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Rohsenow Lecture in Heat and Mass Transfer

Liquid Fuel Combustion in an Evolving Energy Environment:

the role of spherically symmetric droplet combustion for developing surrogate fuels

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on Friday, April 20th at 3:30pm in 3-270

The high price of gasoline has generated renewed interest to improve the performance of liquid fuels in power and propulsion devices. However, the stochastic environment that transportation fuels are subjected to in engines makes it a challenge to extract fundamental information that could guide hardware and fuel improvement strategies. An alternative approach is presented to understand the combustion process of real liquid fuels, and to developing simplified alternatives to such fuels (i.e., surrogates) that better characterize their performance. Recognizing that droplets represent the fine-grid structure of sprays, the combustion dynamics of fuel droplets are examined in an environment that seeks to remove external convective influences which greatly simplifies the transport field and produces spherical symmetry in the droplet burning process. The one-dimensional flames and transport dynamics that result are well positioned to reveal the influence of such parameters as fuel composition, droplet size, and ambient pressure on ignition, combustion and emissions, and to provide data for validating comprehensive models of droplet burning.

Experiments are carried out in a facility that incorporates stationary droplets in a stagnant ambience, and which promotes low gravity to reduce the influence of buoyant convection. Results are presented for a wide range of fuel systems that show the influence of droplet size and fuel composition on the burning rate and flame structure, as well as the unique sooting dynamics that are intrinsic to the one-dimensional droplet flame configuration.

Warren Max Rohsenow was an active member of the MIT faculty from 1946 to 1985. As a researcher, educator and leader, he made outstanding and lasting contributions to the engineering profession in general and thermal power systems in particular. His fundamental and applied research in nearly all modes of heat transfer is highly respected throughout the world and underpins many modern developments in the thermal power industry. The classroom teaching of Professor Rohsenow was noted for its strong emphasis on fundamentals and practice-oriented problems. His teaching experience began in the early 1940's at Yale University where he taught classes in thermodynamics and heat power. In 1946, he joined MIT as assistant professor of mechanical engineering, which marked the beginning of a new era for the department in the field of heat transfer. His boiling and condensation research had a lasting impact on both the theory and the practice of phase change heat transfer and its application to thermal power technology. He was a Fellow of the American Academy of Arts and Science (1956) and a member of the National Academy of Engineering (1975). An accomplished pianist, he kept a piano in his MIT office, which he would occasionally roll out into the corridor for departmental parties. In 1985 after 39 years of service, Professor Rohsenow retired from MIT. The Rohsenow Kendall Heat Transfer Laboratory at MIT is named in his honor.

Refreshments will be served before the seminar.
Please contact Tony Pulsone at pulsone@mit.edu with any questions.

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