ChEMference 2011

Think Share Relish

September 23 - 24

Organised by

Department of Chemical Engineering
Indian Institute of Science
Bangalore 560 012 INDIA

WELCOME MESSAGE

ChEmference, a national conference of graduate students in chemical engineering, presents a unique opportunity for students to share their latest research findings with their peers, engage in a fruitful exchange of ideas, and come face-to-face with senior colleagues from the academia and the industry. Following the initiative of the Department of Chemical Engineering, IIT Kanpur in 2008, ChEmference has become an annual event and is growing in stature. It is our privilege to host the fourth ChEmference at the Department of Chemical Engineering, IISc Bangalore.

The two day event this year will commence with a plenary lecture by Prof. Ashutosh Sharma, IIT Kanpur. This will be followed by four sessions of oral presentations, each containing a keynote lecture by a faculty member and presentations by students selected from submitted abstracts, and a poster session. In addition, the last session, an added attraction this year, is a special session on entrepreneurship, which will expose students to the avenues for and the challenges in starting-up in chemical engineering in India. It is only appropriate that Bangalore, the epicenter of start-up activities in India, adds this new flavor to ChEmference.

The contributions and support of many institutions and individuals have made this event possible. We are grateful to the administration of IISc for enabling the hosting of the event on our campus. We thank DST and our corporate sponsors for their generous support. Our special thanks go to NIAS for accommodating our student participants in their guest house. Our chairman, Prof. Prabhu Nott, and the faculty and staff of our department have contributed in numerous ways to the organization of the event. And, finally, it is the long, tireless and enthusiastic hours that our student volunteers have put in that brings this event alive before you.

It gives us great pleasure to welcome you to ChEmference 2011.

Narendra M. DIXIT
Convener

K. Kesava RAO
Convener

TECHNICAL PROGRAMME

Day 1: September 23, 2011

08 : 00 - 09 : 00	Registration
09 : 00 - 09 : 30	Opening Ceremony Welcome address by Prof. K. Kesava Rao Department of Chemical Engineering, Indian Institute of Science Bangalore
	PLENARY LECTURE
	Sponsored by SABIC Innovative Plastics
09 : 30 - 10 : 30	Prof. Ashutosh Sharma Department of Chemical Engineering, Indian Institute of Technology Kanpur
10 : 30 - 11 : 00	**Tea**
	SESSION-I
	Sponsored by SABIC Innovative Plastics
11 : 00 - 11 : 45	Keynote address by Prof. Supreet Saini Department of Chemical Engineering, Indian Institute of Technology Gandhinagar
13 : 05 - 14 : 30	**Lunch**
	SESSION-II
	Sponsored by Bristol-Myers Squibb
14 : 30 - 15 : 15	Keynote address by Dr. S. K. Dhawan National Physical Laboratory New Delhi
	BOOK RELEASE
16 : 35 - 17 : 00	Release of Book: *Heat and Mass Transfer: A Transport Phenomena Approach* Author: Prof. K. S. Gandhi Department of Chemical Engineering, Indian Institute of Science Bangalore
17 : 00 - 17 : 30	**High Tea**
	POSTER SESSION
	Sponsored by Hindustan Petroleum Corporation Limited
17 : 30 - 19 : 00	Poster presentations by participants*
20 : 00	**Dinner**

Day 2: September 24, 2011

SESSION-III	
	Sponsored by Shell, India
09 : 00 - 09 : 45	Keynote address by Prof. Raghunathan Rengaswamy Department of Chemical Engineering, Indian Institute of Technology Madras
11 : 00 - 11 : 35	**Tea**
SESSION-IV	
	Sponsored by *Tata Research Development and Design Centre*
11 : 35 - 12 : 20	Keynote address by Prof. Mahesh Tirumkudulu Department of Chemical Engineering, Indian Institute of Technology Bombay
13 : 40 - 15 : 00	**Lunch**
SESSION ON ENTREPRENEURSHIP	
15 : 00 - 15 : 30	Dr. Dhananjaya Dendukuri CEO & Co-Founder, Achira Labs Pvt. Ltd., Bangalore
15 : 30 - 16 : 00	Mr. Anupam Kunwar Director Technology, SuRe Energy Systems Pvt. Ltd., Hyderabad
16 : 00 - 16 : 30	Dr. Vivek V. Ranade Founder & Chairman, Tridigonal Solutions, Pune
16 : 30 - 17 : 00	Discussion
17 : 00 - 17 : 30	**High Tea**
CLOSING CEREMONY	
17 : 30 - 18 : 00	Prize distribution Vote of thanks

