Combustion Webinar

Combustion Fundamentals for Burning and Making Biofuels

Speaker: Phillip Westmoreland, NCSU

Time: Sept. 25th 2021
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Zoom Meeting ID: 959 5515 8623
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Check https://sun.ae.gatech.edu/combustion-webinar for details or directly contact wenting.sun@aerospace.gatech.edu
Biography: Phil Westmoreland is Professor of Chemical and Biomolecular Engineering at North Carolina State University, working in reaction kinetics using experiment, computation, and theory. Major contributions include identifying/quantifying the pivotal role of chemically activated additions in hydrocarbon combustion, benzene formation, and fluorocarbon oxidation; establishing cellulose decomposition as being homogeneous self-catalysis; and co-creating Synchrotron-VUV-Photoionization MBMS. His degrees are NCSU (BS'73), LSU (MS'75), and MIT (PhD'86), where he worked with Jack Howard and Jack Longwell. Prior to N.C. State, he has worked at Oak Ridge National Laboratory / Union Carbide, UMass Amherst, and the U.S. National Science Foundation; was 2013 President of AIChE; and was a board member of the Combustion Institute (2002-2012). His recognitions include the ASEE Corcoran Award, AIChE's Institute Award for Excellence in Industrial Gases Technology, Combustion Institute Fellow, Lawrence Berkeley National Lab's David Shirley Award, and NSF CAREER and Director's Awards.

Abstract: Use of liquid biofuels is increasing because they have high energy densities and are potentially sustainable fuels. They are mostly oxygenated hydrocarbons, where much of the oxygen is in OH groups. Our experiments and modeling have revealed usefully strong analogies in combustion kinetics relative to hydrocarbons, although reaction networks are complicated by the wider range of intermediates and by natural stereochemical constraints.

These biofuels can be produced from woody biomass by pyrolytic processes. Our earlier coal and polymer combustion research helped lead to discovery of the reaction paths that convert woody biomass thermally. It is not by simply pulling molecules apart into radicals, but rather through homogeneous catalysis by the OH groups within the biomass, making molecular intermediates. Again, experiments and modeling have been powerful complements in making these discoveries. In the webinar, I will examine both the combustion and the pyrolysis of these materials. You can see a recent perspective on the latter topic in Current Opinions in Chemical Engineering 23 (2019) 123-9.
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