

Post-doctoral position in Electrosynthesis of porous metal oxide film for applications in gas sensors – 12 months fixed term contract

CENTRE DE RECHERCHE SPIN, ECOLE DES MINES DE SAINT ETIENNE

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 researcher for developing porous metal oxides materials to be finally used in gas microsensors platform.

JOB DESCRIPTION:

The proposed postdoc will be carried at the Gas sensors group of the “Procédés de Transformations des Solides et Instrumentation (PTSI)” department of the SPIN research center at Ecole des Mines de Saint Etienne. The group is also a part of the SURF team of the Laboratory George Friedel (LGF, CNRS UMR 5307). The group has extensive experiences in developing MO_x formulation and its coating by different methods. These functional MO_x coatings are further used to develop electrochemical and conductometric gas sensors for environmental and healthcare applications. Beside these, an important research line is the electrochemical functionalization of MO_x surface to improve the selectivity of the sensors.

In this endeavor, the proposed postdoctoral position is aimed to develop porous MO_x coating, such as tin oxide (SnO₂) by electrochemical methods. The interest in this oxide material is because of its tunable surface and electrical properties, which can be exploited in designing gas sensors for optimum performances. Among the different electrochemical methods, the two preferred approaches that would be used in this postdoc work would be the dynamic oxygen bubble templet (DOBT) and dynamic hydrogen bubble template (DHBT). They have been previously used to deposit porous film of metals. The porous geometry of the generated films by these deposition methods are very different. In DOBT, the pores are homogeneous and are in the nanometric range, while in DHBT, a hierarchical porous film is generated. The morphology, microstructure and thickness of the porous film can be controlled. One of the key tasks in this postdoc work will be to modify the DOBT and DHBT electrosynthesis methods to prepare porous SnO₂ film. For this goal, effect of different electrodeposition conditions (electrochemical potential, time, concentration and addition of additives) on the porous film growth, its microstructure and surface conductivity will be investigated. The oxide film deposition will be also monitored by electrochemical quartz crystal microbalance to quantify the mass loading.

The postdoc researcher will have access to different electrochemical and material characterizations equipment, which can be handled independently (most of them) or with the support of engineer/technician. The institute has advanced facilities for surface and microstructure characterizations, such as XPS, XRD, XRD tomography, SEM, TEM, AFM, BET and chemisorption analyzer, which can be used in this work. Another task would be depositing the porous SnO₂ film on gas sensor electrodes and conduct sensing experiments to redox gases like NH₃ and NO₂ in association with engineer and Master-2 interns. The researcher will be performing data analysis and writing of report and articles. The researcher will also get opportunity to participate in national/international conferences in electrochemistry and sensors for dissemination of the research outputs and networking.

In some cases, tasks may change depending on the needs of the department and Mines Saint-Etienne.

The position is based on the Saint-Étienne campus. Participation in activities operated by the Saint-Étienne/Aix-Marseille-Provence/Lyon campuses of Ecole des Mines de Saint Etienne and international collaborations are encouraged.

PROFIL SOUGHT:

You are in one of the following situations:

- Holder of a PhD in chemistry, chemical engineering or material science

You have the following skills, knowledge and experience:

- Electrochemistry and chemical sensors
- Familiarity with using potentiostat and working in a chemistry lab
- Data analysis of electrochemical experiments
- Analytical skills in surface and microstructure characterizations of materials
- Thin film coating
- Manuscript writing

WHY JOIN US:

Mines Saint-Etienne is distinguished by:

- 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: **01/01/2025**
- 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

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 [11/11/2024]:**

<https://institutminestelecom.recruitee.com/o/electrosynthese-de-films-oxydes-metalliques-poreux-pour-applications-dans-les-capteurs-de-gaz>

Candidates selected based on their application will be interviewed either by video conference or on site.

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:

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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>