

Post-doctoral position on materials for Li-ion batteries

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Contract	Post-doctoral position opening in October 2015
Requirements	Ph.D degree
Background	Chemical-physics, electrochemistry or materials science
Languages	French and English
Location	CEA Saclay (Paris area) and CEA Grenoble
Job description	<p>CEA is a French government-funded technological research organization. With more than 15,000 researchers and co-workers, its activities cover four main areas: Energy, Defence & security, Health & information technologies, and Fundamental research. CEA-IRAMIS is located in Saclay and is involved in fundamental research in particular for Energy applications and develops materials with tailored properties such as core@shell nanoparticles. Located in Grenoble, the Laboratory for Innovation in New Energy Technologies and Nanomaterials (LITEN) is around 1,000 people working on energy R&D (fuel cell, batteries, biomass, and solar application).</p> <p>A two years post doc position is opened in the frame of a collaboration between LITEN in Grenoble and IRAMIS in Saclay – France. The project deals with replacement of graphite as anode material in Li-ion batteries in order to improve energy density. Silicon appears today as a very promising negative electrode material for Li-ion batteries. Indeed, thanks to its high theoretical specific capacity (3579 mAh/g), this material is an interesting alternative to graphite (372 mAh/g) for high density energy applications. However, silicon presents an important electrochemical performances fading during charge and discharge cycles due to huge volume changes. Improvements are possible by reducing particles size around 100nm in order to limit the mechanical pulverization or by developing silicon-carbon composites with complex nanostructures. In this context, original core-shell silicon carbon particles, Si@C, have been synthesized by a double stage laser pyrolysis set-up recently developed in the framework of an internal collaboration (IRAMIS/LITEN). Such Si@C nanoparticles allowed reaching high performances at the state of art [J. Sourice et al, ACS Appl. Mater. Interfaces, 2015, 7 (12), pp 6637-6644]. However, several drawbacks remain before wide use in Li-ion batteries: the large surface area induces irreversible loss of Li at the first cycles, the production is limited to a few grams due to fluid instabilities in the double stage reactor.</p> <p>Based on these results, the post-doc researcher will be in charge of proposing solutions and implement them in order to solve the drawbacks related to both synthesis and formulation. Among possible ideas, a task will deal with the development of the synthesis process to solve the instability matters; achieve improved homogeneity of the batches, better control</p>

	<p>of Si core diameter and organization as well as C shell structure and thickness. The objective is achieving a fully controlled and scalable process at the end of the project.</p> <p>In parallel, the effect of the structural parameters of Si@C nanoparticles will be studied in batteries in coin cell configuration, and in Li-ion cells to finish with a demonstration in a prototype. Several solutions could be investigated to solve the issues related to large surface area: formulation of the electrode will be adapted, Si@C nanoparticles will be functionalized and/or used for the elaboration of composite carbonaceous material... The effect of interfaces will be closely studied using for example impedance spectroscopy.</p> <p>The post doc researcher will synthesize Si@C nanoparticles in Saclay, elaborate composites materials with the nanoparticles and study their electrochemical performances in Grenoble. He (she) will work in close collaboration with other researchers in charge of surface functionalization of nanoparticles, development of additives, formulation of the electrodes and theoretical understanding of their behavior based on modeling. It is aimed to publish results in Journals with high impact factor as well as developing a prototype for pre-industrial demonstration.</p>
Desired skills	<p>We are looking for excellent candidates with a general background in chemical-physics, electrochemistry and/or materials science and a PhD in one of these domains. Experience in Li-ion batteries will be strongly appreciated. They must have passed their PhD between September 2013 and September 2015. For French candidates, an experience out of France will be an advantage.</p>
Key words	<p>Dynamism, Proactivity, team work, creativity, autonomy, leadership, sense of challenge.</p>