | 16 h | | 8 h | | | |
| Functional oxides | 3 ECTS | | | | | | |
| Functional oxides | | | 24 h | | | | |
| Advanced optical spectroscopies | 3 ECTS | | | | | | |
| Advanced optical spectroscopies | | | 21 h | | | | |
| Bibliographic project | 3 ECTS | | | | | | |
| Bibliographic project | | | | | | | |
| CPM-M2S3 Bloc d'UEs à choix (pour un total de 12 ECTS) | | | | | | | |
| Molecular materials : magnetism and electronics | 3 ECTS | | | | | | |
| Molecular materials : magnetism and electronics | | | 24 h | | | | |
| Surface reactivity and heterogeneous catalysis | 3 ECTS | | | | | | |
| Surface reactivity and heterogeneous catalysis | | | 24 h | | | | |
| Structural biology and molecular modelling | 3 ECTS | | | | | | |
| Structural biology and molecular modelling | | 16 h | | 8 h | | | |
| Biophysicalchemistry | 3 ECTS | | | | | | |
| Biophysicalchemistry | | 16 h | | 8 h | | | |
| Advanced quantum chemistry | 3 ECTS | | | | | | |
| Advanced quantum chemistry | | 16 h | | 8 h | 8 h | | |
| Cours du RFCT | 3 ECTS | | | | | | |
| Cours du RFCT | | | 30 h | | | | |
| Molecular dynamics simulation | 3 ECTS | | | | | | |
| Molecular dynamics simulation | | | 24 h | | | | |

## Semestre 4 - Chimie physique et matériaux

| | ECTS | CM | CI | TD | TP | TE | Stage |
|---|---|---|---|---|---|---|---|
| Stage en laboratoire de recherche ou en entreprise Training period | 30 ECTS | | | | | | 20 sem |