

# Goals of the training

The specialization CRYSTALLIZATION proposed in the Master of Chemistry at the University of Rouen Normandie is **unique in France**.

This formation proposes a multi-disciplinary training based on a **fundamental and applied** approach of the CRYSTALLIZATION process.

This complex physico-chemical process is central to **separation operations, purification or fabrication of materials with controlled properties** in various industrial fields (fine chemicals, pharmaceutical industry, semi-conductors, cosmetics, ...).

The graduated student will possess the theoretical and experimental knowledge allowing him/her to understand classical methods of crystallization and design new ones suitable for the considered materials and the targeted applications.

# Admission requirements

## Admission in first year of Master (M1):

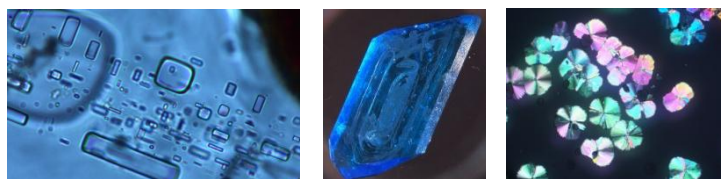
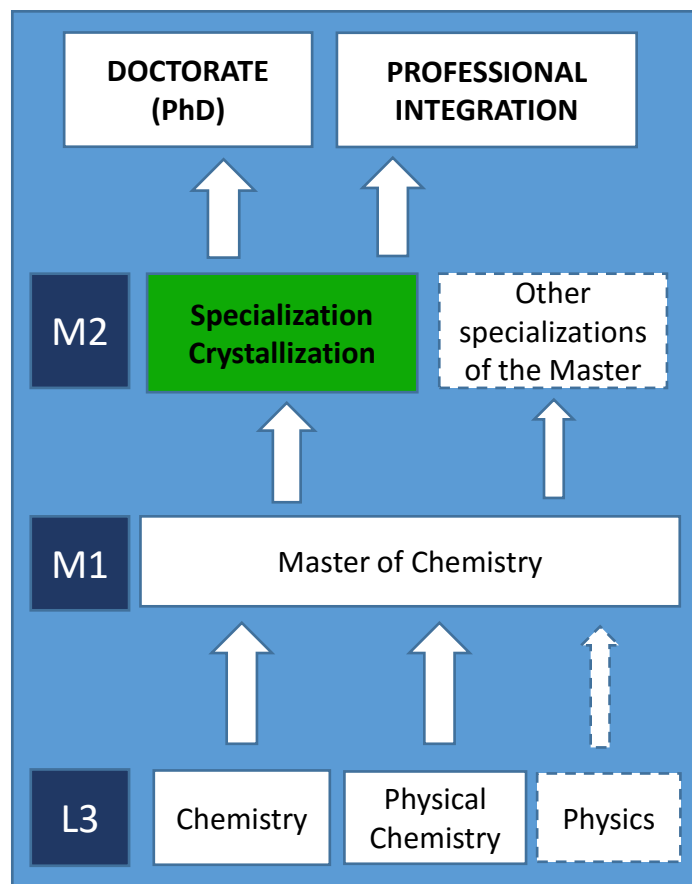
➤ For students who obtained their bachelor degree (Licence) in a French or foreign university in chemistry, physical chemistry, physics or an equivalent degree, the admission is subjected to the evaluation of an application file by a validation commission.

## Admission in second year of Master (M2):

➤ **Direct admission** for students who validated their M1 Chemistry at the University of Rouen Normandie.

