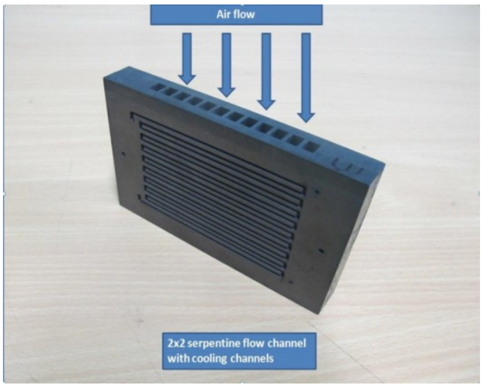

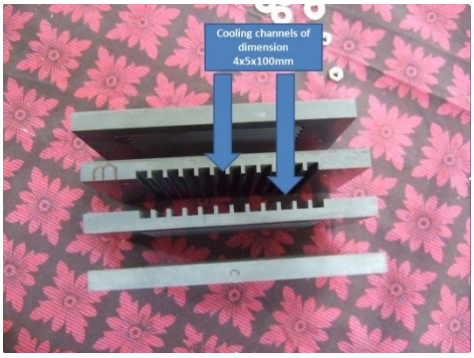

Complimentary 1 year SAEINDIA membership for non-member participants

SPECIAL DISCOUNT ON GROUP BOOKING (MINIMUM 5 ATTENDEES FOR SAME SESSION 10% DISCOUNT)

TOPTECH: Challenges and Issues on Fuel Cell Technology - Potential, Advanced Power Source for the Future

Date: 20th & 21st February 2015

Speaker: **Dr. P. Karthikeyan**

Professor at PSG College of Technology, Coimbatore

SAEINDIA
SOUTHERN SECTION

Venue:

SAEINDIA Southern Section

Block-1, Modules 29 & 30, SIDCO Electronic Complex

Thiru-Vi-Ka Industrial Estate, Guindy, Chennai-600032

Phone: 044-42188651-52 Mobile: +91-90430 01718

E-mail Id: toptech@saeiss.org Website: www.saeiss.org

Course Content
Abstract:

With an ever increasing awareness of environmental pollution and desire for energy independence; renewable and clean energy resources have been intensively studied and developed with the aim of replacing traditional fossil fuels in our day to day life. Fuel cells are clean (the byproducts are water and heat), highly efficient, scalable power generators (modular in nature which allows for stacking up) can be fuelled by a variety of fuels which contain hydrogen, hence there are used in versatile applications. Among many types of fuel cells, Proton Exchange Membrane Fuel Cells (PEMFC) seems to be more promising than other types of fuel cells and is particularly suitable for automotive applications since they are compact and produce a powerful electric current (high ampere) relative to their size. They operate at a relatively low temperature, allows for fast start-up and response to changes in demand for power. This makes PEMFCs ideally suitable for transportation and smaller stationary applications (less than 1 MW). In spite of its excellent benefits, commercialization of fuel cells is very challenging because of the high cost of materials and low reliability, apart from the sub systems such as hydrogen generation and storage technologies.

Currently, active research is carried out in reducing the platinum catalyst loading using platinum alloy catalyst and non-noble metal catalysts using nano-materials, reducing thermal and water management issues on scaling and stacking of fuel cell, improving cell performance, durability and system integration. The cost reduction in the design and development of individual fuel cell system would lead to substantial cost savings in the fabrication of the complicated fuel cell stack.

The challenges faced during the development of fuel cell from research to product stage while scaling up and stacking up fuel cells to match the requirements of a power source are discussed. However, in real world applications, when the power requirement is more, the active area will be much more than 25cm2 (conventional fuel cell systems for research studies) which requires scaling up or increasing the active area of the Membrane Electrode Assembly (MEA). With the knowledge obtained by scaling and stacking up, it can be concluded that both scaling and stacking were found to reduce the power density of fuel cells.

When compared to small fuel cells, scaled up fuel cells usually require a complex design, like appropriate flow channel geometry and provisions for water management, as scaling up could lead to performance losses due to lack of proper water and management, and reactant concentration deficiency, owing to the increased reactant chamber volume. By addressing these issues a high energy density PEMFC Stack with effective heat and water management is to be developed, which will be both scalable and stackable. This is to be done by numerical design and simulation of fuel cell components. Flow field, bipolar plate designs and its influence of PEMFC system including structural design and computational fluid dynamics (CFD) are studied using software’s such as ANSYS CFX, COMSOL Multiphysics. Hence, by properly optimizing flow channels the power density of the scaled up fuel cell/stack can be improved.

