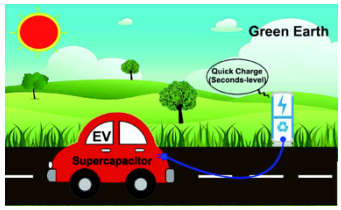
CHALMERS
UNIVERSITY OF TECHNOLOGY

Master Thesis project in
Functionalized Graphene for High-performance Energy Storage Devices
(30/60 credits)

Background and objective of the project



To tackle the two main challenges of the need for sustainable energy production and mitigating global warming, our society needs an urgent solution to develop efficient, sustainable and cheap energy storage devices for applications in electrical vehicles, and portable electronic devices, etc. Among the most promising energy storage devices, supercapacitors have attracted enormous attention due to their high power density, fast charging/discharging rate, and exceptional cycle stability. In this context, developing novel electrode materials is the key to achieve high performance.

Graphene-based materials have recently attracted a notable attention due to their extraordinary properties, which make them interesting candidates for many technological applications in energy storage, sensing, catalysis and nanodevices, etc.[1,2] Chemical functionalization of graphene is a very important research area in graphene community.[3] Chemical functionalization can not only prevent the aggregation of graphene in solvents, improve its dispersibility, wettability and processability, but also tune its physicochemical properties, furthermore potentially impart new properties. In this project, you will work on an exciting project to explore novel electrodes by combination of graphene with functional organic molecules/polymers using covalent or noncovalent approaches, and further study their mutual interactions and physicochemical properties using various characterization techniques. Finally, the functionalized graphene will be used as electrode materials in supercapacitors.

Description of the project

The research project will mainly include combination of organic molecules/polymers with graphene using wet chemical approaches (covalent or noncovalent). The as-prepared hybrid materials will be characterized fully using various spectroscopic and microscopic methods. Then the functionalized graphene will be employed as electrode materials for high performance supercapacitors.

During the project, you will have opportunities to learn and get familiar with several techniques: (1) Raman, FTIR, UV/Vis absorption, Fluorescence; (2) Thermal analysis (TGA) and surface analysis (XPS); (3) Microscopic techniques including TEM, SEM, and AFM**.** In additional, you will also have the chance to learn characterization techniques on organic molecules (NMR, MS).

Interested? **You will be the owner of your project!**

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References:

1. Nanoscale 2015 (4598). 2. Adv. Energy Mater. 2016 (1600671). 3. Chem. Rev. 2012 (6156).