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Preparation of anion-conducting polymer electrolytes for the manufacture of organic anion batteries

Today, lithium-ion batteries are used in a wide range of applications ranging from portable electronics to automotive applications, with demand constantly rising. This trend has highlighted a problem of resources, in particular certain metals critical to the manufacture of these batteries, such as lithium and cobalt. Alternative solutions to lithium-ion batteries need to be developed.

Among these, organic batteries with anionic shuttles are particularly innovative. In these batteries, ions are ions are transported in the electrolyte by an anion (halide BF_4^-, PF_6^-, $TFSI^-$, etc.). The main advantage of this technology is that it allows the use of active materials that can exchange several electrons per molecule during charge/discharge cycles without the diffusion limitations that are generally observed in the case of post-Li batteries with multivalent batteries (e.g. Mg or Al batteries). This thesis is part of the PEPR Batteries SONIC project, funded by France-2030, comprising several partners who will be developing various active materials as electrodes for organic batteries. IFPEN (Lyon) will be responsible for developing electrolytes anion-conducting polymer electrolytes in partnership with LEPMI (Grenoble).

The aim will be to synthesize innovative flexible polymers comprising grafted cationic groups associated with different counterions. The materials synthesized will then be characterized in polymer membrane to determine their properties in terms of ionic conductivity, electrochemical and mechanical stabilities. The polymer electrolytes will then be characterized in complete cells using the active electrode materials supplied by the project partners.

The thesis will be carried out in collaboration between IFPEN (Solaize-Lyon) and the LEPMI laboratory (Grenoble), with periods spent at both sites. Occasional missions to other SONIC project partners are also envisaged.

Keywords: Battery materials, polymer synthesis, organic batteries, electrochemical characterisation

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