Graphene-based Nanocomposites for Energy Harvesting/Storage Applications

Overview

In the quest for novel energy storage and conversion solutions, supercapacitors, lithium ion batteries, fuel cells and solar cells have risen to eminence as an important and rapidly growing class of devices. These classes of energy storage and conversion devices need novel electrode materials to find broad applications in areas, which include hybrid vehicles, consumer electronics, medical electronics, power back-up, and load leveling. The research focus on energy field has undergone immense growth in the past decade due to emerging energy needs of modern society and ecological concerns. Nonetheless graphene has gained considerable attention in recent years because of its fascinating properties such as atom-thick 2D structure, high electrical conductivity, large specific surface area, and excellent electrochemical stability. The unique characteristics of graphene enable it to be widely applied in energy storage and conversion platform. There are some trade-offs in graphene electrode materials applied in electrochemical energy storage and conversion devices. In case of supercapacitors, highly porous graphene electrodes offer a large surface area and favor ion diffusion, resulting in a high gravimetric capacitance, but usually have a lower volumetric capacitance due to the relatively low packing density. Graphene finds importance in fuel cells, where to replace the conventional Pt-based materials that have been recycled as active electrode materials for both anodes and cathodes in fuel cells. Rising energy costs coupled with climate change are driving the increase in use of energy storage and conversion technologies. Therefore, continuous advancements in the field of batteries, supercapacitors, fuels cells and solar cells along with significant reductions in cost, and this helps drive further adoption of such technologies.

Objectives

The primary objectives of the course are as follows:

- Synthesis and optimization of high quality smart materials (2D and 3D graphene and its nanocomposites)
- Potential applications of graphene in energy storage and energy conversion devices.
- Fabrication of smart materials (graphene based electrodes) for supercapacitors, lithium ion batteries, fuel cells and solar cells.
- To implement the smart materials for electrochemically active and conductive substrates with high performance non-precious electrode material at the industrial level.

Modules	**Module A:** Fabrication of smart materials based on graphene and their application for Energy Storage Devices **Module B:** Energy storage and conversion device fabrication and commercialization **Dates: 30 May 2016 to 10 June 2016** **Number of participants for the course will be limited to Sixty.**
You Should Attend If…	• Students at all levels (B.Tech/M.Sc/M.Tech/Ph.D) or Faculty from reputed academic institutions and technical institutions. • Executives, engineers and researchers, serving in academic and government organizations including R&D laboratories
Fees	The participation fees for taking the course is as follows: • Students from host institution : Free • Students from academic Institutions: Rs. 2000/- • Faculty from academic Institutions : Rs. 3000/- • Industry/ Research Organizations : Rs. 6000/- • Participants from abroad : US $250 The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges.

The Faculty

Prof. Joong Hee Lee is the highest honor awarded professor for last 5 years consecutively (the **Best research Professor** at the **Chonbuk National University (CBNU), South Korea**). Prof. Lee has published more than 600 reputed articles. Prof. Lee received many awards such as the best scientist and engineer of the month in Korean Government in 2013 and the **Great Knowledge and Creative Award in 2014** from Korean Government for the most contributing in the field of material science for last 10 years. Prof. Lee has also **dominated as rank top 2nd in all engineering fields in Korea** for the highest citation number of his papers during last 3 years (2013-2015). Prof. Lee is a member of the National Academy of Engineering of South Korea. Prof. Lee is the Director, Department of BIN Convergence Technology, Head of the Advanced Materials Institute, Head of Basic Research Laboratory, Director of Center for Carbon Composite Materials, Director of Advanced Wind Power System Research Center, CBNU. Prof. Lee was the president of Korea Composite Research Company for 14 years, in which he has developed ultra-high pressure hydrogen fuel tanks using advance composite materials. Prof. Lee received MS and Ph.D (1995, Mech. Engg.) from University of Minnesota, USA. Prof. Lee is now the editorial board member of Composites Part B (SCI Journal), the Editor in chief of Advanced Composite Materials (SCIE Journal), the Vice President, Korean Society of Hydrogen and New Energy. Prof. Lee has advised more than 60 graduate students for MS and Ph. D until now.

Dr. Siddaramaiah obtained Ph.D., degree from University of Mysore, Mysore. He worked as a Post Doctoral Research Fellow under BK-21 Fellowship (2007-08), Chonbuk National University, South Korea**.** He visited University of Federal, Rio de Janeiro, Brasil, two times (2005 & 2009) for a period of 3 months each under UNESCO-TWAS visiting Fellowship. He has authored more than 280 research articles in reputed journals, more than 220 conference papers, 5 book chapters, 2 review articles, one book and is a co-inventor of 2 Indian patents. 20 Ph.D., have been successfully completed under his supervision. He is a recipient of **"Young Scientist Award-1997**", in **'Chemical Science'** (1997) by KAAS, Bangalore, & **"Sir C.V. Raman Young Scientist Award-1999"** in **'Chemical Technology'** by KSCST, GOK, Bangalore (2002). He is the recipient of '**PROJECT OF THE YEAR'** award twice. His research team received **"Best Paper Award" more than five times.** He received, "**Silver Trophy", Plasticon Award-2012** in the category of **Best Research** from Plastindia Foundation, New Delhi. Very recently he received 6th **National Award of Technology Innovation, 2015-16** for Innovation in Polymeric Product on **"***Nano Composite for UV sensing applications*", from Ministry of Chemicals and Fertilizers, Dept. of Chemicals & Petrochemicals, Govt. of India**,** New Delhi.

Course Co-ordinator

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