CONTENTS

Scientific Commonsense & Creativity: Some Case Studies in New Process and Product Development

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Dear Friends:
I would like to explore with you some ideas about what innovation and creativity may mean and their roles in the context of modern chemical engineering research. I will touch upon some aspects of creative scientific thinking illustrated by a few examples from my own experiences. There is already a paradigm shift in chemical engineering research that demands that we not only do scaleup of known processes, but also integrate in a seamless way the many concerns of materials science, physics, chemistry, biology, mechanical and electrical sciences; in fact pretty much everything on demand as dictated by the problem at hand!. These challenges include, but are not limited to, such diverse areas as biomedical and electronic materials and devices, functional and smart materials, computational biology/genomics, bio- mimetics, colloids and interfaces, new separation/reaction processes & their intensification, green chemistry, novel ways of harnessing and utilization of energy and water resources and scale-down of materials and processes (nanotechnology) towards both novel and traditional ends. The potentialities are truly staggering, but their understanding and the action plans require synthesis of a diverse body of knowledge which now stands compartmentalized over different departments. Thus, new advances demand two major ingredients: (1) acquiring a life-long capacity to learn and assimilate new ideas regardless of the name tag they carry, and (2) capacity for learning not just from the printed material, but an innovation/creativity centric style of functioning, especially in the realm of research and long term developments. I would like to share with you some thoughts about the second ingredient by giving some examples from my own experience of seeking scientific solutions to some problems of product and process development (both the terms meant in their general modern context). These examples include:

1) Search for a reusable pressure sensitive adhesive that functions both in dry and wet environments with equal ease [1].
2) How to make small micro/nano 3-D objects?—search for a new fabrication method [2].
3) How to sculpt small scale features in carbon including nano-interconnects?— Fabrication of carbon-MEMS/NEMS platforms including micro-batteries, sensors, cell supports and environmental remediation [3].
4) How to make nano-channels without the use of slow and expensive tools such as ion-beams?[4]
5) How to use self-organization for micro/nano fabrication?[5]

The examples are intended only to guide and incite some intuitive thoughts about the creative processes, rather than provide a comprehensive catalogue of the many facets of innovation and creativity! Thank you. Enjoy!

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How do cells count? Flagellar regulation in Salmonella.

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Abstract

Cells, including bacteria, house a number of discrete organelles. While in some cases the cell only needs to build a single copy of a given organelle, in other cases it needs to build many. This suggests that cells must employ an active mechanism for sensing and controlling organelle abundance. For, if the cell builds too few, then the integrated activity of these organelles may be insufficient to complete necessary tasks; and if the cell builds too many, then critical resources are wasted.

Using the flagellum from the pathogen Salmonella as a model system for organelle number control, I will talk about the strategies employed by the bacterium to do number control. Using modeling and experimental analysis, I will demonstrate how Salmonella employs protein secretion as a proxy for flagellar abundance and then uses this signal to dynamically regulate flagellar gene expression.

Conducting Polymers: What Does the Future hold?

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Abstract

Electronically conducting polymers are a new class of materials with interesting potential applications in number of technologies like an electrode material in primary and secondary batteries, shielding of electronic equipments from electromagnetic pollution and electrostatic charge dissipation, stealth applications in microwave range, sensors, organic light emitting diodes, super conducting polymers, super capacitors and as corrosion inhibition coatings. Deliberate modification in the chemical and super molecular structure in the polymer matrix can lead to the formation of conducting polymers of high electronic conductivity (p & n type) which can be suitably designed for high tech applications.

