



Post-doctoral position



<p>Title</p>	<p>Post-doctoral position <i>Optimization of an amorphous methylated silicon electrode for Li-ion battery</i></p>
<p>General information</p>	<p>A postdoctoral Research Fellow position (supported by the chaire développement durable EDF-Ecole Polytechnique) is available in the "laboratoire de Physique de la Matière Condensée" at Ecole Polytechnique. This position is open for a period of 18 months.</p> <p>Workplace : Laboratoire de Physique de la Matière Condensée –LPMC- Ecole polytechnique Desired level of education :PHD in chemistry, physics or material science</p>
<p>Subject</p>	<p>Silicon is one of the best negative electrode materials for Li-ion batteries because of its high capacity, 10 times that of carbon. In practice, however, the performance of silicon anodes remains limited due to two main reasons: i) degradation of the electrodes resulting from large volume changes of the material during charge and discharge and ii) the formation of an unstable passivation layer called SEI (Solid-Electrolyte Interphase) at the interface between the silicon electrode and the electrolyte.</p> <p>Previous work at PMC laboratory has demonstrated the superiority in terms of cyclability and lifespan [1-3] of amorphous methylated silicon as a negative electrode material for Li-ion batteries . The replacement of graphite by this material would represent a very significant progress in terms of performance. However, improvements in terms of energy or power capacity and durability are still necessary.</p> <p>The study proposed within the framework of this postdoc concerns the electrode material itself and the control of its interface with the electrolyte.</p> <p>It will focus on:</p> <ul style="list-style-type: none"> - optimization of methyl groups content. The electrodes are of amorphous silicon layers obtained by PECVD: it is proposed to replace the methane + silane mixture currently used as precursor gas by methyl-silane which would make it possible to extend the range of concentration in methyl groups (currently limited to approximately 10%). - stabilization of the electrode / electrolyte interface by an artificial passivation layer (electronic insulating thin layer, and ion conductive). <p>The project involves the production of the electrode material and the realization of the passivation layers by different procedures developed in the PMC laboratory. The electrodes thus produced will be characterized by different surface techniques, SEM or AFM, FTIR / Raman spectroscopy, X-ray techniques, optical spectroscopy) and their electrochemical behavior will be studied by conventional techniques: potentiometry, galvanostatic cycling, impedance spectroscopy.</p> <p>[1] L. Touahir, A. Cheriet, D.A. Dalla Corte, J.-N. Chazalviel, C. Henry de Villeneuve, F. Ozanam, I. Solomon, A. Keffous, N. Gabouze, M. Rosso, J. Power Sources 240 (2013) 551–557. [2] B.M. Koo, D.A. Dalla Corte, J.-N. Chazalviel, F. Maroun, M. Rosso, F. Ozanam, Adv. Energy Mater. 8 (2018) 1702568. [3] Y. Feng, T.-D.-T. Ngo, M. Panagopoulou, A. Cheriet, B.M. Koo, C. Henry-de-Villeneuve, M. Rosso, F. Ozanam, Electrochim. Acta 302 (2019) 249-258.</p>
<p>Skills</p>	<p>The candidate should demonstrate knowledge in surface physical chemistry, thin films, and chemical/physical spectroscopies. Experience in materials science would be appreciated. Teamwork skills are considered essential.</p>
<p>Context of work</p>	<p>PMC (Laboratoire de Physique de la Matière Condensée) is one of 22 laboratories located at the Ecole polytechnique research centre working on the frontier of knowledge on the major interdisciplinary scientific, technological and societal issues.</p> <p>Within the Teaching and Research Department of Ecole polytechnique, PMC is a mixed research unit (Ecole polytechnique/CNRS) whose work is organized around two fundamental topics that are the nanosciences and the physics of Irregularity.</p>
<p>Supplementary information</p>	<p>The position is available from October 1st, 2020.</p> <p>Informal inquires can be addressed via email to François Ozanam (francois.ozanam@polytechnique.edu), Michel Rosso (michel.rosso@polytechnique.edu), or Catherine de Villeneuve (catherine.henry-de-villeneuve@polytechnique.edu).</p> <p>Applicants should provide a CV, including contact details of two referees, a list of publications and a covering letter describing their suitability for the position.</p> <p>Closing date: until position filled</p>