Glass, glass-ceramic and ceramic electrolytes for all-solid batteries

General information

Offer title: Glassy, glass-ceramic and ceramic electrolytes for all-solid batteries (Thesis, M/F)

Reference :

Workplace: AMIENS and MONTPELLIER

Publication date :

Name of supervisor: VIALLET (LRCS - Amiens) et PIARRISTEGUY (ICGM - Montpellier)

Type of contract: CDD Doctorant/Contrat doctoral

Section CN : 15 Chemistry of materials, nanomaterials and processes

Contract duration: 36 months

Thesis start date: October 2024

Working hours: Full time

Remuneration: €2,135.00 gross per month

**Glassy electrolytes, glass-ceramics and ceramics for all-solid batteries (Thesis, M/F)**

The aim of this collaborative PhD work between an industrial partner, UMICORE, the LRCS at the Université de Picardie Jules Verne in Amiens and the "Chalcogenides and glasses" thematic group of the IGCM D4 department in Montpellier, is to explore the chemistry of inorganic glass, glass-ceramic and ceramic ionic conductors, to be used as solid electrolytes for all-solid-state batteries, by exploring different synthesis routes and compositions. A comprehensive study of transport properties and electrochemical stability will be carried out in conjunction with structural characteristics.

Following an in-depth bibliographical study, the candidate will develop chalcogenide glasses and glass-ceramics by mechanosynthesis and melt-quenching.

Various compositions will be tested, and processing parameters (grinding time and duration) will also be evaluated. Characterization techniques will include X-ray and neutron diffraction, SEM and TEM electron microscopy, and electrical measurements from -35°C to 500°C. Temperature-controlled synchrotron X-ray and neutron diffraction experiments will be used as additional key techniques to study order-disorder transitions and thermal motion factors, as well as glass recrystallization. Raman spectroscopy and solid-state MAS NMR, in collaboration with the RS2E NMR platform, will also be used to investigate local structural and diffusion characteristics.

Solid electrolytes will be integrated into solid-state batteries and their performance evaluated.

**Context of work**

The PhD student will be enrolled in the PhD program of the Université de Picardie Jules Verne (France).

The project will be carried out on two sites:

(a) at the Laboratoire de Réactivité et de Chimie des Solides (LRCS), a joint research unit (UMR 7314) between the CNRS and the Université de Picardie Jules Verne, located in Amiens, France, under the direction of Virginie VIALLET (MCF).

and

(b) Institut Charles Gerhardt Montpellier (ICGM), a joint research unit (UMR 5253) between CNRS, Ecole Nationale Supérieure de Chimie de Montpellier and Université de Montpellier, headed by Andrea PIARRISTEGUY (MCF).

Over 130 people of more than 25 different nationalities work at the LRCS, mainly in the field of electrochemical energy storage technologies (batteries). Virginie Viallet (MCF at LRCS, Université d'Amiens) is an expert in solid-state electrochemistry, and in particular in the development of innovative electrodes and next-generation batteries. She has been involved in several collaborative projects (ANR projects SOLIBAT and CERALION, European project EUROLIS, PEPR LIMASSE) and several contracts with industry (ASB, Renault, UMICORE).

The "Chalcogenides and glasses" thematic group of the D4 department of the Institut Charles Gerhardt Montpellier (ICGM) is one of the world's leading research groups in the study of ionically conductive chalcogenide glasses. Alongside classical solid state chemistry techniques, the group also has expertise in the study of glass homogeneity at micro and nano scales (near-field microscopy) and in structural characterization (large instruments). Andrea Piarristeguy (MCF at ICGM) has extensive experience in the study of ion-conducting chalcogenide glasses (synthesis, structure, conductivity). She is the scientific leader of the "Chalcogenides and Glasses" thematic group and a member of the steering committee of the CNRS "CHALCO" research group. She has been involved in several collaborative projects (ANR TEAM, ANR VTG, ANR GLASS Surf-IR, SATT-AxLR, Procope, ...).

UMICORE is a global player in materials technology. The company has extensive expertise in materials science, chemistry and metallurgy, and develops technologies and materials for the production of high-quality solar cells used in satellites, rechargeable batteries, LED applications and catalysts. It also recycles precious metals from laptops and cell phones, among others.

**Required field of research** : Chemistry, physical chemistry and/or electrochemistry.

**Level of education required** : Master's degree or equivalent

**Skills/qualifications**

You must have a solid background in chemistry and/or physical chemistry, ideally with initial experience in battery research and electrochemistry.

You must be highly motivated and interested in working in a collaborative environment.

You are rigorous, curious and ready to take up a challenge with an industrial partner.

Excellent knowledge of written and spoken English (working language) is required.

**Eligibility criteria**

Candidates may be of any nationality and must hold a Master's degree (or equivalent) in Materials Science or Electrochemistry. To be eligible, candidates must not already hold a PhD at the time of recruitment.

**Further information**

Applicants should send a CV, covering letter, Bachelor's and Master's degrees and transcripts, and at least one letter of recommendation. Copies of publications can be sent at a later stage, on request. Interviews will be requested at the end of the selection process.

All applications must be sent in parallel with this online application to the following e-mail addresses: virginie.viallet@u-picardie.fr, anne.charbonnier@u-picardie.fr and andrea.piarristeguy@umontpellier.fr with the subject line "UMR7314-VIRVIA-006".