



KNOWLEDGE INCUBATION FOR TEQIP, IIT KANPUR

International Workshop on Novel combustion concepts for Sustainable Energy Development

January 2- 4, 2014

IIT Kanpur, in association with TEQIP, hosted an international workshop titled Novel combustion concepts for Sustainable Energy Development. The workshop was sponsored by NSF (National Science Foundation) and ONR. It was held between 2nd and 4th January, 2014 at IIT Kanpur, India. The workshop aimed to bring experts in Combustion Science and Technology from around the world on a single platform. The experts presented their ongoing research on Novel Combustion Concepts for Sustainable Energy Development followed by the panel discussion to identify few promising technologies and develop a strategy to promote collaborative research on those technologies in order to offer few viable novel technologies for improved, efficient and sustainable utilization of combustion based energy production using fossil/bio fuels. As part of this activity special emphasis was placed on micro-scale combustion systems that offer new challenges and opportunities.

Apart from the inaugural session and the panel discussion, the workshop was divided into eight technical sessions in which 3-4 leading experts on the topic presented their work. These include dedicated sessions on Micro-combustion, low temperature combustion in IC engines, Ultra lean combustion, partially premixed combustion, combustion on renewable fuels, Distributed combustion, supersonic combustion, Combustion instability and control, and Noise. These topics are of significant importance for sustainable use of fossil fuels due to their lower fuel consumption rates and enhanced performance including efficiency, pollutants emission levels, lower thermal signatures, and enhanced life of the engine.

TOPICS DISCUSSED

- Micro-combustion
- Low Temperature / Ultra Lean Combustion
- Gas Turbine Combustion
- Partially Premixed Combustion
- Gasification and Coal combustion / Combustion of renewable fuels
- HCCI of Gasoline and Diesel like Fuels
- Distributed combustion and other Novel combustion and Ignition Concepts
- Combustion Modelling and Simulation
- Novel Combustion Concepts for Sustainable Growth
- Fuel Reforming to Cleaner Fuels
- Energy Development

LIST OF SPEAKERS

- Dr Ashok Pandey, NIIST, Trivandrum, India
- Prof. R.P Sharma, Jaipur, India
- Prof. Avinash Kumar Agarwal, IIT KAnpur, India
- Dr. D. Umamaheshwar, GE Aviation, India
- Prof. Aswani K. Gupta, University of Maryland, USA
- Prof. Achintya Mukhopadhyay, Jadavpur University, India
- Mr. P. Sreedhar, GE Aviation, India
- Dr. Hukam C. Mongia, Perdue University, USA
- Prof. K. Kitagawa, Nagoya University, Japan
- Prof. Swarnendu Sen, Jadavpur University, India
- Prof. Subramanyam R. Gollahalli, University of Oklahoma, USA
- Prof. Ajay K. Aggarawal, University of Alabama, USA
- Prof. Abhijit Kushari, IIT Kanpur, India
- Prof. S.R Chakrabarthy, IIT Madras, India
- Dr. B.R Gurjar, CE, IIT Roorkee, India
- Dr. Tarun Gupta, CE, IIT Kanpur, India
- Prof. Ramesh K. Agarwal, Washington University, USA
- Dr. Gabriel D. Roy, Office of Naval Research, USA

- Dr. Ryo Amano, University of Wisconsin, USA
 - Prof. Raja Bordia, Clemson University, USA
 - Dr. Debasis Chakraborty, DRDL Hyderabad, India
 - Prof. Franz. Winter, Technical University of Vienna, Austria
 - Prof. S. Kerdsuwan, KMUST, Bangkok, Thailand
 - Prof. Kalyan Annamalai, Texas, A&M University, USA
 - Prof. Suresh K. Aggarwal, University of Illinois, Chicago
 - Prof. C. Thomas Avedisian, Cornell University, USA
 - Prof. A Krothapalli, Florida State University, USA
 - Prof. L.M Das, CES, IIT Delhi, India
 - Prof. O.N Srivastava, IIT Varanasi, India
- Dr. R.K Malhotra, IOCL R&D, Faridabad, India

PARTICIPATING INSTITUTES

Institute	Number of Participants
G.B. Pant, Pantnagar	1
UIET, Punjab University	1
IET, Lucknow	1
BIET, Jhansi	1
BTKIT, Dwarhat	2



International Workshop on Novel Combustion Concepts for Sustainable Energy Development



