COMBUSTION WEBINAR

When is enough *enough*? Predicting fuel properties from spectral data

Speaker: Patrick Lynch, University of Illinois at Chicago

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Biography: Patrick Lynch is an Assistant Professor of Mechanical Engineering at the University of Illinois at Chicago. He previously was a postdoctoral associate at Argonne National Laboratory and an assistant professor at the University of Michigan Dearborn. His work has focused upon the use of diagnostic tools for studying combustion and chemical kinetics with applications primarily in propulsion. Recent interests include aviation fuels, ignition, and sensing. Lynch and collaborators have developed high repetition rate shock tubes and other apparatuses for use with laser and synchrotron sourced diagnostics. He has authored more than 25 archival publications, and his research has been supported by the ACS, NSF, DOE, ARL, and AFOSR..

Abstract: Despite transitions away from liquid fuels in ground vehicle transportation, the high energy density of these fuels suggests that they will continue to be used for a while in aviation applications, perhaps with different and new blends. Understanding the properties of these fuels is important for their use, most prominently when it comes to ignition properties, which vary. The use of spectroscopy to measure jet fuels and link to a relevant ignition property like cetane number has justifiably received attention over the past several years. Increasingly sophisticated machine learning based models are used to train the response to cetane number, and these approaches provide pathways to miniaturizable sensors. In this talk, we focus upon how much data are necessary to form these models, both in terms of the spectral region/regions most likely to provide accurate prediction to cetane number as well as the range of samples needed to build confidence in these models. We will highlight recent results from the University of Illinois at Chicago which have come to focus upon the use of the fingerprint region in the spectra of real jet fuels, pure components, and surrogate mixtures exhibiting most of the chemical functional groups encountered in real fuels.

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