



The Combustion Institute

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2018 Saudi Arabia Section of The Combustion Institute Report

Section Website: <http://sas-ci.com/>

Section Chair: Hong G. Im

List section officers and board members with titles:

Prof. Hong G. Im, KAUST, Chair
Dr. Jihad Badra, Saudi Aramco, Vice-Chair
Dr. Kai Morganti, Saudi Aramco, Secretary
Prof. S. Mani Sarathy, KAUST, Officer
Dr. Amer Amer, Saudi Aramco, Officer
Ms. Maryam Altaher, Saudi Aramco, Officer
Prof. William Roberts, KAUST, Officer

Members of the Saudi Arabia Section:

Active Members	140+
Non-Student Members	
Student Members	

Section meetings and workshops since 2016 with date and attendance information:

Seventh Annual Meeting – May 2017

The seventh annual meeting was hosted at the Clean Combustion Research Center at KAUST from 21 to 22 May, 2017. More than 150 researchers from all over Saudi Arabia and the surrounding regions attended. The meeting featured four invited lectures and 39 oral presentations across four different technical sessions, and 20 poster presentations.

The first invited talk was provided by Dr. Nicholas Chase from the Transportation and Urban Infrastructure Team at King Abdullah Petroleum Studies and Research Center (KAPSARC). “The surging demand for transportation in emerging economies has reshaped the geography of energy consumption away from industrialized economies and towards much more populous regions where passenger and freight demand could continue to grow rapidly. This is especially true to the two emerging energy giants – China and India. How will this geographic change continue into the future?” asked Dr. Chase.

Dr. Chase also discussed how the modal distribution and consequently the types of fuels consumed are widely expected to change from today. There are new energy efficient technologies, greater use of non-petroleum fuels for motive power, and new travel demand paradigms through concepts such as shared mobility. “The impact of these developments on global transportation energy demand are uncertain but have the potential to greatly change future energy markets and the environment. How can these developments shape the future of global transportation energy demand?” he asked.

Prof. Assad R. Masri from the School of Aerospace, Mechanical and Mechatronic Engineering at The University of Sydney, Australia provided the second invited talk. He reviewed the recent advances in the field of Compositional inhomogeneity with particular focus on the Sydney piloted burner with compositionally inhomogeneous inlets. This burner was recently introduced as an ideal platform featuring mixed-modes of combustion and showing enhanced stability with varying gradients of mixture fraction at the inlet. This and other characteristics of the flames with enhanced stability are now a challenge to modelers worldwide.

The third invited talk was provided by Dr. Aqil Jamal from the Carbon Management R&D Division at the Saudi Aramco Research & Development Center. He discussed the recent trends in CO₂ capture and utilization, which is a key technology platform to enable deep reduction of greenhouse gases while meeting the growing global energy demand. "Power plant and process industries are the two biggest sectors where large amounts of CO₂ can be captured in a cost-effective manner for further utilization or underground storage. Recent advances in material science offer new opportunities for economically feasible CO₂ capture and utilization in combination with renewable energy." Jamal said. He also introduced the latest innovative materials and approaches to capture and utilize CO₂ from industrial point sources and highlight key carbon capture and utilization technologies under development at Saudi Aramco.

The final invited talk of the meeting was provided by Prof. Baki M. Cetegen from the Department of Mechanical Engineering, University of Connecticut, Storrs, CT. He enumerated in detail about his study of the structure of unconfined, lean premixed, bluff body stabilized flames for different levels of turbulence intensity in the approach flow and different fuels.

Eighth Annual Meeting – May 2018

The eighth annual meeting was held from 1 to 2 May at King Abdullah Petroleum Studies and Research Center (KAPSARC) in Riyadh. The event brought together more than 100 experts from institutions in Saudi Arabia, the UAE, Oman, and the U.S. The theme of the meeting was "Clean and Efficient Utilization of Fuels for a Sustainable Future." In total, 49 presentations were made across the six different technical sessions. In addition to the technical sessions, the meeting featured a work-in-progress poster presentation session. Recently appointed KAPSARC President, Adam Sieminski, provided the opening remarks at the meeting.

As a leading global exporter of energy, Saudi Arabia has an important role to play in the development of technologies which promote and enhance sustainability. The establishment of the Saudi Arabian section in 2010 was central to this objective. "Our local section actively supports the growth and development of the Kingdom's young scientists," said Kai Morganti, a scientist in the Saudi Aramco R&DC and secretary of the Saudi Arabian section. "These meetings provide a forum for networking with top researchers, disseminating knowledge, and promoting the role of combustion science as a key pillar of sustainability."