To achieve this many types of flow channels such as circular, triangular, trapezoidal and rectangular will be studied under different land to channel ratios with different feasible combinations of slopes for easy water removal from flow channels. After different stages of design review the optimized combination of flow channel parameters will be chosen for a specific stack. Various critical issues associated with PEMFCs, such as, investigation of issues associated with scaling and stacking up of fuel cells, thermal management of stack with effective cooling of fuel cell stack system with forced convection and natural convection, water management of stack by effective water removal from gas diffusion layer (GDL)/rib surface interface using porous inserts on conventional flow channel are also addressed. Performance studies of fuel cell stack with various operating parameters on reliability studies will be also addressed which will pave way to the commercialisation of fuel cells.

The knowledge obtained are viable on the present study will be able to develop model based vehicle study to outline the vehicle requirements on 5 kW PEMFC power unit under steady state conditions to analyse and simulate the working process of the system. A standalone fuel cell power generator with an effective control and monitoring system which will deliver a robust and efficient performance under various operating conditions will be developed. Also, it requires a fuel (hydrogen) which is clean carrier and storage of energy. Hydrogen can be produced from various renewable and non-renewable energy sources owing to the various environmental hazards such as the greenhouse effect, ozone layer depletion, acid rains and pollutions etc; so, a renewable energy source is preferred for hydrogen production. Water electrolysis is a safe option for production of pure H2 at point of use, as it does not require substantial storage requirements. By utilizing a renewable electrical energy source, e.g. solar, water electrolysis offers a practical route to sustainable H2 production. Commercial H2 production by water electrolysis is based on one of two technologies; aqueous alkaline (KOH) electrolytes and proton exchange membrane (PEM) electrolytes. Currently the dominant (lower capital cost) technology is alkaline electrolysis. The capital cost of proton exchange membrane electrolyses is high and is largely dictated by the high material costs of membranes (perfluorinated polymers) and precious metal (Pt, Ir, Ru) based catalysts. However proton exchange membrane water electrolysis systems offer advantages over alkaline technologies; greater energy efficiency, higher production rates (current density per unit electrode area), and more compact and flexible design operation. In addition, proton exchange membrane water electrolyser (need less operation and maintenance effort and are thus promising for use in small scale applications (residential homes). In the solar technology, nowadays concentrating photovoltaic (CPV) is one of the promising and proven technologies in the solar photovoltaic field. The usage of CPV lead to 3 to 4 times higher efficiency than conventional PV systems. The CPV system can be effectively used to generate the electricity for the electrolysis process in the fuel cell set-up. This paves way for integration of solar energy with fuel cells for automobile applications. Another aspect is onboard hydrogen generation with Partial oxidation and auto thermal reforming process and storage at low pressure hydrogen systems for parallel/series fuel cell power train.

About the Course

Fuel cell, an electro chemical device which produces an electrical energy from the chemical energy through electrochemical reactions, has attracted increasing attention as the most promising energy converters, especially for automobile applications, because of their high-energy density at low operating temperatures, quick start-up, and zero emissions. Hence, this makes it the ideal choice for use in several applications such as transportation, stationary and portable products. In spite of its excellent benefits, commercialization of fuel cells is very challenging because of the high cost of its materials and low reliability. Currently, active research in this area is underway in several areas such as, reducing the platinum catalyst loading, seeking inexpensive materials and construction methods, and improving cell performance and durability.

Benefits of attending the Course

- Dissemination of knowledge gained on fuel cells through a new course "Fuel Cell Technology".
- This course bestows a disclosure to the participants towards the up to date state of play in international research and development in fuel cell energy technology.
- The course takes in hand the issues of environment and energy resources using fuel cell for small and portable applications.
- Serves as an imminent avenue of improving energy efficiency in fuel cells to enable designers to develop better designs.
- Enhances in-depth understanding of Proton exchange membrane Fuel cells (PEMFC) for energy efficiency, performance, safety and economics.
- This underpinning course will follow a line of investigation and progress in Scaling up & Stacking up of Fuel Cells.

