

2023- Postdoctoral position at CEA Grenoble Collaboration LITEN/IRIG



General informations

Description of the entities	<p>The French Alternative Energies and Atomic Energy Commission (CEA) is a public research organisation and a key player in research, development and innovation.</p> <p><u>Description of host unit 1</u></p> <p>CEA-Liten is a major European research institute and a driving force behind the development of the sustainable energy technologies of the future. The institute is spearheading the EU's efforts to limit dependency on fossil fuels and reduce greenhouse gas emissions in three key areas: renewable energy, energy efficiency/storage and development of materials.</p> <p>The Fuel Cell Components Laboratory develops, assembles and validates stack components for low- and medium-temperature hydrogen fuel cells. The Membrane Electrode Assembly (MEA) is the electrochemical heart of the PEMFC fuel cell, in which hydrogen is converted into electricity, and of the AEMW electrolyzers developed to produce hydrogen from water. The manufacture and qualification of the performance and durability of this AME component is an essential link in the development of the fuel cell and electrolyzers.</p> <p><u>Description of host unit 2</u></p> <p>At the CEA's Grenoble centre, the Grenoble Interdisciplinary Institute (IRIG), created in 2019 and attached to the CEA's Fundamental Research Division, conducts research in biology, health, nanosciences, cryotechnologies and new technologies for energy and the environment. Physicists, chemists, biologists, medical doctors, computer scientists and mathematicians are jointly involved in this fundamental research and the applications that arise from it, giving the institute a remarkable capacity to respond to major societal challenges.</p> <p>SyMMES (Systèmes Moléculaires et Matériaux pour l'Energie et la Santé) - one of the IRIG laboratory - explores the design, synthesis and study of innovative and original functional architectures and materials, to respond to societal challenges linked to health and energy storage and conversion.</p>
Description of unit	<p>This post-doctoral contract will mainly be carried out at LITEN/DEHT/STP/LCP, a laboratory specialising in the development and testing in fuel cells of electro-catalysts of the carbonaceous materials/Pt nanoparticles composite type.</p> <p>The post-doc will also carry out experimental campaigns at SyMMES focusing on graphene-based material design, development and structural characterisation (in particular using diffusion techniques: WAXS, SAXS, SANS).</p>

Description du poste

Site	CEA Grenoble
Country	France
Region	Rhone-Alpes
City	Grenoble
Domaine	Materials chemistry - electrochemistry - energy conversion
Contract Job title	Post doctoral position at Grenoble
Project topic	New Sustainable Carbon Catalysts for PEMFC
Contract duration (in months)	24 months
Offer description	<p><u>Project background: the development of materials for PEMFCs</u></p> <p>With the acceleration of developments associated with PEMFC-type fuel cells for decarbonising/decarbonised mobility, barriers/locks, such as the cost and durability of the systems, remain to be overcome/lifted. To achieve this goal, active research is being carried out in the field of active materials development. At present, the most promising electrocatalysts are platinum on a</p>

	<p>carbon support (Pt/C). However, carbon can be electrochemically oxidised under the operating conditions of PEM fuel cells, leading to the agglomeration and coalescence of Pt nanoparticles (Pt-NPs) on the support materials or their detachment, which degrades fuel cell performance. In this context, LITEN is studying other carbon derivatives as catalyst supports, in particular mesoporous carbons, which anchor the Pt-NPs and thus limit their migration or coalescence. This work allowed to establish that a compromise between the active surface area and the degree of graphitisation of carbon supports needs to be reached in order to target more durable and catalytically efficient catalysts.</p> <p><u>Description of the post-doctoral project:</u></p> <p>The aim of the project is to develop and test for ORR, a mesoporous and graphitised graphene aerogel based material, presenting a hierarchical structuring allowing a better material transfer and graphitic domains increasing the durability and conductivity of the final material, and functionalised by Pt-NPs.</p> <p>These graphene-based structures developed at IRIG/SyMMES possess surface chemistries and micro/meso/macro porosities that depend on the synthesis, functionalisation and drying methods used. The aim will be to increase their degree of graphitisation, and then to deposit Pt-NPs by chemical means. The electrocatalytic properties of these materials will then be tested.</p> <p>Advanced meso-structural characterisation of these materials by scattering (X-ray or neutrons) methods will enable to investigate the structural properties of these new electro-catalysts. These properties will then be correlated to their electrocatalytic properties, and performances in fuel cell systems. This knowledge will be gained through ex-situ and operando analyses.</p>
Resources / Methods	<p>Graphene sheet assemblies will be prepared from graphene oxide (GO) by the hydrothermal method. Different parameters (initial GO concentration, pH, drying method, etc.) will be tested to vary the mesoporosity of the final sample. Once prepared, these aerogels will be graphitised thermally (different graphitisation T°C, different carrier gases). The Pt-NPs will then be deposited on these modified aerogels using the polyol method. The size and crystallinity of the Pt-NPs will be studied as a function of the synthesis parameters. The electrocatalysts obtained will be characterised by various routine physico-chemical techniques (XRD, TGA, BET, MEB, TEM, EDX). Advanced meso-structural characterisation by scattering techniques (WAXS, SAXS, SANS) of these supports will be carried out. Electrochemical tests in a 2cm² cell (CdP, EIS, CV) will then be carried out, in order to correlate the physicochemical/morphological/structural properties and electrochemical performance of these materials.</p>
Profile of the candidate	<p>To carry out this research, we are looking for a candidate with a PhD in electrochemistry applied to energy storage or conversion. It would be appreciated if he/she also had dual skills in materials chemistry.</p>

Criteria for applicants

Recommended training	PhD in energy storage
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Requester

How to apply ?	Send CV, covering letter and letters of recommendation to marie.heimann@cea.fr
Position availability	Fall 2023