



Master 2 internship position in CEA Grenoble/IRIG/DIESE/SyMMES: Development of graphene-based assemblies designed for supercapacitors

Summary

Based on the laboratory background on pillared graphene materials, the goal of the internship project is to develop such structured graphene matrixes in order to achieve improved storage performances in supercapacitor (SC) cells. Methodologies will be based on graphene functionalization with bi-functional pillar molecules selected to promote ions intercalation and transport. The student will perform the material preparation/characterization and will conduct electrochemical evaluation in SC cells.

Detailed subject

Supercapacitors (SCs), are devices that store energy through charge separation from electrolytic ion sorption on charged electrode surfaces. This project is focused on the use of graphene based materials (GBMs) for SC as graphene theoretical surface area, mechanical resistance and conductivity are attractive to obtain performant SCs. However the expected high surface area for single layer graphene is never achieved as graphene sheets restack to each other by π - π stacking; hence the electrolytic ions sorption surface obtained experimentally is drastically lower than theoretically expected and leads to average device performances. The group recent researches deal with the preparation of graphene oxide derived samples designed to limit this phenomenon. The methodologies followed are dealing with the cross-linking of graphene sheets with molecular pillars yielding the so-called pillared graphene materials. So far, following this strategy high storage performances have been achieved. The specific objectives of this internship are to further optimize these graphene assemblies to get access to improved storage properties. New pillar molecules chosen to facilitate and promote the ions transport will be tested. Graphene assemblies with varying bulk porosity will also be prepared. Physico-chemical characterization will be performed on all samples to allow a comprehensive comparison of the various materials properties. The most interesting materials will be selected and tested electrochemically in SC cells.

This internship will hence involve i) to perform basic synthesis steps, ii) to conduct characterization on the carbon architectures (TGA, IR, SEM), ii) to take part to specific analysis (XPS, XRD) and iii) to do electrochemical characterization of the materials. The student will have an active part in the laboratory life and will be asked to report on his work. This Master internship could be followed by a PhD within the same research area (funding dependent).

Related Publication

Banda, H. et al. "Sparsely Pillared Graphene Materials for High-Performance Supercapacitors: Improving Ion Transport and Storage Capacity" (2019) ACS Nano, 13 (2), pp. 1443-1453. DOI: 10.1021/acsnano.8b07102.

Background and skills expected

To carry out this project we are looking for students with a background in chemistry and who are now in a Nanoscience or Electrochemistry related Master Research. Surface chemistry/characterization knowledge and an interest for the energy storage field would be appreciated.

Person to contact

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