The growing global demands for energy and environmental sustainability pose tremendous challenges and opportunities for the combustion research community. "There is no one-fit-for-all solution to address these challenges," said Hong Im, Professor at King Abdullah University of Science and Technology, and Chairman of the Saudi Arabian section. Instead, synergistic integration of conventional and emerging technologies, including renewables, will be essential in delivering solutions which are both environmentally and socially sustainable. "I am proud to be part of the many world class researchers in the Kingdom who will lead these efforts," said Im.

Sustainability was the recurring theme in the three invited lectures at this year's meeting. Sylvain Cote, Program Director for Energy Demand, Efficiency & Productivity at KAPSARC, discussed the challenges and opportunities associated with the transition to renewable energy in the Kingdom. Among these, Cote highlighted the need for targeted policy action by government to help alleviate an anticipated skills gap. "Although the emerging renewable energy sector is expected to provide new jobs, it is equally important to recognize the limitation and reflect on the adjustment and reform efforts needed. If not, the current labor mismatch could represent a lost opportunity for the upcoming young Saudi population" said Cote.

Dr. Anvita Arora, Program Director for Transport & Urban Infrastructure at KAPSARC, discussed strategies for environmentally and socially sustainable urban transport systems. "Our research is closely aligned with the Kingdom's Vision 2030 and the National Transportation Strategy, which seek to reduce domestic dependence on oil, while creating smart and sustainable cities throughout the Kingdom," said Arora.

The final invited lecture was delivered by Dr. Dimitrios Kyritsis, Professor and Chair of the Department of Mechanical Engineering at Khalifa University, United Arab Emirates. This lecture highlighted the role of carbon capture in addressing the climate challenge, while also unlocking additional petroleum resources when used for enhanced oil recovery (EOR). "This technology has already been deployed in the Kingdom, with approximately 800,000 tons of carbon dioxide captured and stored each year," said Kyritsis. "Carbon capture and storage can enhance sustainability on a large scale."

List other activities (e.g. section journals, projects, working groups, school for students, etc.)

KAUST-CI Clean Combustion Summer School

The KAUST Clean Combustion Research Center (CCRC) hosted a Combustion Institute- Summer School (CI-SS) on April 1-5, 2018, to increase the visibility of combustion science to young scientists. The organizing committee funded the KAUST CI-SS using funds from both KAUST and the Combustion Institute (\$50 K). In the spirit of KAUST diversity requirements, the school welcomed students from all over the world, as well as a reasonable proportion of female students (20%). The majority of students of the 160 students (> 80%) were from Saudi Arabia, and students travelled from across the globe to attend. The participants included graduate students (50%), industry professionals (40%), and academic faculty/researchers (10%). We also succeeded with making this the first virtual CI-SS by having live high quality video streaming of lectures for global participation.

Saudi Arabia: 58 + 80 KAUST participants

Spain: 4

Italy: 4

USA: 3

India: 2

Egypt, UK, Norway, China, Ireland, Netherland, Poland, Germany, Chile, Australia, Brazil:
1 each

The KAUST CI-SS educated students on how to innovate fuels, flames, and engines to ensure that combustion technologies meet the societal and environmental challenges of the 21st century. These topics were be taught using a combination of lectures on fundamental combustion science together with practical laboratory sessions demonstrating how theory can

be applied. Instructors included experts from academia and industry, in order to provide students with a broad understanding of fundamental and applied combustion science. The instructors were Kaoru Maruta (Tohoku, Japan), Hong Im (KAUST, Saudi Arabia), Bengt Johansson (KAUST, Saudi Arabia), Anthony Dean (GE, USA), Aamir Farooq (KAUST, Saudi Arabia), and Angela Violi (Michigan, USA).

6. International Combustion Symposium

The Saudi Arabian section has been well represented at the International Symposium in recent years. The number of accepted papers from SAS-CI members has grown progressively from 6 at the 34th Symposium up to 38 at the most recent 36th Symposium in Korea. A total of 23 papers will be presented at the forthcoming 37th Symposium in Ireland.

Symposium	Accepted Papers
34th Symposium	6
35th Symposium	13
36th Symposium	38
37th Symposium	23

SAS-CI Website

We have recently developed a website for the Saudi Arabian Section of the Combustion Institute. The website has been co-developed between Saudi Aramco and KAUST, and is administered by the KAUST IT Department. The website includes detailed information on the local section, and can be accessed at: www.sas-ci.com.

List awards given by section with details:

No awards given.

Other Information:

Future Plans

The board of officers is working on a number of improvements for the local section. The proposed short and medium term action plan includes:

- Continuing to grow the number of members from Saudi Arabia and neighboring countries.
- Arranging frequent social gatherings and events for members.
- Creating a bank account to handle financial transactions.
- Continuing to create value for the Kingdom and the local combustion research community.