Singapore Section of the Combustion Institute

SSCI | Young Combustion Researchers Webinar

Lean blow-off behaviour of premixed bluff-body stabilised ammonia/hydrogen/nitrogen flames

Dr. Tong Su

Cambridge Centre for Advanced Research and Education (CARES)

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Host: Dr. Shangpeng Li (National University of Singapore)

Zoom meeting: https://nus-sg.zoom.us/j/87500134506

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ABSTRACT

Ammonia is a promising carbon-free fuel, but its low reactivity makes flame stabilisation challenging, and the lean blow-off (LBO) mechanisms of flames with different Lewis numbers remain unclear. This talk presents an experimental study of the LBO behaviour of turbulent premixed bluff-body stabilised NH3/H2/N2 flames, compared with CH4 and C3H8 flames. LBO limits were measured in two confinements of different lengths, and flame structures and flow fields were characterised using OH* and NH2* chemiluminescence, OH-PLIF, PIV and high-speed photomultiplier (PMT) measurements, complemented by large-eddy simulations. The results show that NH3/H2/N2 flames are more resilient to LBO than hydrocarbon flames, with stability improving as the H2 fraction increases. Near LBO, these flames keep a 'V-shape', with H2 consumed at the flame root, more positive curvature, smaller changes in strain rate and the smallest temperature drop. A longer confinement extends the LBO limits and gives rise to low-frequency, large-scale oscillations near LBO, which are attributed to the accumulation and reignition of unburnt reactants. Finally, the challenges of predicting LBO limits using Karlovitz numbers are discussed, and possible corrections are proposed.

ABOUT THE SPEAKER



Dr. Tong Su is a Research Fellow at the Cambridge Centre for Advanced Research and Education in Singapore (Cambridge CARES), where she works on the HYCOMBS project on carbon-free fuel combustion. She received her Ph.D. in Energy and Process Engineering from the Norwegian University of Science and Technology (NTNU) in 2025, under the supervision of Prof. Nicholas A. Worth and Prof. James R. Dawson. Her doctoral research focused on the lean blow-off behaviour of turbulent bluff-body stabilised ammonia/hydrogen/nitrogen flames. She is an experimentalist whose research focuses on the flame structure, stability limits and flame dynamics of ammonia and hydrogen flames, using advanced laser diagnostics such as OH-PLIF, PIV and high-speed chemiluminescence imaging. She has published in Combustion and Flame and the Proceedings of the Combustion Institute. She received the ASME Turbo Expo Combustion, Fuels and Emissions Committee Best Paper Award in 2024 and a Best Paper Award at the Symposium on Ammonia Energy in 2026. She currently serves as Secretary of the 2nd Singapore Section of the Combustion Institute.