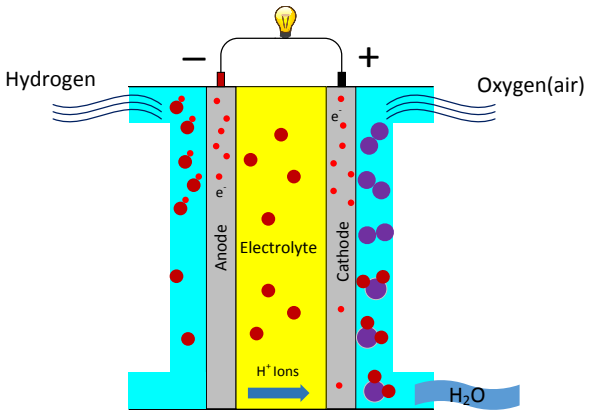
Fuel Cell Technology

a GIAN short course



Dates : 5-9 December, 2016
Venue : IIT Gandhinagar
Instructor : Dr. Gregory S. Jackson
(Professor and Head, Department of Mechanical Engineering, Colorado School of Mines)

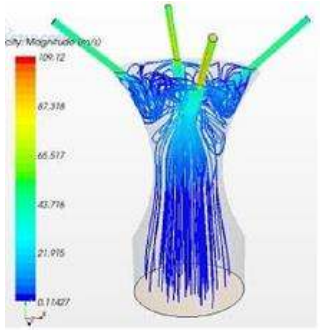
Overview

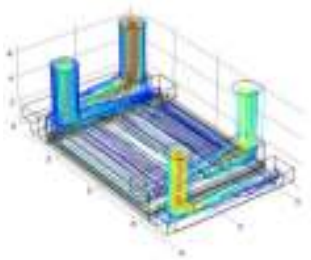
Fuel cells are rapidly finding use in energy conversion applications such as material handling, auxiliary power, cogeneration and combined heat and power (CHP). They mitigate the effect of global warming by reducing or eliminating CO_2 release in the atmosphere. Although the concepts of electrochemical energy conversion are relatively simple and well-known, fuel cell systems have continued to evolve in complexity, particularly with respect to the fuel supply and storage system. In this context, IIT Gandhinagar (with support from GIAN) offers a unique short course that addresses both physical concepts as well as technology aspects, with a focus on the latter.

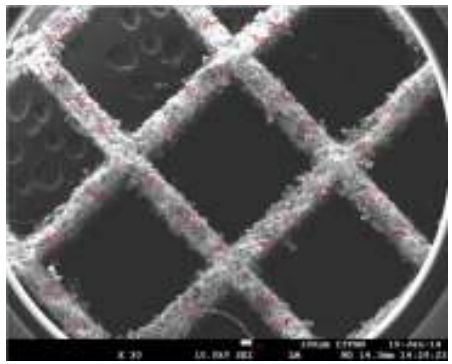
Objectives

- To make participants aware of the immediate market opportunities and challenges in fuel cell systems, and the current state of the art.
- To make participants aware of different types fuel cells and fuel processing systems.
- Use case studies from the US, Europe and India to explain the technology.
- To provide hands on experience and practical demonstration at the Energy Systems Research Laboratory at IITGN.

Fuel Cell Research @ IITGN







Who should attend?

Engineers and researchers from the telecommunications industry and scientists from the R&D laboratories of the government with a research focus on PEM and SOFC fuel cells, fuel processing and reforming.

Students at the undergraduate and postgraduate level (BSc/B-Tech, MSc/M–Tech and PhD) and faculty from recognized academic institutions and technical institutions.

Schedule

5th Dec 2016: Monday

Lecture 1: 09:30 - 10:30 hrs Introduction to fuel cells: History; Principle and current state of the art Lecture 2: 10:45–11:45 hrs Introduction to fuel cells: Types, fuels and applications

Lecture 3: 14:00 - 16:00 hrs Introduction to fuel cells: Basic electrochemistry for all the fuel cells

6th Dec 2016: Tuesday

Lecture 4: 09:30 - 10:30 hrs
Fuel cell thermodynamics: Gibb's free energy; Fuel cell efficiency

Lecture 5: 10:45– 11:45 hrs
Fuel cell thermodynamics: Nernst equation; Effect of temperature, pressure, concentration on Nernst potential Lecture 6: 14:00 - 15:00 hrs

Fuel cell thermodynamics: Fuel cell efficiencies, comparison with Carnot efficiencies

Lecture 7: 15:15 - 16:15 hrs
Fuel cell thermodynamics: Concept of electrochemical potential

7th Dec 2016: Wednesday

Lecture 8: 09:30 to 10:30 hrs Fuel cell kinetics : The Arrhenius equation, the Nernst equation Lecture 9: 10:45 to 11:45 hrs
Fuel cell kinetics : Tafel equation, the Butler – Volmer theory for electrode kinetics

Lecture 10: 14:00 -16:00 hrs
Fuel cell mass transfer :Mass transport effects, activation loss

8th Dec 2016: Thursday

Lecture 11: 09:30 –11:45 hrs
Fuel cell materials and characterization

Lecture 12: 14:00 - 15:00 hrs
Balance of plants : Power electronics and system integration

Lecture 13: 15:15 - 16:15 hrs
Balance of plants : production and storage

Lecture 14: 16:30 to 17:30 hrs
Balance of plants : Endurance analysis; Safety issues; Cost issues

9th Dec 2016: Friday

Lecture 15: 09:30 to 10:30 hrs
Hydrogen storage: issues and perspective

Lecture 16: 10:45 to 11:45 hrs
Fuel cell durability/lifetime issues Critical issues, adoption, future technologies Lecture 17: 14:00 to 16:00 hrs
Special Materials for fuel cell applications: research overview

Lecture 18: 16:00 to 17:00 hrs
Concluding session – summary – general Q&A session

Registration

Participants from outside India: $500
Industry/ government lab: Rs. 10,000
Academic institutions:
Faculty: Rs. 2,000
Student: Rs. 1,000
Reserved students: Rs. 500
Register online at:
http://www.iitgn.ac.in/gian/courses_fuel_cell.php

Accommodation is included in fees.
If you have difficulty in making this payment, please write to us.

Prof. **Gregory Jackson** completed his B.S.M.E. at Rice University and received his M.S. and PhD from Cornell University for his research on liquid fuel combustion. He is correctly working as Professor and Head of the Mechanical Engineering Department at Colorado School of Mines. He is actively involved in the Colorado Fuel Cell Center (CFCC), conducting research on fuel processing and polymer electrolyte membrane development. He brings over 20 years of experience in developing and deploying commercial fuel cell systems.

Dr. Atul Bhargav completed his B-Tech from IIT, Madras in 2002 and received his M.S. and PhD from University of Maryland, College Park, USA in 2008 and 2010 respectively. He has worked on diesel-, NG- and LPG-based fuel cell systems at Ballard Power Systems and the University of Maryland. He has been a faculty member at IIT Gandhinagar since 2011 and is currently leading research and development efforts (through sponsored projects) in hydrocarbon based fuel cell systems.