2nd - 4th January 2014

International Society for Energy, Environment and Sustainability

Schedule

		2 nd January, 2014
Event	Time	Details
Registration	8:00 am to 9:00 am	Outreach Auditorium, IIT Kanpur
Inaugural Session	9:00 am to 10:00 am	Outreach Auditorium, IIT Kanpur
Inaugural Speech	10:00 am to 10:30 am	Plenary Speech: Hydrogen as a fuel: Challenges and opportunities Dr. R. K. Malhotra, Director, IOCL R&D, Faridabad, India
Inaugural Tea	10:30 am to 11:00 am	
Session-1 Biofuels Venue: Outreach Auditorium	11:00 am to 11:45 am	Keynote: Production of second generation biofuels in India: Status and perspectives Dr. Ashok Pandey, NIIST, Trivandrum, India
	11:45 am to 12:15 pm	Recent Trends in Biodiesel Prof. R. P. Sharma, Jaipur, India
	12:15 pm to 12:45 pm	Biodiesel Combustion and Endoscopy in Single Cylinder Research Engine Prof. Avinash Kumar Agarwal, IIT Kanpur, India
	12:45 pm to 1:15 pm	Power the Future Flight... Perspectives from CAE Dr. K. Umamaheswaran, GE Aviation, India
Lunch	1:15 pm to 2:15 pm	
Session-2 High Intensity combustion and Sprays Venue: PBCEC Seminar Room	2:15 pm to 3:00 pm	Keynote: Hydrogen Addition Effects on Volume Distributed High Intensity Combustion Prof. Ashwani K. Gupta, University of Maryland, USA
	3:00 pm to 3:30 pm	Linear and Nonlinear Analysis of Breakup of Liquid Sheets and Resulting Spray Formation Prof. Achintya Mukhopadhyay, Jadavpur University
	3:30 pm to 4:00 pm	Development of the GE Aviation Low Emissions TAPS Combustor for Next Generation Aircraft Engines Dr. Sreedhar Pillutla, GE Aviation, India
Tea Break	4:00 pm to 4:30 pm	
Session-3 Combustion Measurements Venue: PBCEC Seminar Room	4:30 pm to 5:00 pm	Intersections of Combustion Products, Technology, Science, CFD and Diagnostics: Ultra Low NO _x , Fuel Flexibility and Dynamics Dr. Hukam C. Mongia, GE Aviation, USA
	5:00 pm to 5:30 pm	Spectroscopic Visualization of Combustion Flames and Plasmas for Energy Systems Prof. K. Kitagawa, Nagoya University, Japan
	5:30 pm to 6:00 pm	Flame Colour Based Lean Blow Out Detection For Dump Combustors Prof. Swarnendu Sen, Jadavpur University, India.

		3 rd January, 2014 (Friday)
Event	Time	Details
Session-4 Advanced Combustion Concepts Venue: PBCEC	9:00 am to 9:45 am	Keynote: Partial Premixed Flames of Vaporized Renewable Fuels and Their Blends with Petroleum Fuels Prof. Subramanyam R. Gollahalli, University of Oklahoma, USA
	9:45 am to 10:10 am	A Low-emission Combustion System for Liquid Biofuels Prof. Ajay K. Aggrawal, University of Alabama, USA
	10:10 am to 10:35 am	Emission and soot formation in partially premixed combustion

Seminar Room		Prof. Abhijit Kushari, IIT Kanpur, India
	10:35 am to 11:00 am	Acoustic Reynolds Stress- The source of coherent structures in combustion instability Prof. S. R. Chakrabarthy, IIT Madras, India
Tea Break	11:00 am to 11:30 am	
Session-5 Emission Control Venue: PBCEC Seminar Room	11:30 am to 12:00 pm	Modeling of Exhaust and Non-exhaust Emissions from Urban Road Transport Vehicles in India Dr. B. R. Gurjar, CE, IIT Roorkee, India
	12:00 pm to 12:30 pm	Comparison of Primary vs. Secondary Emissions from Internal Combustion Engines Dr. Tarun Gupta, IIT Kanpur, India
	12:30 pm to 1:00 pm	Coal-Direct Chemical Looping Combustion: Process and Reactor Level Simulations and Optimization of Carbon Capture Prof. Ramesh K. Agarwal, Washington University, USA
Lunch	1:00 pm to 2:00 pm	
AGM of the Society	2:00 pm to 3:30 pm	Venue: PBCEC Seminar Room
Tea Break	3:30 pm to 4:00 pm	
Lab Tour	4:00 pm to 6:00 pm	Engine Research Laboratory, ME & Flames and Combustion Dynamics Laboratory, AE
Conference Reception	7:30 to 10:00 pm	Type-II Community Hall

