THESIS PROPOSAL:

NEW IONOGEL ELECTROLYTE FOR SPACE APPLICATION

The goal of this thesis is to study a new type of all-solid hybrid supercapacitor-battery microdevice that can be used in applications such as cubesats or other space and remote applications. The core of the work would be the synthesis, full characterization and implementation of a solid ionogel electrolyte with Mg2+ conduction. Such an electrolyte should show good performances around 100 °C, and does not need heavy packaging since no vapour pressure would appear. The host network of this electrolyte confining Mg2+ based ionic liquid would be tuned in order to show the best balance between ion transport and mechanical properties. This will include the design, synthesis and characterisation of new porous polymer materials to allow optimisation of the host network. Electrode materials will also be explored with positive electrodes to be made of carbon while negative would be a suitable porous metallic electrode.

Within the framework of a collaboration between the University of Nantes (France) and the University of South Australia (Australia), our ambition is to propose new material solutions for disruptive technologies, in the context of energy storage and space applications. The project, as far as possible and according to the work progress as well as to wishes of the candidate, is to carry out the first part (~1.5 year) of the work in Nantes (IMN), then to continue in Adelaide (FII). A Franco-Australian co-supervision will be set up.

Main goals of the thesis:
• To prepare ionogels with polymer host network;
• To study electrochemical performances of SCap (impedance spectroscopy, evaluation of performance using standard electrochemical experiments);
• To deepen the understanding and thus to rationalize the effect of confinement onto electrochemical properties (interfaces studies by means of Raman and IR spectrosopies);
• Overall, to assemble a prototype device of interest in energy storage for extreme environments (space, aircraft, etc.), and / or requiring increased safety.

Profile sought: physico-chemist, the candidate will have to manipulate simple concepts and syntheses in chemistry, perform electrochemical studies, and have the willingness to deepen understanding using various physical methods.

Starting: December 2020

Monthly net salary: ~1400 € (social security included) (+ travelling funding)

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