➤ **Subjected to the evaluation of an application file by a validation commission for:**

- ◆ Students who validated a M1 in Chemistry or in Chemistry and Material Sciences in another French University.
- ◆ Students in French Schools of Engineering who are willing to follow a double cursus during their fifth year.
- ◆ Students from foreign Universities who justify of getting knowledge and skills equivalent to those obtained in a M1 Chemistry or M1 Chemistry and Material Sciences.
- ◆ Employees from industry who are willing to obtain a degree equivalent to the M2 via a "VAE" or the "formation tout au long de la vie" (in the framework of the personal training account). *Only employees of French companies are eligible to these training options.*



# Targeted skills

The Master of Chemistry - specialization **Crystallization** will enable students of this training to:

- Understand the fundamental mechanisms involved in the phenomenon of crystallization
- Acquire the fundamental and practical knowledge for analyzing and describing the solid state
- Get a multi-disciplinary knowledge of the crystallization process and manufacture of solid materials
- Be familiar with industrial crystallization processes (separation, purification, final processing)
- Propose and design crystallization methods suitable for a given issue

# Program and contents

## Master of Chemistry 1<sup>st</sup> year (60 ECTS)

### Semester 1

- English (2 ECTS)
- Preparation to professional integration (1 ECTS)
- Tutoed project\* (2 ECTS)
- Physico-chemistry of polymers (6 ECTS)
- Chemistry of non-metals and chromatography (6 ECTS)
- Quantum chemistry and molecular modeling (4 ECTS)
- Organic chemistry (6 ECTS)
- Optional course (1 choice among 2) (3ECTS)
  - NMR and mass spectrometry
  - Solid state chemistry

### Semester 2

- Analytical and applied electrochemistry (6 ECTS)
- Chemistry specialization 1 (among 2 choices) (6 ECTS)
  - Synthesis of natural products
  - Polymer materials and dispersed systems
- Chemistry specialization 2 (among 2 choices) (6 ECTS)
  - Methods and strategies in organic synthesis
  - Inorganic materials
- Chemistry specialization 3 (among 2 choices) (6 ECTS)
  - Analysis and spectrochemistry
  - Fundamentals of crystallization
- Chemistry specialization 4 (among 2 choices) (6 ECTS)
  - Natural macromolecules
  - Spectroscopy, spectrometry and modeling

## Master of Chemistry 2<sup>nd</sup> year (60 ECTS)

### Semester 3

- Fundamentals about the solid state (4 ECTS)
- Metallic solid state (3 ECTS)
- Crystallization processes (7 ECTS)
- Molecular solids (7 ECTS)
- Characterization of polymers (5 ECTS)
- Crystalline inorganic materials (4 ECTS)

### Semester 4

- English (3 ECTS)
- Professional integration (1 ECTS)
- Communication and industrial environment (1 ECTS)
- Internship \*\* (25 ECTS)

\* *Research project to be realized during 5 weeks in a research laboratory.*

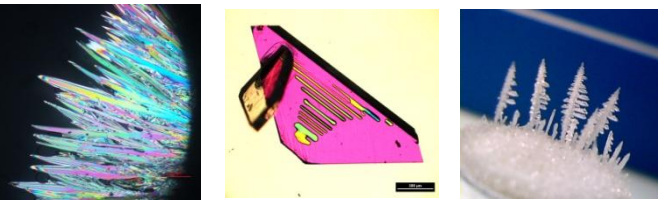
\*\* *Internship of ca. 6 months achieved in an academic laboratory or in industry (France or foreign countries).*

# Career opportunities

**Fields** : pharmaceutical industry, fine chemicals, ceramics, cosmetics, agrochemical industry, mineral wastes treatment and valorization.


**Positions in academia** : research engineers, researcher, associate professor (after three years of PhD)


**Positions in Industrial/private companies** : executive, project or service leader, design or research engineers, consulting engineers/experts in the field of intellectual property.



