

Postdoc in Thermodynamics and modeling of a chemical process of REEs extraction from the phosphogypses - 12-month fixed term contract

CENTRE SPIN

JOB ENVIRONMENT:

Institut Mines-Télécom is the leading public group of engineering and management *Grandes Écoles* in France. Consisting of eight public graduate *Grandes Écoles* and two subsidiary graduate schools, *Institut Mines-Télécom* leads and develops a rich ecosystem of partner schools, economic, academic and institutional partners, key players in education, research and economic development.

Mines Saint-Étienne, a graduate school of the *Institut Mines-Télécom*, is responsible for education, research, innovation, industrial transfer and scientific culture dissemination. With 2,500 students, 500 staff and a budget of €50m, it has 3 campuses dedicated to the industry of the future, health and well-being, and digital sovereignty and microelectronics. It is ranked in the top 15 graduate engineering schools in France and the top 500 universities worldwide.

The 2023-2027 strategy of Mines Saint-Etienne is in line with that of *Institut Mines Telecom*. It aims to:

- Support the ecological, digital and generational transitions and educate the people involved
- Support national and European sovereignty in microelectronics and digital technology.

To support this strategy, it is recruiting a postdoctoral.

JOB DESCRIPTION:

Phosphogypsum Processing to Critical Raw Materials (PG2CRM) is a project funded through the EU Co-funded ERA-MIN Joint Transnational Call 2021, spearheaded by EMSE. The objective of the project is to further develop an innovative process for Rare Earth Elements (REEs) recovery from Phosphogypsum (PG). The focus will be on the comprehensive use of PG and besides the opportunity to recover REEs from it, the remaining gypsum matrix will be used as an inexpensive material in construction/sound insulation.

In this context, SPIN, which is the chemical engineering research center of Mines Saint-Etienne is in charge of the process of the sustainable extraction and purification of REEs from PG, with the final goal of demonstrating an integrated pilot line. Special focus will be paid to waste reduction, management, and valorization along the process.

The present job offer is a 12-month post-doctoral contract which will take place in the laboratory of Mines Saint-Etienne.

The project aims to collect and analyze different types of PG, conduct laboratory-scale recovery of rare earth elements from PG while purifying it, implement the developed processes on a pilot scale, and demonstrate the technology for rare earth element recovery and PG purification.

Reporting to the research director, your main tasks will be explained here :

The successful candidate will be responsible for translating and implementing the processes developed in the laboratory setting onto a pilot scale.

As part of the PG2CRM project within the PEG-SPIN laboratory, the candidate will exploit experimental data collected at the laboratory scale, providing essential specifications for the implementation of thermodynamic modeling. This project aims to achieve a comprehensive understanding and effective management of the

multitude of processes, phenomena and mechanisms associated with the extraction of REEs. To achieve this, it is essential to carry out an in-depth thermodynamic study of our polyelectrolyte system. This study, rooted in thermodynamic modeling, is of twofold importance. Firstly, it provides valuable information about the reaction system by calculating the aqueous speciation and predicting the mineral phases into which substances can precipitate. This involves calculating saturation indices and maximum quantities under variable conditions such as temperature, impurity concentration and the use of additives to facilitate the extraction process. In addition, this study provides a basis for predicting and calculating specific, experimentally accessible macroscopic parameters such as pH, solubility, conductivity, aqueous phase density and water activity (a_w), among others. These parameters serve as indispensable tools for selecting and validating the thermodynamic model.

A comprehensive exploration of the thermodynamics establishes a solid basis for the modeling, simulation and optimization of potential industrial processes for the extraction of rare earths from PG. Based on various experimental protocols carried out in the PEG-SPIN laboratory and on the results obtained from the thermodynamic analysis, the candidate will develop an initial process scheme. This scheme will include the key unit operations known in chemical engineering. Next, the candidate will formulate the mathematical model of the process, integrating the material balances, energy balances and thermodynamic models. Preliminary simulation calculations will then begin, guiding progress toward the sizing phase of the various process equipment, whether on a pilot or industrial scale, and the selection of the appropriate technologies to be employed.

Tasks may change depending on the needs of the department and Mines Saint-Etienne.
The position is based on the Saint-Etienne campus.

PROFIL SOUGHT:

You are in one of the following situations:

- A doctoral degree no more than 3 years old, in which case you will be employed as a post-doctoral researcher.
- If your doctorate is more than 3 years old, you will be employed as a research and development engineer.

**In accordance with the law on programming and research.*

And ideally:

- Holder of PhD in a relevant field (Chemical Engineering, Process Engineering, ...).

You have the following skills, knowledge and experience:

- Strong background in heat and mass transfer simulation
- Strong background in the design, construction and commissioning of industrial prototypes
- Good knowledge of simulations using state-of-the-art software (e.g. gPROMS, ASPEN, MATLAB, Python, etc.)
- Proficiency in CAD 3D & 2D software (e.g. Autodesk software suite).

You recognise yourself in the following abilities and skills:

- Demonstrated research aptitude
- Excellent communication skills

WHY JOIN US:

Institut Mines-Telecom is characterised by:

<https://www.youtube.com/watch?v=m39m6hdNC48>

- A scientific environment of excellence
- A group with entities throughout France

Mines Saint-Etienne is distinguished by:

- A privileged working environment with a high student supervision rate and a high environment rate (support and back-up functions)
- First-rate experimental and digital resources
- Significant contract research activity (€11m/year in Research and Innovation contracts), mainly with industrial partners
- 25% international students, Member of the T.I.M.E. network and the EULIST European University
- A centre for scientific, technical and industrial culture - *La Rotonde* - which is unique in France, and which has a major impact on society (> 50,000 visitors per year)
- Pleasant workplace, easily accessible by public transport and close to motorways
- Public transport costs reimbursed up to 75% (subject to conditions)
- Sustainable mobility package
- Staff committee that subsidises sports, leisure, cultural and social events and activities
- The possibility of partial remote working
- 49 days annual leave

ADDITIONAL INFORMATION:

Recruitment conditions:

- Fixed-term contract for a period of 12 months
- Desired start date: 01/09/2024
- Remuneration will be set according to the candidate's profile, based on the rules defined by the *Institut Mines Télécom*'s management framework
- Full time
- Position based in Saint-Étienne
- For internal use:
 - Category II - Job P - *Post-doctorant* according to the Management Framework

The position is open to all, with accommodation available on request for candidates with disabilities.

The job is open to civil servants and/or the general public.

All applications may be subject to an administrative enquiry.

How to apply:

Applications (CV, covering letter, letter of recommendation if applicable) must be submitted on the RECRUITEE platform **no later than 15/07/2024:**

<https://institutminestelem.com/recrutee.com/o/postdoc-in-thermodynamics-and-modeling-of-a-chemical-process-of-rees-extraction-from-the-phosphogypses-12-month-fixed-term-contract-2>

Candidates selected based on their application will be interviewed by videoconference.

As part of its Equality, Diversity and Inclusion policy, École des Mines de Saint Etienne is an employer that is committed to fair treatment of all applicants.

For further information:

For further information about the position, please contact:

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For all administrative information, please contact:

Charlotte MOGIER– HR Administrator

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Useful links:

<https://www.mines-stetienne.fr/>

<https://www.imt.fr/>

<https://www.youtube.com/watch?v=QUeuC5iQiN0>

Protecting your data:

<https://www.mines-stetienne.fr/wp-content/uploads/2018/12/Informations-des-candidats-sur-les-traitements-de-donn%C3%A9es-personnelles.pdf>