4 th January, 2014 (Saturday)		
Event	Time	Details
Session-6 S&T Approaches & Other Related Topics Venue: PBCEC Seminar Room	9:00 am to 9:45 am	Keynote: S&T Approach for a Sustainable and Fuel Efficient Future Dr. Gabriel D. Roy, Office of Naval Research, USA
	9:45 am to 10:10 am	Propulsion Of Aluminum Propellant In Solid Rocket Motor Nozzle Dr. Ryo Amano, University of Wisconsin, USA
	10:10 am to 10:35 am	Environmental Barrier Polymer Derived Ceramic Coatings Prof. Raj Bordia, Clemson University, USA
	10:35 am to 11:00 am	Combustion Problems in High Speed Flows Dr. Debasis Chakraborty, DRDL Hyderabad, India
Tea Break	11:00 am to 11:30 am	
Session-7 Biomass Combustion Venue: PBCEC Seminar Room	11:30 am to 12:00 pm	Fluidized Bed Conversion: From Coal to Biomass and New Concepts Prof. Franz Winter, Technical University of Vienna, Austria
	12:00 pm to 12:30 pm	In-depth Performance Evaluation of RDF from Old Landfill Dumpsite for Electricity Generation in a Downdraft Gasifier Prof. S. Kerdsuwan, KMUST, Bangkok, Thailand
	12:30 pm to 1:00 pm	Biomass Fuel Quality Enhancement and the RQ (Respiratory Coefficient) For Fossil and Biomass fuels Prof. Kalyan Annamalai, Texas A&M University, USA
Lunch	1:00 pm to 2:00 pm	
Session 8 Futuristic Fuels Venue: PBCEC Seminar Room	2:00 pm to 2:30 pm	Combustion Characteristics of Biomass and Petroleum Based Fuel Blends Prof. Suresh K. Aggarwal, University of Illinois, Chicago, USA.
	2:30 pm to 3:00 pm	Developing Surrogates of Liquid Transportation Fuels Prof C. Thomas Avedisian, Cornell University, USA
	3:00 pm to 3:30 pm	Hydrogen Enriched Synthesis Gas production from Biomass Gasification Prof. A. Krothapalli, Florida State University, USA
Panel Discussion	3:30 pm to 4:30 pm	Combustion Research for Sustainable Energy and Environmental Preservation
Valedictory Tea	4:30 pm to 5:00 pm	
Valedictory Session	5:00 pm to 6:00 pm	Venue: PBCEC Seminar Room

Summary of Faculty Feedback

Workshop

Questions	Excellent	Good	Ordinary
Clarity of communication about workshop	05	01	00
Organization of the sessions	05	01	00
Quality of lectures	05	01	00
Quality of posters	02	04	00
Effectiveness of discussions	04	02	00
Effectiveness of learning experience	04	02	00
	Appropriate	Short	long
Duration of workshop	03	03	00
	Definitely	Maybe	No
Would you like to have more such sessions?	06	00	00
Would you like e-lectures by experts on special topics?	04	02	00
Suggest specific topic that you would like additional expert lectures on	<ul style="list-style-type: none"> • Combustion, Instrumentation, Heat • Transfer, Thermodynamics. • Natural Convection, Virtual lab. • Fluid Mechanics, CFD. 		
Additional Suggestions	<input type="checkbox"/> Need to discuss general possible problems related to different area. <input type="checkbox"/> It is good platform to interact the high profile people in different research area. <input type="checkbox"/> Need of some experimental activities.		

Teaching

Which subjects do you teach?	<input type="checkbox"/> Heat and Mass Transfer, Thermodynamics. <input type="checkbox"/> IC Engine, Power plant. <input type="checkbox"/> SOM, Mechanics, Engg. Drawing. <input type="checkbox"/> Automobile Engg. <input type="checkbox"/> R & AC. <input type="checkbox"/> CFD			
What is average student to teacher ratio in your institute?	<input type="checkbox"/> 25:1 <input type="checkbox"/> 20:1 <input type="checkbox"/> 30:1 <input type="checkbox"/> 70:1 <input type="checkbox"/> 25:1 <input type="checkbox"/> 20:1			
Questions	YES		NO	
Do you have additional support for teaching (tutors, graders, teaching Assistants, etc)?	03		02	
Do you give class projects for UG classes?	06		00	
Do you give class projects for PG classes?	05		01	
Do you have sufficient resources for laboratory courses?	02		04	
	Sufficient		Inadequate	
Is the library/journal/e-connection support adequate?	01		05	
	Definitely	May be	No	
Would you like to have common (TEQIP) repository of course material?	04	02	00	
Would you like to visit IITK to participate in and develop course material (existing or new)	04	01	00	
Would you like to participate in creation of the repository material (course files/lab. Manuals/question bank/etc)	04	02	00	
	e-courses	Workshops	Content	none
How can IITK effectively help you prepare for teaching?	03	03	03	00
How can TEQIP help improve your teaching?	<input type="checkbox"/> Interaction with the quality faculties of IIT K.			

Research

Questions	Definitely	Maybe	No
Would you like to visit an IIT for a visiting-faculty/post-doctoral fellow ,if offered(via TEQIP)?	04	02	00
Would you like to share/use research infrastructure at IITK, if made available?	06	00	00
Would you like to conduct collaborative research with IITK?	05	01	00
Would you like lectures by experts (Indian and international) on niche research areas/topics?	04	02	00
Do you want special-topic conferences?	03	03	00
How can TEQIP help improve your research?	<ul style="list-style-type: none"> •By this scheme it will be better for a teacher to see the different research concept at different IITs and they suggest to add that kind of research at low level as example whatever discussed by prof. Agrawal to how people can develop engine lab as per the fund availability in Institute. •Use of research facilities. 		

OUTCOME

This workshop introduced the participants to the required course content and pedagogy of combustion education both in undergraduate levels as well as the research ideas and methods in related issues. The Participants learned about various types of combustion and how to model combustion for sustainable growth. The workshop also emphasized on the need of cleaner fuel and development in the field of energy. This workshop provided a mix of industrial and academic perspectives to teaching of fluid mechanics, combustion and engine research at the undergraduate and graduate levels. There was a healthy interaction amongst the teachers from KIT Quality Circle and the experts