Oak Ridge National Laboratory

Sustainable Transportation Update

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Bredesen Center graduates first doctorates and gains new transportation science focus

The first doctorates earned through the Bredesen Center: Vincent Kandagor and Scott Curran (standing, from left) were certified by (seated, from left) ORNL Director Thom Mason, former Tennessee Governor Phil Bredesen, and Bredesen Center Director Lee Riedinger.

ORNL researchers Scott Curran and Vincent Kandagor became the first students to earn their doctoral degrees through the Bredesen Center for Interdisciplinary Research and Graduate Education at the University of Tennessee (UT). ORNL and UT are leveraging their combined resources through the Bredesen Center in a unique education and workforce development program that brings an interdisciplinary focus to advancing energy science and engineering.

"The interdisciplinary aspect of the Bredesen Center was very attractive in terms of broadening my field of knowledge and bridging my interests in mechanical and environmental engineering," Curran said. "The link between ORNL and the University of Tennessee with the Bredesen made a lot of sense in being able to focus my doctoral research on a cutting-edge research area that I was already engaged in while being able to take classes at UT."

Kandagor previously worked with ORNL on the Artificial Retina project and contributed to ORNL materials science research while earning his new degree through the Bredesen Center.

"We're awfully proud of Scott and Vincent," said Bredesen Center Director Lee Riedinger. "They both transferred into our program once we'd started and were able to really shine, to really do some positive things."

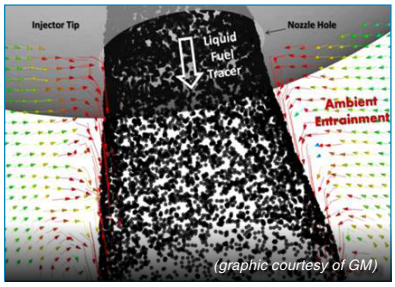
Curran focuses on pushing the efficiency limits of internal combustion engines in his position with ORNL's Fuels, Engines, and Emissions Research Center (FEERC). Curran worked with Robert Wagner, director of FEERC and joint faculty member with the Bredesen Center, to establish a new transportation science focus for the Bredesen PhD program. Wagner described the transportation thrust as providing "a multidisciplinary foundation for addressing the goals of reduced energy use and associated emissions from all aspects of transportation."

"Scott's research and accomplishments while in the Bredesen Center are an excellent example going forward of the value of a multidisciplinary approach to the complex challenges of the next generation of transportation," Wagner continued.

The Bredesen Center Energy Science and Engineering doctoral program was founded in January 2010 by former Tennessee Governor Phil Bredesen in partnership with UT and ORNL.

ORNL partners with automakers to supercharge design process

Researchers from ORNL and General Motors (GM) are working together to create an advanced method to design fuel injectors for greater fuel efficiency. Leveraging the power of ORNL's Titan supercomputer and computational tools first developed for fusion reactors, researchers are accelerating the pace of innovation.



Computer simulation shows fuel spray from a fuel injector.

"The standard design optimization process is very time- and labor-intensive," said ORNL researcher Sreekanth Pannala. "As a result, it is not possible to fully investigate the `numerous geometry and operating parameters and truly optimize the injector design for best fuel efficiency." *(see Automakers, page 3)*

Features

Vertimass licenses ORNL biofuel-to-hydrocarbon conversion technology

By Morgan McCorkle

Vertimass LLC, a California-based start-up company, has licensed ORNL technology that converts ethanol into a hydrocarbon blend-stock for use in transportation fuels.

The ORNL technology offers a new pathway to biomass-derived renewable fuels that can lower greenhouse gas (GHG) emissions and decrease US reliance on foreign sources of oil.

"Vertimass is very pleased to be partnering with ORNL to commercialize this revolutionary technology that can broaden the market for alternative fuels," said Vertimass chairman William Shopoff. "We see this technology as a significant step in moving the United States toward energy independence."

The technology, developed by ORNL's Chaitanya Narula, Brian Davison, and Associate Laboratory Director Martin Keller, uses an inexpensive zeolite catalyst to transform ethanol into hydrocarbon blend-stock. The resulting liquid is compatible with existing engine technologies and the fuel distribution infrastructure.

"This technology is a pathway to overcome the ethanol blend-wall," Narula said. "The blend-stock can be mixed into gasoline at higher concentrations than ethanol's current limit of 10%; plus, it can be added to diesel and jet fuel."

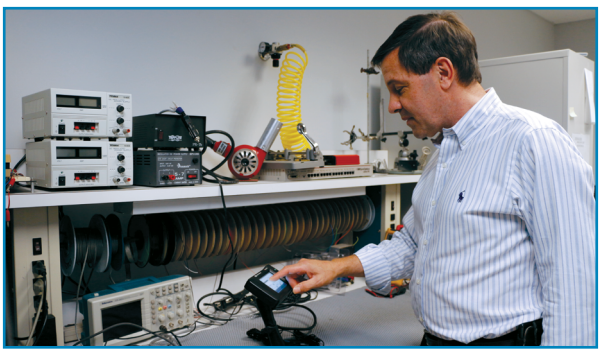
The potential impact of the newly licensed technology received coverage from the media, including Green Car Congress, Biomass Magazine, and Phys.org. Vertimass plans to move from laboratory scale to a commercially available technology within 4 to 6 years.

