Post-doctoral position available at LCMCP (Sorbonne Université) and at LPPI (Université de Cergy Pontoise)

Starting date: as soon as possible.

Topic: Conception, synthesis and characterization of hybrid films combining 3-D inorganic and organic networks for all solid state battery

Place: Paris (CMCP- Sorbonne University (Team RMES, https://lcmcp.upmc.fr/site/rmes-2/) and Neuville-sur-Oise (LPPI -University of Cergy Pontoise

(https://www.u-cergy.fr/en/research/laboratories/lppi.html)

This project is to support **the cooperative effort of the RS2E** (Task force "**all solid-state battery**") on designing reliable, high power all solid-state battery in a view of fabricating a prototype in 2025.

It concerns the conception, the synthesis and the characterization of hybrid organic-inorganic electrolyte containing a **3-D inorganic Li-ion conducting network** embedded into a **Li-ion conducting polymer network for all solid-state battery**. Developing these electrolytes should accommodate interfaces toward metallic Li and high voltage positive electrode. The originality of the work consisted in fabricating a continuous 3-D inorganic Li-ion conducting network coupling the sol-gel chemistry and the electrospinning process. This processing technique results in the formation of well-defined fibers organized into a 3-D that delineates a porous network. Because of the dimension of the fibers and their organization, this porous ceramic network exhibits flexibility. Among the various Li-ion conducting oxide, $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ (LATP) and $Li_7La_3Zr_2O_{12}$ (LLZO) oxides will be privileged. Lately, the 3-D network will be impregnated with a Li-ion ion conducting polymer. To do so, different strategies will be estimated and a low viscosity monomer solution will be employed to ensure good impregnation. A particular attention will be paid to UV-assisted polymerization to achieve good inorganic/polymer interfaces, that is a key point for the physical properties of the hybrid film. Processing parameters (electrospinning and sol-gel chemistry) will be used as a mean to control the thickness of the inorganic 3-D network, the fibers density and the fibers' diameter as all these parameters will impact monomer's impregnation. For interface tuning, different polymer chemistry will be explored more specifically at the Li-metal interface.

The morphological and structural characterizations of the hybrid film will be performed using different techniques including electron microscopy (SEM, TEM coupled with EDX analyses), mercury porosity and XRD analyses. Mechanical (DMA and tensile tests) as well as Li-ion conductivity will be performed. A particular attention will be paid for the determination of the Li-ion transfer number. Finally, the hybrid films will be mounted in Li-metal battery as proof of concept to evaluate the performance of these new electrolytes at different C-rates and their resistance to Li-dendrite formation.

Qualifications and experience:

PhD in materials science. You have experience in sol-gel chemistry, or/and polymer science or/and in inorganic chemistry and materials science. You have adequate communication skills to coordinate with project partners and to promote the technique within academic and industrial users.

Post-Doctoral contract of 12 months.

How to apply:

Please send your CV and motivation letters to Prof. Christel Laberty-Robert and Prof. Odile Fichet

christel.laberty@sorbonne-universite.fr and odile.fichet@u-cergy.fr with a list of your peer-reviewed publications and the names of 2 references, including one from your present work place.