

Role of Combustion Research in Circular Carbon Economy

Saudi Arabian Section of the Combustion Institute (SAS-CI)

11th Annual Meeting



Virtual Conference

<http://sas-ci.com/sasci-2021/>

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Keynote Talks

Keynote Speaker 1:

Yehia Khoja
Advisor,
Ministry of Energy

Biography:

Yehia Khoja is an Advisor at the Saudi Ministry of Energy, and an energy professional with over 10 years of experience covering energy system optimization, energy efficiency, local content development, circular carbon economy, artificial intelligence, and innovation. He has a proven record of leading teams in different energy programs involving stakeholders from government, research, and industry. He has helped develop Saudi Arabia's first set of industrial energy efficiency targets which helped achieve estimated savings of \$1 billion dollars annually by 2030. Next, he led a team during the COVID-19 pandemic to localize the production of sanitizer raw materials by leveraging the existing companies in the energy sector. Currently, he leads three key and transformative initiatives at the Ministry of Energy: the Energy Innovation Program, the Artificial Intelligence Center for Energy, and the Energy Ecosystem Digital Transformation. He received his Master's degree in Electrical Engineering and his MBA from Stanford University, and his Bachelor's degree in Electrical Engineering from Purdue University.



Abstract:

The Circular Carbon Economy National Program, the Energy Innovation Program, and the AI Center for Energy to Unlock Additional Value from the Energy Sector

The Saudi Ministry of Energy has been on a transformational journey to unlock additional value from the energy sector. This is done through ambitious programs in collaboration with partners in government, research, and industry. Some of these flagship programs include: the Circular Carbon Economy National Program, the Energy Innovation Program, and the AI Center for Energy. In this talk, we provide an overview on each of these efforts by describing their objectives, main initiatives, and the role that the Ministry of Energy plays to drive this transformation.

Keynote Speaker 2:

Bassam Dally
Professor, Mechanical Engineering
King Abdullah University of Science and Technology



Biography:

Bassam Dally is a Professor of Mechanical Engineering and a member of the Clean Combustion Research Center at KAUST.

Over the last 30 years, Prof. Dally has contributed seminal works on a variety of research topics under the broad field of Thermo-Fluids. His major contributions are in turbulent reacting flows, MILD combustion, soot in flames, plasma propulsion, hybrid of concentrated solar thermal and combustion, and applied laser diagnostics. He has attracted millions of dollars for his research and have published more than 170 papers in leading scientific journals. He won many awards over the years, including 'Energy Professional of the Year in South Australia', and recently was awarded a Fellowship of the Combustion Institute.

Abstract:

New Insights into Laminar and Turbulent Sooting Flames

Soot in flames have been under intense investigation for many years, due to its impact on the environment (haze and acid rain) and public health (cancer and asthma) if emitted from flames. On the other hand, soot in flames enhances the thermal radiation, which in turns improve the thermal efficiency of combustion devices like furnaces and boilers. Consistent research have shown that the current soot models have failed to offer reliable predictions of soot inception and growth in turbulent flames and for practical fuels. Latest advances in laser based measurement techniques have re-energized the quest for better soot models through systematic experimental studies into a variety of flames and fuels offering new insights and benchmark data. In this talk, the latest development in the planar measurements of temperature, soot volume fraction and primary soot particles' distribution will be presented. The talk will present results and findings from a variety of campaigns of sooting steady and forced laminar jet flames, Jet and bluff-body turbulent flames and jet in a hot coflow flames. A variety of fuels and blends will also be discussed. The talk will also provide some thoughts on future research needs.

Keynote Speaker 3:

Umesh Patil
R&D Manager,
Air Products Technology Center



Biography:

Umesh has been the Air Products Technology Centre's R&D manager since 2018. He oversees Air Products' research collaboration activities in the Middle East, collaborating closely with major customers and universities. His technology team supports Air Products' business, operations, and joint ventures in Grey, Blue, Green hydrogen and Residue Gasification. Umesh holds both an M.S. and a Ph.D. in Materials Chemistry. He has spent the last ten years in Saudi Arabia working on technologies ranging from molecules to megawatts scale in the energy, petrochemical, and oil and gas sectors, with increasing responsibilities throughout his career.

Abstract:

The True Promise of H₂ in Saudi Arabia: Moving Beyond the Hype

Air Products is playing a major role in globally significant Blue and Green Hydrogen Development. There is a clear path for large-scale deployment of low-carbon hydrogen, as evidenced by our present projects in NEOM, Jubail and recently in Edmonton . However, for that to happen, the sector must focus on the appropriate applications of the technology—and there must be a legislative framework that encourages those applications while discouraging expenditures, especially in the technology areas where CCU efforts will not flourish. That is to say, everyone involved must get past the hype and focus on the true promise of hydrogen.

Keynote Speaker 4:

Sophie Colson
Specially Appointed Assistant Professor,
Institute of Fluid Science, Tohoku University



Biography:

Sophie Colson received her Ph.D. in Aerospace engineering with a specialization in thermal energy from Tohoku University and INSA de Lyon in 2020. Her Ph.D. work on the fundamental combustion characteristics and chemistry of ammonia blend fuels was done under the joint supervision of Professor Hideaki Kobayashi at Tohoku University and Professor Dany Escudie at INSA de Lyon. Dr. Colson is currently working as a specially appointed assistant professor in the Institute of Fluid Science at Tohoku University. Her research focuses on the fundamentals of ammonia combustion for its use in industrial applications, including stabilization and emissions for both gaseous and liquid ammonia.

Abstract:

Study of ammonia combustion fundamental characteristics

Ammonia has attracted a lot of attention in recent years as a promising carbon-free energy carrier for the transition toward a greener society. Its combustion in thermal power stations enables electricity production without carbon emission, and while its production still heavily relies on hydrocarbons, it has the potential for the transition toward a cleaner energy production cycle, using gradually more blue and green ammonia, and limiting our CO₂ emissions, as demonstrated by the Saudi Arabia blue ammonia shipping to Japan just a year ago. Its flexibility, affordability, and reliability make ammonia indispensable in tomorrow's energy sector and industry.

Though ammonia combustion has been studied for several years, some challenges still remain for the extension of this knowledge and for its broad deployment in a variety of applications.

In this presentation, some of the recent results obtained in the IFS, Tohoku University, on ammonia combustion fundamentals will be introduced, followed by a presentation of some upcoming research projects and future challenges.