



ELECTROCHEMICAL ENERGY STORAGE

PROF. SUBHASISH BASU MAJUMDER

Department of Materials Science Center
IIT KGP

TYPE OF COURSE : New | Elective | UG/PG

COURSE DURATION : 12 Weeks (26-Jul' 21 - 15-Oct' 21)

EXAM DATE : 23 Oct 2021

PRE-REQUISITES : High school knowledge in Chemistry, Physics and Mathematics are required. Knowledge on undergraduate level electrochemistry is a plus.

INTENDED AUDIENCE : 3rd or Final year UG and 1st Semester PG/Ph.D students studying Metallurgical and Materials Engineering/Materials Science/Ceramic Technology/Electrical Engineering/Energy Science/Nanotechnology (as one of the open elective courses)

INDUSTRIES APPLICABLE TO : Tata Steel R&D, Tata Motors, Amara Raja Batteries Limited, Various CSIR Labs

COURSE OUTLINE :

This course illustrates the diversity of applications for secondary batteries and the main characteristics required of them in terms of storage. The introductory module introduces the concept of energy storage and also briefly describes about energy conversion. A module is also devoted to present useful definitions and measuring methods used in electrochemical storage. Subsequent modules are devoted to teach students the details of Li ion batteries, sodium ion batteries, supercapacitors, lithium – air, and lithium - sulphur batteries. Separate modules are also devoted to describe lithium reserves, extraction and recycling of Li ion batteries. Finally, other types of batteries including redox – flow batteries are described in a separate module. The course is divided into twelve modules each contains five half an hour lectures. Each module lectures is self contained to encourage student understanding and reinforce key concepts. Carefully designed problem set will help students to grasp the underlying concepts taught in the course.

ABOUT INSTRUCTOR :

Dr Subhasish Basu Majumder is presently working as a Professor at the Materials Science Center, IIT Kharagpur. He completed his B. Tech in Ceramic Technology from the Government College of Engineering and Ceramic Technology, Kolkata in the year 1988. Subsequently he obtained his M. Tech and Ph.D degree in Materials Science from IIT Kanpur in the year of 1990 and 1997 respectively. He worked as a postdoctoral fellow and subsequently as a research faculty at the University of Puerto Rico, San Juan, USA. As an Alexander von Humboldt fellow, he has also worked at RWTH Aachen, Germany.

COURSE PLAN :

Week 1: Introduction to electrochemical energy storage and conversion

Week 2: Definitions and measuring methods

Week 3: Lithium batteries

Week 4: Basic components in Lithium – ion batteries: Electrodes, Electrolytes, and collectors

Week 5: Characteristics of commercial lithium ion cells

Week 6: Sodium ion rechargeable cell

Week 7: Introduction to battery pack design

Week 8: Advanced materials and technologies for supercapacitors

Week 9: Li – Air batteries

Week 10: Li – Sulphur batteries

Week 11: Li resources and recycling of Li ion batterie

Week 12: Other types of batteries