Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, March 29, 2016
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

Characterization of Renewable Fuels and Additives with the Advanced Distillation Curve Method

Thomas Bruno, *National Institute of Standards and Technology*

The analysis of complex fluids such as fuels poses significant challenges arising primarily from the multiplicity of components, the different properties of the components (polarity, polarizability, etc) and matrix properties (such as dirty fluids). Despite this, the pressure to develop alternative fuels and extenders for existing fuels makes overcoming these challenges a critical requirement. We have recently introduced fluid characterization strategy that simplifies many of these analyses, and provides the added potential of linking analytical information with physical property information. This aspect can be used to facilitate equation of state development for the complex fluids. In addition to chemical characterization, the approach provides the ability to calculate thermodynamic and transport properties for such complex heterogeneous streams. The technique is based on the advanced distillation curve (ADC) metrology, which separates a complex fluid by distillation into fractions that are sampled, and for which thermodynamically consistent temperatures are measured at atmospheric pressure. The collected sample fractions can be analyzed by any method that is appropriate. The analytical methods we have applied include gas chromatography (with flame ionization, mass spectrometric and sulfur chemiluminescence detection), thin layer chromatography, FTIR, corrosivity analysis, neutron activation analysis and cold neutron prompt gamma activation analysis. We have applied this strategy to finished fuels (gasoline, diesel fuels, aviation fuels, rocket propellants), renewable fuels, mixtures of fuels with bio-derived fuel additives, and even waste feedstocks. In this talk I will describe the essential features of the advanced distillation curve metrology, and concentrate on applications to renewable alternatives to petroleum based fuels.

Biography: Thomas J. Bruno, Ph.D. leads the Experimental Properties of Fluids Group at NIST, Boulder, Colorado. He received his B.S. in chemistry from Polytechnic Institute of Brooklyn, and his M.S. and Ph.D. in physical chemistry from Georgetown University. He has done research on properties of fuel mixtures, explosives, reacting fluids, environmental pollutants and development of novel analytical methods. In his research areas, Tom has published over 250 research papers, 7 books, and has been awarded 9 patents, and is one of the most highly cited authors at NIST. He serves as regional editor of *Fuel Processing Technology* (Elsevier) and as associate editor of the CRC Handbook of Chemistry and physics. He is the recipient of numerous awards including the Department of Commerce Bronze and Silver Medals, and the American Chemical Society Colorado Section Research Award.