

2013/11/22 NCRS Forum / GA Lecture Series

**FY2013 The 1st Novel Carbon Resource Sciences (NCRS) Forum / Green Asia (GA) Lecture Series
Forum I (Effective Energy Utilization) / II (Energy Saving) / III (Asian Environment)**

Date: Friday, 22 November, 13:30-16:30

Place: Room 303, 3rd Floor, C-Cube, Chikushi Campus, Kyushu University

Theme: Seeds and Needs of Energy Storage Devices in India

13:30-	Opening Remarks
13:45-14:45	Solar Chargeable New Lithium Ion Batteries Dr. S. Gopukumar Senior Principal Scientist, Central Electrochemical Research Institute (CSIR), India
15:00-16:00	Essentials of Electrochemical Capacitors Dr. A. Shukla Professor, Indian Institute of Science (IISc), India
16:00-16:30	Q & A, Discussion with students

Sukumaran Gopukumar

*Lithium ion Battery Section
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Dr. Sukumaran Gopukumar, 52 years obtained his PhD degree in Physical Chemistry in 1986 from University of Dibrugarh, Assam, India. He then joined the Central Electrochemical Research Institute (CSIR), Karaikudi in 1986 and is presently holding the post of Senior Principal Scientist in the Electrochemical Power Systems Division. Dr Gopukumar is specialized in the area of electrochemical power systems especially magnesium, aluminum and lithium batteries. His rich experience in the area of lithium ion batteries has resulted in invitations as invited scientist/ visiting professor to various countries viz., South Korea, Germany and Japan. He has published more than 60 research papers in peer reviewed high impact journals and has filed 6 patents. He has delivered invited talks in various universities/international meetings in India and Abroad (USA, France, Germany, South Korea, United Kingdom, Canada, Taiwan, Singapore and Japan). His contributions in the field of electrochemical power system have resulted in numerous citations and honored with being the reviewer for various international electrochemical journals and have guided Four PhD students. He has completed many national and International projects (Japan, UK, Taiwan, France) and is serving as a member of International Advisory Board for Asian Power Sources Conferences. He is the Lead Editor for a special issue on Lithium Batteries in International Journal of Electrochemistry. Presently, he is also the National Coordinator in the area of Storage Materials / Battery under the TAP SUN, a Solar Energy Mission programme of CSIR (Rs 71.67 crores ie.,(~ US\$ 1,20,00,000).

ABSTRACT

SOLAR CHARGEABLE NEW LITHIUM ION BATTERIES

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The lithium ion battery has evolved as the major power source ever since it's discovery in 1991 by Sony and represents one of the major successes of materials electrochemistry. Lithium ion batteries are becoming more and more popular in view of the multifarious applications arising from their high voltage and high power leading to light weight and smaller size cells/batteries. In view of the growing day to day demand for lithium ion batteries, intensive research is being pursued globally to develop new high performing cost effective electrode and electrolyte materials and importantly without compromising on environmental issues.

In my talk, I shall give you an overview of the recent developments in the area of cathode and anode materials. Details regarding the synthesis and characterization of high voltage (up to 5V) cathode materials based on layered and olivine materials shall be presented. Normally, graphite powders are employed as anode materials but we demonstrate a new type of lithium ion battery replacing the conventional graphite powder coated on to a copper foil exhibiting high performance even at high rates (2C) when cycled between 2.9 and 4.1V and finds applications in LED lighting etc. These cells could be charged by solar energy.

Ashok Shukla

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Born on 3.2 1947, Professor Ashok Shukla is presently an Honorary Professor at the Indian Institute of Science Bangalore. Prior to this, he held the position of Dean Science Faculties at Indian Institute of Science, Bangalore during 2012. He was the Chairman of Solid State and Structural Chemistry Unit at Indian Institute of Science during 2009-2011. During 2003-2009, Professor Shukla provided leadership to Central Electrochemical Research Institute (CECRI) at Karaikudi in Tamilnadu (India) as its Director, and helped transform CECRI into a leading centre in Fuel Cell R&D and engineering. Professor Shukla has made extensive scientific and engineering contributions to the field of renewable energy, materials chemistry and electrochemical science and technology through interdisciplinary research during the last 35 years, in particular, for investigations leading to novel electrocatalysts, superior lithium-ion cathodes/anodes, polymer electrolyte membranes, mixed-reactant fuel cells and low-cost high energy-density lead-acid batteries with special mention to self-supported polymer electrolyte, direct methanol and direct borohydride fuel cell systems. Professor Shukla's innovations in tropical lead-acid batteries have been incorporated by lead-acid battery industries in their commercial products. His recent work on cost-effective hybrid ultracapacitors is remarkably innovative for quickly harvesting and storing energy, and is especially promising for memory back-up, electric and hybrid vehicles, power quality, battery improvement, portable power supplies, rural/remote area lighting and renewable energy applications. It is truly seminal step forward in the development of third-generation lead-acid batteries. Some of the technologies developed by Professor Shukla have been licensed to industries both in India and abroad. Professor Shukla has authored/co-authored over 300 scientific papers (h-index: 52) in reputed national/international journals and has 19 national/ international patents to his credit. Professor Shukla is recipient of several awards, and is an elected fellow of Indian Academy of Sciences (FASc), National Academy of Sciences (FNASc), Indian National Academy of Engineering (FNAE), Indian National Science Academy (FNA) and The Electrochemical Society (FECS).

ABSTRACT

ESSENTIALS OF ELECTROCHEMICAL CAPACITORS

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Electrochemical capacitors are potential devices that could help bringing about major advances in future energy storage. They are lightweight and their manufacture and disposal has no detrimental effects on the environment. A comprehensive description of fundamental science of electrochemical capacitors will be presented. Similarities and differences between electrochemical capacitors and secondary batteries for electrical energy storage will be highlighted and various types of electrochemical capacitors will be discussed with special reference to lead–carbon hybrid ultracapacitors. Some envisaged applications of electrochemical capacitors will also be described along with the technical challenges and prognosis for future markets.