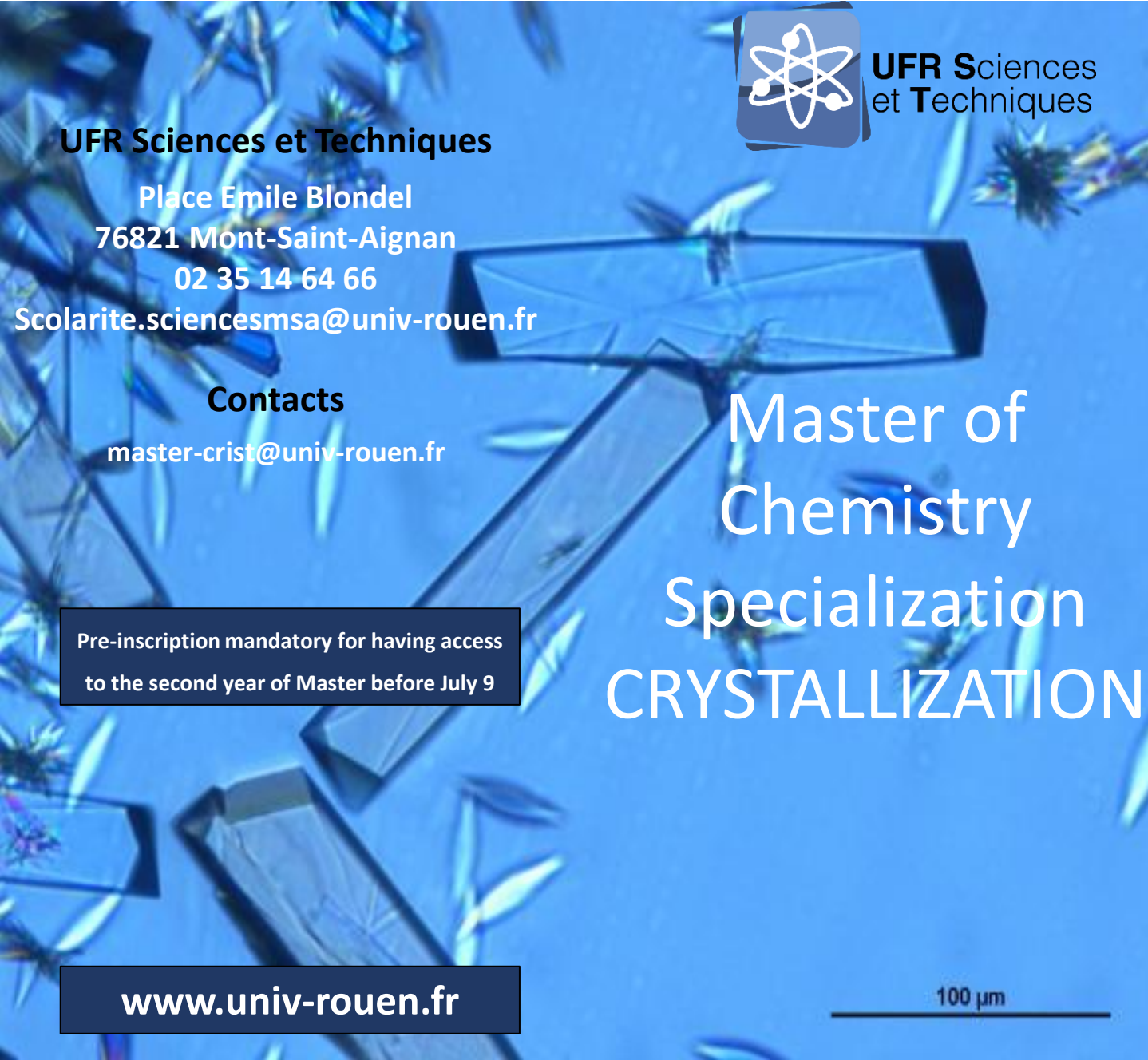
Research laboratories associated to the Master of Chemistry specialization  
Crystallization:


 **Laboratoire Sciences & Méthodes Séparatives**  
EA 3233  
<http://labsms.univ-rouen.fr/en>

 **Laboratoire de Cristallographie et Sciences des matériaux UMR 6508**  
<http://www-crismat.ensicaen.fr/>

 **Laboratoire Polymères Biopolymères Surfaces UMR 6270**  
<http://pbs.univ-rouen.fr/>

 **Laboratoire Catalyse et Spectrochimie UMR 6506**  
<http://www-lcs.ensicaen.fr/>



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Pre-inscription mandatory for having access to the second year of Master before July 9

**Master of Chemistry Specialization CRYSTALLIZATION**

[www.univ-rouen.fr](http://www.univ-rouen.fr)

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