Redox Flow Batteries for Electrical Energy Storage

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Overview

The global energy demand is rising rapidly due to various reasons such as increasing population, industrial growth, and increasing human index. However, at the same time, global CO_2 emissions are also increasing, which must be reduced to restrict global warming. In this concern, renewable energy is expected to provide the pivotal solution to our need for a sustainable fuel and environment. Many countries have announced plans in the use of clean energy, which are accelerating the development and application of renewable energies. Major challenges presented by renewable energies, such as fluctuations in output, unavailability (e.g. solar energy in the night) and unpredictability (e.g., wind power), limit their usages. Therefore, as a solution to these problems, energy storage technologies are attracting attention. The renewable energy resources, such as solar or wind, can easily be converted into electrical energy. Thus the storage of the electrical energy is very important. In this respect, redox flow batteries (RFB) offer an effective way to balance out fluctuations in the supply of renewable energy and thus guarantee its constant availability. In a RFB, soluble redox couples are used to store and release the renewable energy during the battery charge and discharge, respectively.

This course will provide details of electrochemical energy storage using redox flow batteries, for applications ranging from grid-scale storage of intermittent renewables to energy arbitrage to distributed energy generation. The course will first introduce the basic principles of electrochemical engineering, followed by an in-depth lectures of redox flow batteries, their operating principles, construction, performance evaluation, and economics. The course will include tutorial components, wherein participants will be exposed to RFB preparation, assembly and testing, followed by data evaluation. Electrical aspects of grid stabilization using redox flow battery will be introduced. At the end, the key applications of RFBs and the economics and practical entry barriers to various sectors will be discussed.

Modules	**A: Electrochemical Engineering pertaining to Energy Storage: 1-7 December 2017** **B: Redox Flow Batteries and their Application : 8-14 December 2017** ***Number of participants for the course would be limited to twenty (20) only.***
You Should Attend If...	▪ you are an executive/engineer/researcher and interested in renewable energy storage. ▪ You are a student at BTech/MSc/MTech/PhD level having interest in battery research.
Fees	The participation fees for taking the course is as follows: Research Scholar/Students : Rs. 5,000/7,500 for 1 or 2 week program, respectively Faculty members : Rs. 10,000/15,000 for 1 or 2 week program, respectively Working Professional : Rs. 15,000/20,000 for 1 or 2 week program, respectively

The Faculty

Vijay Ramani holds the Roma B. and Raymond H. Wittcoff Professorship in the Department of Energy Environmental and Chemical Engineering at Washington University in St. Louis, and concurrently serves as the Director of the Center for Solar Energy and Energy Storage at Washington University. His research interests lie at the confluence of electrochemical engineering, materials science, and renewable energy technologies. Current research directions in his group include multi-functional electrolyte and electrocatalyst materials for electrochemical systems. NSF, ONR, DOE and ARPA-E have funded his research, with mechanisms including an NSF CAREER award (2009) and an ONR Young Investigator Award (ONR-YIP; 2010). He is the recipient of the 3M Non-tenured Faculty Award (2010) and the Subramaniam Srinivasan Young Investigator Award from the ETD Division of ECS (2012). He is a past Chair of the IE&EE Division of ECS, and currently serves as the Chair of Area 1E of AIChE. He holds an Extraordinary Professorship at North West University, South Africa, a visiting Professorship at Tsinghua University, and has held an Adjunct Professorship in Chemical Engineering at IIT-Madras. He is the co Editor of ECS Interface.

B.K. Panigrahi is a Professor in the Department of Electrical Engineering, IIT Delhi. His research interest is in the field of Power Quality, FACTS Devices, Power System Protection, and AI Application to Power System. He would discuss the basic aspects of Grid Integration pertaining to RFB.

Anil Verma is an Associate Professor in the Department of Chemical Engineering, IIT Delhi. He is recipient of many national and international awards such as The prestigious Amar Dye-Chem Award for Excellence in Research and Development by Indian Institute of Chemical Engineers (IIChE); Honorable Mention for Dr. Bernard S. Baker Award for Fuel Cell Research, etc. He is recipient of UKIERI (UK-India Education and Research Initiative) Award and worked as Visiting Fellow in the Department of Chemical Engineering and Advanced Materials, Newcastle University, UK. His research work is focused on renewable energy technologies. He is working on Fuel Cells, Redox Flow Battery, and also actively working on Carbon Dioxide Utilization into the high calorific value products using Solar Energy.

Course Coordinator

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