Learning Objective

- To combine the expertise in various areas to design and develop a fuel cell system for vehicle applications on the avenues of improving energy efficiency in fuel cells to develop better designs
- Develop low cost and high energy density PEMFC stacks integrate with an efficient control and monitoring system for deliver robust and efficient performance under various operating conditions for automobile application.

Course prerequisites

Participants should have an undergraduate/ postgraduate degree in engineering or equivalent experience/ knowledge.

Who should attend?

This course is designed to assist individuals in various industries including automotive, aerospace background. Budding engineering graduate in the field of mechanical/automobile/ chemical/ material science/ metallurgy and electrochemical engineering are invited to enrich their knowledge in this emerging technology for automotive and power generating sectors. Company's senior executives, engineering managers and engineers will find the course relevant and informative

Course Date & Time

Challenges and Issues on Fuel Cell Technology - Potential, Advanced Power Source for the Future	**20th & 21st Feb 2015**
Start: 9:00 am to 5:00 pm	

Facilities provided during course

- Networking Tea/Snacks
- Networking Lunch
- Delegate Kits

How to enroll

Fee Structure (Two days)

Non-Member	INR 13000/-	Last date of Registration 18th Feb 2015
Member	INR 10000/-	
Faculty Advisor	INR 4000/-	
Registration fee for two days		

- Admissions would be on first come first serve basis and will be strictly through enrolment Procedure
- Limited seats per batch
- Special discount to Teaching Faculty advisor
- Special discount on group booking (minimum 5 attendees for same session- 10% Discount)

Pay course fee through DD/Cheque or Transfer to our account

Name of the account holder: SAEINDIA Southern Section Toptech
Account No. : 32506111653
Bank Name : State Bank of India
Branch Name : Kottur, Chennai
IFSC Code : SBIN0001669

Enrollment Procedure

- Send us following details to **toptech@saeiss.org** for registration
- Registration form enclosed or **Click Here**

Course Instructor

Dr. P. Karthikeyan, Professor in the Dept. of Automobile Engineering at PSG College of Technology, Coimbatore. He received his PhD Degree at Indian Institute of Technology Madras (IIT-M), Chennai on 2008. After successful completion of his PhD Degree at Indian Institute of Technology Madras (IIT-M), he was received BOYSCAST fellowship (2009-10) from DST, Government of India for conducting Advanced Research Training in the area of "Fuel Cells - Water Management in PEM Fuel Cells" in USA. In part of his research work on Post - Doctoral Fellowship, he also visited Fuel Cell Dynamics and Diagnostics Laboratory, Pennsylvania State University, Pennsylvania, USA and Electro Chemical Engineering and Membrane Science Lab at School of Engineering, Vanderbilt University, Nashville, Tennessee, USA during 2009-10. He had also visited High Temperature Super and Semi Conductor Laboratory, University of Houston, Houston, Texas & College of Engineering, University of Berkeley, San Francisco, California and Stanford University, San Francisco, USA. He had authored more than 29 research papers in reputed national and international journal, 16 peer reviewed international conferences, and filed 1 technical patent (Invention Disclosure No.: D2010-65). Also, set up fuel cell laboratory in University of Toledo, Toledo, OHIO, USA & PSGCT, Coimbatore, India. He had research coordination with various universities such as the Centre for Research and Advanced Studies (CENVESTAV-IPN), Unidad Saltillo-Mexico, University of Toledo, OHIO, USA, Loughborough University, Loughborough, Leicestershire UK and Curtin University, Australia. He is currently supervising 6 PhD students and guided more than 20 ME / M.Tech students in their project work.

Research Interests:

- Thermal and Water Management issues on scaling and stacking up of fuel cell systems
- Studies on PEM Fuel Cells with Porous Flow channels and Porous Inserts on Conventional Flow Channel
- Membrane Electrode Assembly (MEA) with platinum alloy catalyst and non-noble metal catalyst using nano-materials
- Optimization of flow channel design and various operating parameters for enhancement of performance on PEMFC
- Development of Indigenous Fuel cell Stack for automobile and stationary applications, and various issues for system development and system integration.
- Design and development of concentrating photovoltaic (CPV) for solar power generation
- Design and development of solar energy aided electrolyser for hydrogen production

Further pls contact:

S. Ilangovan, TopTech Executive

SAEINDIA Southern Section

Mobile No: 9043001718