The conducting polymer, polyacetylene, discovered by Shiakawa, Heeger and MacDiarmid has electronic conductivity of the order of 105 S/cm whereas the conductivity of copper is 106 S/cm. With the idea that electronic conductivity can be varied with doping has revolutionized the area of research. They acquire importance over inorganic semiconductors in their application because of their high strength to weight ratio, toughness, low cost and ease of processing into film. The prospect of plastic metals has inspired much interest in these materials for technological applications such as antistatic coatings and electromagnetic interference shielding and in other areas where light weight, flexibility and high conductivity materials are required.

Molecular design opportunities in conducting polymers where the electrical and mechanical properties make them outstanding candidate materials for engineered designs and will form a new basis for a new generation of high tech specialty polymers.

A Stick in a Haystack: Identifying the Root Cause for Oscillations in a Process Plant

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Abstract

In this talk, we will introduce the problem of root cause diagnosis of oscillating control loops. In a single-input single-output (SISO) closed-loop chemical process system, under constant or non-oscillatory set-point, oscillations in the output can occur mainly due to one or a combination of the following reasons: aggressively tuned controllers, presence of stiction in control valves and disturbances external to the loop. The presence of these oscillations can propagate plant-wide and force plants to back off from optimal operating conditions. Therefore, it is essential to develop techniques that can diagnose the source of oscillation in control loops. In recent years, several methods have been developed to address this diagnosis problem by focusing on only one of the causes for oscillation. In this talk, a data driven approach combining both parametric (Hammerstein model based analysis) and non-parametric (Hilbert-Huang spectrum analysis) schemes for identifying the root causes of oscillation will be discussed. Unlike the existing techniques, our approach identifies and distinguishes between the three causes of oscillation in linear closed loop process systems with minimal assumptions. Simulation and industrial chemical process case studies that demonstrate the utility of the proposed method will be discussed.

Instability of a Moving Liquid Sheet in the Presence of Acoustic Forcing

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Abstract

A fundamental understanding of the break-up and subsequent drop formation is important in areas as diverse as spray coating, combustion, biomedical devices such nebulizers etc. One such route of atomization involves radial liquid sheets generated by laminar jet impingement which eventually break-up into fine droplets. We focus on sheet break-up subjected to acoustic forcing of controlled sound intensity and frequency to identify regimes of accelerated and more violent sheet break-up. Experiments show that for a given frequency, there was a threshold value of sound pressure level below which the sheet was unaffected. The droplet sizes formed by the disintegration of the sheet reduced with an increase of the measured response and the drop-shedding frequency was near the imposed frequency. Model equations accounting for the varying pressure field across the moving liquid sheet of constant thickness was solved to determine the linear stability of the system. The model calculations suggest that the parametric resonance involving the dilatational mode are responsible for the observed instability.

Microfluidic Technology as a New Frontier for Chemical Engineers: Experiences of a Start-up Company

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Abstract

Microfluidic technologies are an exciting set of new platform technologies that can be used to enable the miniaturization of fluid flow and analysis in a number of areas such as medical diagnostics, food and environment testing and drug screening. Achira Labs is a start-up company in Bangalore focused on the development of microfluidic technologies that can serve as a platform to perform rapid, affordable and multi-analyte testing in the medical diagnostics space. I will talk about some of our experiences in this regard and the technology portfolio that Achira Labs has built. The talk will focus on two different platform technologies that we have created – one involves methods to load micron sized reagent blocks into a microfluidic device and the other is a novel fabric-based platform to perform ultra low-cost testing.

Entrepreneurial Ventures of a Research Scientist: Conceiving, Founding, Running & Letting it Fly

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Abstract

In this talk I will provide personal reflections of a first generation entrepreneur on science/ technology based entrepreneurship. At the end of this talk I will also briefly touch upon eco system we have created at NCL to encourage and support such science based entrepreneurship as well as importance of 'intrapreneurship'.

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