Graphene-based composites for electrochemical energy storage

Achieving secure, clean and sustainable energy production, storage, and consumption are, perhaps, the greatest technical and social challenge that the world is facing. The key achievement is not only to construct renewable and sustainable energy sources but also, perhaps even more importantly, to store energy efficiently and deliver on demand. The realization of high performance electrochemical energy storage devices is no doubt strongly dependent on the achievements of multidisciplinary sciences, including materials sciences, chemistry sciences and physical sciences etc. Graphene, a single atomic layer of $sp^2$-bonded carbon atoms, has attracted worldwide interest owing to its intrinsic difference from other forms of carbon allotropes. Graphene is particularly suitable for the implementation in electrochemical applications due to its remarkable electrical conductivity, large specific surface area, unique heterogeneous electron transfer and charge carrier rates, and good electrochemical stability. This thesis focuses on the synthesis and characterization of low-dimensional carbon materials, including graphene oxide/graphene, graphene foam (GF), GF/carbon nanotubes (CNTs) hybrids, and their composites with nanostructured metal oxides. The application of these graphene-based materials in electrochemical energy storage devices (i.e. supercapacitor, lithium ion battery and alkaline battery) is also explored.

Date: 8 September 2015 (Tuesday)
Time: 11am
Venue: NTU SPMS PAP Hilbert Space PAP-02-02
Supervisor: Professor Shen Zexiang