ORNL inventors (from left) Chaitanya Narula, Brian Davison, and Martin Keller display the technology with Vertimass chairman William Shopoff.

The ORNL research was supported by the DOE Bioenergy Technologies Office (BETO). Initial funds were from the ORNL Laboratory Directed Research and Development and Technology Innovation programs and from the BioEnergy Science Center, which is supported by the DOE Office of Science.

New system could thwart fuel tax evaders

A potential $10 billion in lost revenue each year is driving an effort by ORNL's Center for Transportation Analysis (CTA) to prevent fuel tax evasion. Researchers and partners from private industry are finalizing the custom-developed sensors, telematics, and sophisticated software that will equip fuel tankers with an integrated monitoring system that tracks fueling stops and flags suspicious activity.



Researcher Oscar Franzese works with an ISE telematics device.

The evidential reasoning system (ERS) uses CTA-developed algorithms to classify a truck's movements as normal or needing further investigation. The ERS makes these determinations in real time based on information from sensors on the tanker's hatches and valves, GPS coordinates, carrier-supplied fuel orders and routing details, and the mapped locations of fuel distribution centers. According to ORNL's Gary Capps, the system learns as it processes increasing amounts of data.

"This solution will make fuel movements transparent for carriers and auditors," said Capps.

ORNL manages the Supply Chain-Based Solution to Prevent Fuel Tax Evasion project for the Federal Highway Administration. Partners Barger Transport, Liquid Bulk Tank, Innovative Software Engineering (ISE), and Air-Weigh have been essential to the progress made to date. The project moves into the field operations phase this fall.

ORNL biofuels research gets boost from Bredesen Center fellows

Andrew Lepore recently won a competitive grant from ORNL to pursue his idea for a new catalyst technology that uses a manufacturing byproduct to convert biomass into bio-oil. Beth Papanek conducts research on microorganisms and their applications in creating biofuels. Emilio Ramirez is using his industry experience working at a California biomass combustion facility to assist in creating numerical models for biomass pyrolysis reactors.

Bredesen fellow Andrew Lepore holds a tube containing a catalytic bed that can convert ethanol into blendstock for use in transportation fuels.

These students are just a sample of the growing number of doctoral fellows who are contributing to ORNL research while earning their PhDs through UT's Bredesen Center for Interdisciplinary Research and Graduate Education. The bioenergy and biofuels emphasis is tied with nuclear energy as the most popular topic among Bredesen energy science and engineering doctorates. The biofuels focus is gaining momentum with each new class. These scholars are impacting key ORNL research funded by BETO in the areas of feedstock supply and logistics, conversion, and analysis and sustainability.

"I am excited to see so many bright students focusing their efforts on bioenergy," said Tim Theiss, manager of the lab's Bioenergy Technologies Program. "This is a win all around for UT, ORNL, BETO, and the students."

Data analysis predicts future hydrogen vehicle market

Could hydrogen light-duty vehicles gain a significant market share in the next few decades? ORNL is using sophisticated data analysis and modeling capabilities to answer this question and others as part of a Government Performance and Results Act study that evaluates the impacts of DOE programs.

ORNL researchers Zhenhong Lin and Changzheng Liu developed modeling tools to analyze the profitability and risk of clustering hydrogen refueling stations. Analysis also identified the optimal hydrogen-delivered pressure under a wide range of market and technological circumstances. Lin constructed 41 scenarios and processed them through an ORNL-developed modeling tool for the fuel cell electric vehicle study. Results show the potential for hydrogen light-duty vehicles to gain 20%–70% market share by 2050, depending on the technical targets achieved.

ORNL collaborated with the National Renewable Energy Laboratory on this project, which was funded by the DOE Vehicle Technologies and Fuel Cell Technologies Offices.

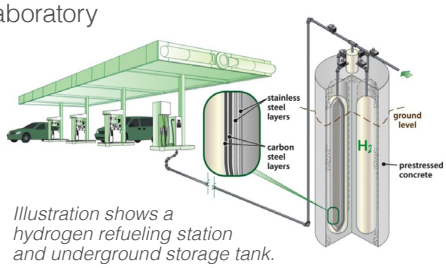


Illustration shows a hydrogen refueling station and underground storage tank.

Automakers *(continued from page 1)*

Through supercomputing, iterative designs can be evaluated autonomously and simultaneously with a wide variety of parameters, including different nozzle quantities and types and variations in pressure and temperature. This approach can reduce design development time from months to weeks.

