

TECHNICAL HIGHLIGHTS FOR SEPTEMBER 2013

The Oak Ridge National Laboratory (ORNL) in Partnership with Industry Awarded a U.S. Department of Energy (DOE) Project on Extending the Driving Range of Electric Vehicles (EVs)

The ORNL team consisting of Tim LaClair, Zhiming Gao, Omar Abdelaziz, and Edward A. Vineyard of the Energy and Transportation Science Division is a partner with Delphi on a new U.S. DOE project for extending the driving range of EVs with a phase-change material (PCM) heating system. The objective of this project is to develop and integrate a PCM heating system for vehicles to demonstrate a significant reduction in the energy used for passenger cabin heating in EVs. Other partner members of this project include Ford Motor Company and Entropy Solutions.

A Prototype Ionic Liquid-Additized Engine Oil Demonstrated >2% Improved Fuel Economy Compared to Mobil 1 5W-30 Engine Oil

The prototype low-viscosity ionic liquid-additized engine oil, developed by an ORNL-General Motors (GM) team led by Jun Qu, has demonstrated a 2.01% improved fuel economy compared to the Mobil 1 5W-30 engine oil (3.93% over the 20W-30 baseline oil) in the standard fuel efficiency engine dynamometer tests (Sequence VID). The sequence VID tests were conducted at InterTek with two repeats on the prototype oil to confirm the efficiency improvement. This result positions ORNL as a national leader in reaching the Vehicle Technologies Office's (VTOs) goal of 2% fuel economy improvement via lubricant advances by 2015.

Fuels, Engines, and Emissions Research Center (FEERC) Researchers Use Vehicle Systems Simulations to Model Fuel Economy of Advanced Combustion Engines

A team of FEERC researchers met a high level DOE VTO milestone by demonstrating a modeled fuel economy improvement of 20% using a dual-fuel reactivity controlled compression ignition (RCCI) with E30 and diesel fuel as compared to a 2009 port fuel injected (PFI) gasoline vehicle baseline. Vehicle systems simulations were used along with engine data from dynamometer engine experiments to model the drive cycle fuel economy of a vehicle using a mixed-mode diesel RCCI strategy. Engine maps ranging from 1.8L–4.0L were obtained for 2009 PFI gasoline baselines from an original equipment manufacturer (OEM) partner. The RCCI-enabled vehicle demonstrated at least a 20% fuel economy improvement on all U.S. Federal drive cycles compared to all of the PFI engines examined.

ORNL Report, *Compatibility Study for Plastic, Elastomeric, and Metallic Fueling Infrastructure Materials Exposed to Aggressive Formulations of Isobutanol-blended Gasoline*

A research team at ORNL consisting of Mike Kass, Tim Theiss, Chris Janke, Steve Pawel, Jeff Thomson, and Harry Meyer has published a comprehensive report assessing the compatibility of fueling infrastructure materials to test fuels representing gasoline blended with isobutanol. This effort was sponsored by Butamax Advanced Biofuels, LLC. Isobutanol is being promoted as bio-derived fuel and it has several attractive attributes relative to ethanol. These include higher volumetric heating value, lower volatility, reduced water solubility, and lower polarity. The report covers a large selection of metals, elastomers, and plastics that were exposed to test fuels containing 16 and 24vol% isobutanol. A solubility analysis was performed and properties (relevant for assessing compatibility) were measured and compared to oxygen-equivalent levels of ethanol fuels. For most materials the property changes associated with isobutanol fuel blends were equivalent to, or less than, those obtained with equivalent ethanol blends. The report can be downloaded from www.osti.gov/servlets/purl/1092302/.

HIGH-LEVEL OR NOTEWORTHY VISITS

Jake Ward visits ORNL for Program Review and Tours

DOE technology manager Jake Ward from VTO visited ORNL this month. He participated in several technical discussions about past, ongoing, and future research efforts at the main campus and at the National Transportation Research Center (NTRC). While at NTRC, Jake toured the FEERC, and the Power Electronics and Electric Power Systems Center (PEEMRC).

INVITED TALKS AND PRESENTATIONS

FEERC Researchers Present Findings from Well-to-Wheel Analysis of Light-Duty Natural Gas Vehicles at DOE Advanced Engines Cross-cut Meeting

FEERC researcher Scott Curran presented findings from a recently completed ORNL study that examined the use of natural gas directly in compressed natural gas (CNG) vehicles versus using EVs that charged batteries from power generated by stationary natural gas power plants to the DOE Advanced Engines Cross-cut meeting. This monthly meeting is held at the U.S. Council for Automotive Research (USCAR) in Southfield, Michigan. Results of the study showed the sensitivity to total energy use and greenhouse gas emissions to the efficiency of the prime mover. Despite the high efficiency of EVs, low power plant efficiency was shown to bring the total energy use to that of the higher fuel economy scenarios of CNG vehicles, illustrating the need for continued focus on prime mover efficiency for both mobile and stationary power generation.

AWARDS

ORNL Staff Member Invited to serve on the Advisory Committee of the University of California's (UC-Riverside) Center for Environmental Research and Technology (CE-CERT)

Mike Kass was invited to serve on the advisory committee of the UC-Riverside CERT to guide the research program of their materials and fuels compatibility projects. The State of California has recognized the importance of the DOE compatibility studies being performed at ORNL and has initiated a similar program with the CE-CERT facility at UC-Riverside to examine material interactions with biofuels. The lead researcher at UC-Riverside, Dr. Tom Durbin, invited Dr. Kass to serve on the advisory committee to provide guidance and assistance of material selection and test methodology.

FEERC Researcher Elected Fellow of the American Institute of Chemical Engineers (AIChE)

The Energy and Transportation Science Division's Stuart Daw has been elected fellow of the AIChE. AIChE recognized Stuart for "numerous technical contributions in the fields of coal conversion, fluidization, reaction engineering, combustion, and engineering applications of nonlinear dynamics." Stuart, who is a UT-Battelle Corporate Fellow and an adjunct faculty member at the University of Tennessee, holds 15 patents and has more than 200 published papers. He is a director of the local AIChE chapter.

FEERC Researcher Receives the American Society of Mechanical Engineers (ASME) Award for Best Presentation from 2012 Internal Combustion Engine Conference (ICEF) Meeting

FEERC researcher, Scott Curran, received the award for the Best Presentation at the ASME Fall 2012 ICEF which was held in Vancouver, British Columbia, in September. The award was for a presentation on the effects of biofuels on the advanced combustion strategy known as RCCI. Only one such Best Presentation award is given out for each meeting. The award will be presented during an awards banquet at the upcoming meeting in October which will be held in Dearborn, Michigan.