Technical Highlights for April 2012

1. Technical Highlights

Fuels, Engines, and Emissions Research Center (FEERC) Researchers Participate in Office of Biomass Webinar

FEERC group leader Tim Theiss and FEERC research and development (R&D) staff member Scott Curran participated in a Department of Energy (DOE) Office of Biomass Webinar regarding DOE educational opportunities in biomass. Tim Theiss gave an overview of the various opportunities to work in bioenergy research at ORNL through internships and post-graduate opportunities. Scott Curran provided a prospective on having gone through the post-graduate program and the transition to R&D staff working on applied bioenergy research related to transportation. Other ORNL researchers gave a mentor and current student research perspective.

Oak Ridge National Laboratory (ORNL) FEERC has Strong Representation at the 2012 Society of Automotive Engineers (SAE) World Congress

A total of 19 ORNL staff members and 2 post-graduate fellows from FEERC contributed to nine technical papers, one oral-only presentation at the annual SAE meeting in Detroit, Michigan. An ORNL representative was the primary author on eight of the technical papers and the oral-only presentation. The work illustrates the breadth of the research done within FEERC, with the diverse range of topics including neutron imaging of soot filters, particle emissions from gasoline-direct injection (GDI) vehicles, aftertreatment simulations, vehicle emissions with ethanol blends, fuel effects on diesel combustion, and advanced combustion (homogeneous charge compression ignition (HCCI) and regenerative air preheating with thermochemical recuperation (RCCI)). Much of the presented work was done as part of a collaboration with industry or academia, with co-authors from the University of Wisconsin, AVL North America, Ricon Ranch Consulting, Delphi, General Motors, the University of Tennessee (UT), and Texas A&M. Four of these technical papers were selected to be included in one of the SAE International Journals. Additionally, Robert Wagner and Scott Curran acted as organizers for two technical sessions, illustrating the leadership role that FEERC has in the larger technical community.

ORNL Serves as Organizer for SAE Symposium on High Efficiency Internal Combustion Engines

Robert Wagner served as an organizer for the second SAE Symposium on High Efficiency Internal Combustion Engines. This symposium combines technology presentations with networking opportunities for professionals associated with technologies impacting fuel efficiency. The technical program included sessions on alternative engine designs, advanced combustion technologies, component level technologies and future fluids for high efficiency. The symposium was well attended with approximately 170 attendees. A summary of the meeting is available on Green Car Congress (http://www.greencarcongress.com/2012/04/saehieff1-20120423.html). Wagner is also lead organizer on an upcoming symposium on heavy duty efficiency technologies in Chicago, Illinois as well as a four-day high efficiency technology week in Tianjin, China.

Journal Article on Modeling of Fuel-Specific Thermodynamics Published in Energy & Fuels

A manuscript entitled "Analysis of the Impact of Selected fuel Thermochemical Properties on Internal Combustion Engine Efficiency" has been published in *Energy & Fuels* (currently available electronically, available in print in coming months). This modeling study evaluates how fuel-specific properties can impact First and Second Law efficiency in an ideal engine cycle. Especially noteworthy is that this article introduces a new term, the molar expansion ratio, to provide a straight-forward, first-of-its-kind physical explanation for the differences between a fuel's lower heating value (First Law energy content) and its thermodynamic potential to perform work (Second Law exergy content). The major finding of this study is that, from a thermodynamic perspective, the potential for fuel-specific efficiency improvements is relatively small because the molar expansion ratio and the ratio of specific heat tend to counteract one another. This study did not include system-specific efficiency gains that can be made possible by other fuel properties (i.e., heat of vaporization, ability to increase compression ratio, etc.).