

Welcome to  
**MINES Saint-Étienne!**



**MINES**  
Saint-Étienne  
—  
Une école de l'IMT



# Process Engineering & Industrial Energy Efficiency

Master of Science

[www.mines-stetienne.fr](http://www.mines-stetienne.fr)



**INSPIRING  
INNOVATION**  
SINCE 1816

**A Master of Science** (National Masters' Degree)  
*Accredited by the French Ministry of Higher  
Education and Research  
at the **École Nationale Supérieure des Mines  
de Saint-Étienne, France***

 **Taught in English**

## **A new opportunity for international students**

- Taught in English
- A one year Programme
- Master of Science diploma
- A key step for PhD studies

## **Applications for Eco-efficient Industrial processes: to produce and use cleaner, safer, and efficient energy**

**This Master of Science in Chemical Engineering is also partly focused on the study of industrial processes in relation with solid reactions (particles, powders, granular and porous media): studies ranging from micro to macro scale "From particles to processes"**

## **Course** structure

### **Process simulation & Advanced thermodynamics (6 ECTS)**

- Focus on fluid thermodynamics
- Focus on water thermodynamics

### **Heat Generation : fission and nuclear reactor, combustion (4 ECTS)**

### **Applied fluid mechanics for industry (6 ECTS)**

### **Classical systems for massive energy generation (4 ECTS)**

### **Systems for mass production of energy based on renewable energies (5 ECTS)**

### **Energy processes biomass and solar (5 ECTS)**

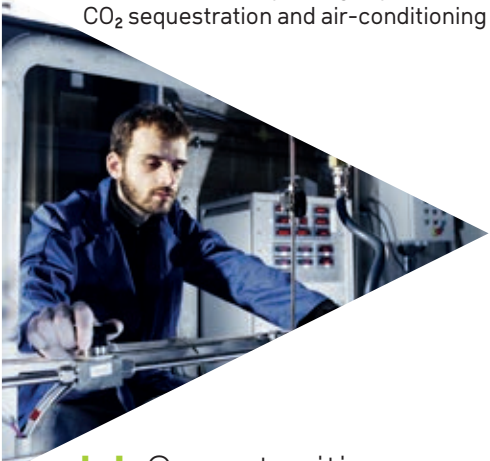
### **One of the following modules:**

- Reactivity of heterogeneous systems and modeling for the design of reactors (6 ECTS)
- Transfers, Reactors and Unit operations (6 ECTS)

### **6-month internship in laboratories at MINES Saint-Etienne or in R&D industrial Centres / 30 ECTS**

# Internship Opportunities

- Particle design: synthesis, reactivity and transport of dispersed and porous materials
- Modelling of powder chemical transformations in controlled atmospheres with a multiscale approach
- Crystallisation of gas hydrates for flow assurance, CO<sub>2</sub> capture, gas production, CO<sub>2</sub> sequestration and air-conditioning



# PhD Opportunities

## Thermodynamic and kinetic study of gas hydrate crystallisation (joint PhD with a petroleum company)

- Development of a NO<sub>x</sub> sensor for automotive exhaust applications (joint PhD with an automotive supplier)
- Study of oxalates mixtures decomposition (joint PhD with a nuclear fuel company)



# Job Opportunities

## Associate Professor, Research Engineer in Industrial R&D Centres, Engineering for Energy processes

### Various profiles in the field of chemical processes related to the energy chain:

- Free carbon energy production : nuclear, fossils and bio-sourced
- Efficient plants : materials, energy and water management



# Requirements for applicants

- Prior successful completion of a first year of a Master's Degree in theoretical and / or applied science, or equivalent diploma (at the home university or Ecole des Mines) / or 240 ECTS validated
- A good command of English is mandatory



**With the collaboration of the Education and Research Centre for Science of Industrial and Natural Processes (SPIN) which gathers:**

**23 faculty members**

**28 PhD Students**

**Laboratories:**

- PRESSIC: Processes with solid reactivity and solid-gas interactions
- ProPICE: Powders Processing, Interfaces, Crystallisation and Flow
- GSE: GeoSciences and Environment

**Expertise, competences and skills:**

- Heterogeneous and granular dynamic systems,
- Multi-physics and multi-scales models, from nm<sup>3</sup> to km<sup>3</sup>
- In line, in-situ and off-line physico-chemical characterisations
- Technology: from sensor to process designing, sizing and prototyping

**4 analytical platforms, 1 technology platform, 1 Nuclear room, 1 Nano room**

- PC2 : Powder and Physico-Chemical characterisations, / ESMAT : Solids Thermal Micro-Analyses,
- SAC : Spectro and Chemical characterisations, / OSP : 2D and 3D Models in GeoSciences
- HALLE-T2E2: Hall for Energy and Water technologies prototyping

**Industrial partners :**

Areva, Total, Solvay, Rio Tinto, Arcelor, Lafarge, St-Gobain, Kerneos, Eramet

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