

Control of Plasma Chemistry and Dynamics for Low Carbon Energy Conversion

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12:30 PM

Maeder Hall, Room 002

MAE Seminar Series



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With the rapid increase of renewable electricity and electrical transportation, in the next a few decades fossil fuel based energy will be transformed into electron energy for a low or zero carbon energy world. Non-equilibrium plasma provide a promising solution to the challenges of large intermittency of renewable electricity, the lack of gigawatt scale of electricity storage, and carbon emissions from fossil fuels by using plasma aided green chemical manufacturing and energy conversion. In this lecture, at first, we will present the principles of plasma aided ultra-lean and low temperature combustion. The impact of plasma discharge on flame stabilization, minimum ignition energy, and cool flame formation will be introduced. Then, the impact of combustion chemistry on plasma dynamics will be discussed and a newly developed plasma chemistry instability theory will be introduced. The opportunities to control plasma discharge using chemistry instability theory for applications in advanced engines and chemical manufacturing will be presented. After that, recent progress in laser diagnostics for non-equilibrium plasma and the development of experimentally validated plasma chemistry models will be summarized. Finally, opportunities of plasma aided low carbon chemical manufacturing will be discussed.

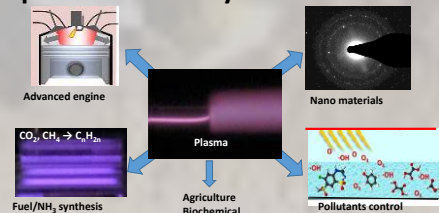


Fig.1 Plasma assisted low carbon energy conversion and chemical manufacturing

Yiguang Ju is the Robert Porter Patterson Professor at Princeton University. He received his bachelor degree from Tsinghua University in 1986, and his PhD degree in Mechanical and Aerospace Engineering from Tohoku University in 1994. He was appointed as an Assistant and Associate Professor at Tohoku University from 1995 to 1999, and as a Chang-Jiang Professor and the Director of Thermo-physics Institute at Tsinghua University in 2000. He joined Princeton University in 2001. Ju’s research interests include combustion, fuels, propulsion, plasma, and energy materials for low carbon energy conversion and chemical manufacturing. He has published more than 250 journal articles. He is an ASME Fellow and an inaugural Fellow of the Combustion Institute. He served as the chair of US Sections of the Combustion Institute and is a Board of Director of the Combustion Institute, the NASA rocket study committee and the NAS steering committee for NASA decadal survey on biological and physical sciences research in space. He received the Bessel Research Award from von Humboldt Foundation, NASA Director’s appreciation award, and the AIAA 2021 Propellants and Combustion award, and was a plenary speaker of the 38th International Symposium on Combustion.