

TECHNICAL HIGHLIGHTS for JUNE 2014

Small Quantity of Bio-Derived Hydrocarbons Characterized in a Research Engine at the Oak Ridge National Laboratory (ORNL)

A single-cylinder research engine at ORNL was used to characterize the performance and emissions of a catalytically-produced, bio-derived hydrocarbon blendstock. Approximately 1 liter of fuel sample was produced in a bench reactor experiment at ORNL by catalytically converting hydrous ethanol to hydrocarbons. Normally much larger quantities of fuel are required for engine experiments, but the single cylinder research engine used for this evaluation has two fueling systems. The engine was warmed-up with the stock fueling system and then switched to the bio-derived blendstock for only a short-duration test. The demonstrated ability to characterize the performance and emissions of small quantities of fuel is unique and is of growing importance to those seeking to produce bio-derived fuels.

Demonstration of Lean Limit Extension by Introducing Small Quantities of Oxygen to the Flame Kernel

A team of ORNL and University of Tennessee (UT) researchers were able to extend the range of stable combustion of methane-air mixtures from an equivalence ratio of 0.56 to 0.50 by metering small quantities of oxygen into the spark plug gap region. These studies were performed using a constant volume chamber and demonstrated a potential pathway to further efficiency improvements by extending range of stable lean combustion.

Flexible Multi-Cylinder Research Engine at ORNL Operates with In-Cylinder Thermochemical Recuperation (TCR) Strategy

The flexible multi-cylinder research engine designed to investigate TCR strategies at ORNL was operated with an in-cylinder reforming methodology. Engine cylinders 1–3 operated under conventional spark-ignition (SI) combustion conditions while cylinder 4 breathed in from the exhaust and exhausted into the intake system. The environment produced in cylinder 4 was very hot and oxygen deficient so that when fuel was injected into it fuel was reformed and then circulated back to cylinders 1–3. With the initial demonstration complete, there will be a series of parametric investigations to characterize the chemistry and efficiency potential of this strategy.

ORNL's Hot Weather Tips on fueleconomy.gov Featured in Numerous News Articles

ORNL maintains the www.fueleconomy.gov website for the Department of Energy (DOE) and the Environmental Protection Agency (EPA). In addition to providing EPA fuel economy estimates for every vehicle model sold since 1984, the site also provides tips to help consumers improve their personal fuel economy (FE). This month Fuels, Engines, and Emissions Research Center (FEERC) staff members John Thomas, Brian West, and Shean Huff and the ORNL team added a page on "Fuel Economy in Hot Weather." The new driving tips page generated several news articles published by CBS News, *Today*, CNBC, and others. The page gives consumer advice (backed by published studies) concerning fuel conservation in hot summer weather.

High-Level or Noteworthy Visits

ORNL/FEERC Hosts Coordinating Research Council (CRC) Meetings

FEERC recently hosted meetings of the CRC. CRC is an organization made up of representatives of the automotive manufacturers and the petroleum companies that sponsor cross-cutting research of concern to its members. The AVFL20 project committee, for which FEERC staff are performing engine-based research and development (R&D), met at the National Transportation Research Center and visited the research facilities where CRC work is ongoing. Meetings of the Advanced Vehicles/Fuels/Lubricants

Committee and the Fuels for Advanced Combustion Engine Working Group were held at the ORNL Conference Center. These meetings brought more than 25 visitors to ORNL.

Invited Talks and Presentations

FEERC Researchers Invited to the United Nations (UN) Foundation to Present High Octane Bio-Fuel Results

Dr. Derek Splitter was invited to present recent ORNL research at a June 3rd UN Foundation workshop on the “Technical and Policy Responses to the Health Risks of Ultrafine Particles and Air Toxics from Light-Vehicle Emissions.” The workshop was sponsored by the Energy Future Coalition. Dr. Splitter presented recent ORNL findings on intermediate gasoline-alcohol fuel blends with Isobutanol and E30 (renewable super premium), which highlighted the advantageous properties of high octane bio-fuels for future generation engines. The talk was attended by members of the Energy Future Coalition, policy makers from government, special interest groups, and industry. Dr. Jim Szybist was also a major contributor to the research and presentation content.

FEERC Staff Member Presents on Advanced Combustion Concepts at International Energy Agency (IEA) Meeting in Norway

Dr. Robert Wagner, Director of FEERC, presented on “Transitioning Advanced Combustion Concepts to Multi-Cylinder Engines” to at a recent IEA meeting of the 36th Task Leaders Meeting on Energy Conservation and Emissions Reduction in Combustion. The presentation was co-authored by Dr. Jim Szybist and Dr. Scott Curran, also of FEERC. This is an annual meeting and was held in Stavanger, Norway this year. More information on this IEA agreement may be found at <http://www.ieacombustion.com/>.

FEERC Staff Member Presents on the Co-optimization of Fuels and Engines

Dr. Robert Wagner of FEERC represented end-use biofuel research and presented on “Advanced Engine Development and Future Fuel Opportunities” at a recent workshop at the National Renewable Energy Laboratory (NREL) to discuss the development of a national laboratory consortium for the joint optimization of biofuels and internal combustion engines. The meeting included representatives from several national laboratories representing research for the DOE Vehicle Technologies Office (VTO) and the Bioenergy Technologies Office.

Awards

ORNL FEERC Staff Receive Outstanding Oral Presentation Award

FEERC researchers Scott Sluder, John Storey, and Scott Curran each received Society of Automotive Engineers (SAE) International’s Outstanding Oral Presentation Award for presentations they delivered at SAE’s 2014 World Congress. The award, which is based upon feedback from the meeting attendees and organizers, is intended to recognize outstanding presenters for their contribution to maintaining a high standard of quality at SAE’s technical meetings. Scott Sluder received the award for his presentation entitled “Determination of the R Factor for Fuel Economy Calculations Using Ethanol-Blended Fuels over Two Test Cycles.” John Storey’s winning presentation was entitled “Novel Characterization of GDI Engine Exhaust for Gasoline and Mid-Level Gasoline-Alcohol blends.” Scott Curran’s presentation was entitled “Reactivity Controlled Compression Ignition Drive Cycle Emissions and Fuel Economy Estimations Using Vehicle Systems Simulations with E30 and ULSD.”

Jun Qu received DOE VTO R&D Award at the Annual Merit Review

Jun Qu received “2014 DOE Vehicle Technologies Office R&D Award” in recognition of the development of novel ionic liquid engine oil additives with the potential to deliver a 2% fuel economy improvement.