Materials for Energy Technology

Overview

The growing demand for energy, brought about by the rising standard of living in the developing world and global population growth, has made it imperative that cleaner and more sustainable means for energy production, conversion, storage, and utilization be found to sustain and grow the current world economy. Alternate fuel resources should be developed because of concerns over global climate change. The search for smaller, cheaper, environmentally-friendly, and more efficient energy technologies is intimately connected to the development of new materials.

Dramatic breakthroughs are taking place in the fields of solar cells, fuel cells, power electronics, rechargeable batteries, high temperature superconductors, hydrogen production/storage, etc. In most of these cases, the development and commercialization of these environmentally-friendly energy technologies is limited by availability of materials. Therefore, it is essential to understand the fundamentals of structure-processing-properties relationship of materials and apply those fundamentals for developing materials for different applications to meet the ever-growing demand for energy.

This course is organized in a series of 10 lectures. The topics in the lectures will expose the participant to the various synthesis and fabrication methodologies to make materials, characterization techniques, understanding properties, such as, electronic, protonic, oxygen-ionic conductivity, transference number, relative permittivity, etc. that are relevant in selecting the materials for specific applications, and understanding materials limitations and opportunities. The topics will include hydrogen technology (production, storage, distribution, and utilization); chemical energy conversion (fuel cells and electrolysers); energy storage (batteries and capacitors); superconductors (conventional and high-temperature superconductors, electric power and advanced electric machines), and gas separation membranes (mixed-conductors, hydrogen separation, air separation, and carbon capture).

Course participants will learn these topics through lectures on materials fabrication and characterization. Assignments will also be shared to stimulate research interests of the participants.

Dates: September 19-23, 2016

You should attend if:

*you are a student, research scholar, or faculty from academic institution interested in learning about various pathways available for cleaner and more sustainable energy production, conversion, storage, and utilization options.

*you are a research scientist and/or engineer interested in developing fuel cells, capacitors, batteries, superconductors, and membrane reactors for real-world applications.

*you are a post-graduate and looking for a research topic to do Ph.D. thesis.

Dr. (Balu) Balachandran is a Distinguished Fellow at Argonne National Laboratory, USA. He has been doing research in the area of electronic materials for over35 years. His research areas include fuel cells, mixed-conducting ceramic membranes for gas separation, ethylene, oxygen and hydrogen production, gas-to-liquid fuel conversion,capacitors for power electronics, high–temperature superconductors, and nano-carbon infused metals for high thermal and electrical conductivity.

Dr. Manjunatha Pattabi has been teaching Materials Science at the Department of Materials Science ever since it was established in 1988. He is currently the Professor and Chairman of the department. His areas of interest are Thin Films, particulate films, Nanoparticles of metals and semiconductors, Shape memory alloys, electron irradiation effects on semiconductors / semiconductor devices, particulate films etc.

Mr. Vishwanath T joined the Materials Science Department in 2013 and teaching Materials Science since then. His research interests are Synthetic Materials for Medicinal Applications, Non Linear Optics, Fluorescent Materials and Polymers.