Researchers and industry partners are using ORNL's Titan supercomputer to accelerate automotive innovation.

DOE's Advanced Scientific Computing Research Leadership Computing Challenge (ALCC) recently awarded 15 million hours on Titan for the GM project. A similar project with partner Ford Motor Company to identify combustion instability and enable advanced engine design received an ALCC award of 17.5 million hours.

These projects are part of ORNL's greater goal of creating an advanced toolset for optimizing vehicles through high performance computing (HPC). The computational frameworks developed for the fuel injector and combustion projects will be made available to the automotive industry.

In addition to the ALCC awards, the GM and Ford projects were funded by the DOE Vehicle Technologies Office (VTO) Advanced Combustion Engine R&D program with support for phase one work from the Oak Ridge Leadership Computing Facility (OLCF), which is funded by the DOE Office of Science.

Briefs

Unique wide bandgap evaluation facility benchmarks devices

ORNL's Power Electronics and Electric Machinery (PEEM) research group is putting its unique wide bandgap (WBG) evaluation facilities to work in benchmarking components used in inverters, converters, and onboard vehicle chargers. PEEM's WBG facility can autonomously evaluate any WBG device in any package for any power level. Results covering a variety of performance and efficiency metrics are available to research partners, academia, and industry through the *PEEM website* at http://peemrc.ornl.gov/Testing.shtml.

Madhu Chinthavali works with specialized WBG equipment at the PEEM laboratory.

DOE's VTO sponsors the Advanced Power Electronics and Electric Motors benchmarking program.

New standards recommended for heavy-duty trucks

Sustainable Transportation Program (STP) Director Ron Graves is a coauthor of the National Research Council report *Reducing the Fuel Consumption and Greenhouse Gas Emissions of Medium- and Heavy-Duty Vehicles, Phase Two*. Key findings include the emergence of natural gas as a transportation fuel and the need for aerodynamic devices on trailers. The report makes recommendations for developing standards that will increase fuel economy and reduce GHG emissions.

New battery research reduces production costs

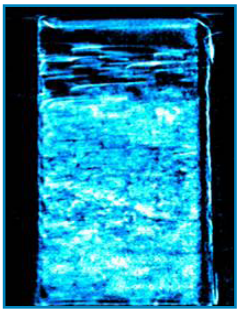
ORNL researcher Chengdu Liang and his team, with funding through DOE VTO, have developed an arsenic-substituted lithium-sulfur battery that can be produced in air for application in electric vehicles and other devices. This method can result in a significant savings in battery production costs compared with most battery chemistries, which require special handling in a controlled atmosphere. The new battery has a solid electrolyte rather than the more conventional, more flammable liquid electrolyte. "We believe solid-state batteries will be the future batteries that are energy-dense and intrinsically safe," said Liang. The study was published in *Energy and Environmental Science* 2014, 7, 1053–1058.

Researchers contribute to National Climate Assessment

ORNL researchers Tom Wilbanks, Ben Preston, Steve Fernandez, Laurence Eaton, and Virginia Dale authored sections of the third National Climate Assessment (NCA). The report points out recent trends in climate change, including an increase in extreme disturbances, and calls for reduced use of fossil fuels that contribute to atmospheric concentrations of GHGs. The NCA is produced by the 13 federal agencies that make up the US Global tChange Research Program and is written by experts drawn from academia, government, and industry.

ORNL partners with diesel manufacturers to increase engine efficiency

ORNL is collaborating with nine US diesel engine manufacturers to address an industry-wide problem in a key emission control component. Exhaust gas recirculation (EGR) coolers reduce the temperature of recirculated gases in diesel engines, increasing engine efficiency and reducing emissions of nitrogen oxides. Over time, soot and unburned fuel foul the EGR cooler and limit function. According to ORNL researcher Michael Lance, these deposits "have the thermal conductivity of Styrofoam." The result is an efficiency loss of 1%–2%, which can mean millions of gallons in wasted fuel each year across the commercial vehicle sector.



Neutron imaging reveals deposits in an EGR cooler.

Lance uses neutron tomography, microscopy, and other nondestructive methods to gain a better understanding of fouling and corrosion in EGR coolers. Researchers from FEERC contribute to the effort by characterizing the composition of soot deposits. Diesel manufacturers provide the real-world components for evaluation, and results are available to industry.

Outreach

Transportation seminars continue with high performance computing talk

Sreekanth Pannala, distinguished member of the R&D staff in ORNL's Computer Science and Mathematics Division, recently presented "High Performance Computing for Accelerating Sustainable Transportation Innovations" as part of the Transportation Science Seminar Series. The presentation included an overview of transportation challenges and the many opportunities for HPC to speed the design of highly efficient and cost-effective vehicles that meet regulatory, safety, and consumer demands.

The Transportation Science Seminar Series features the crosscutting capabilities of transportation R&D to encourage collaboration across ORNL. To recieve a copy of this presentation, please contact Kim Askey at askeyka@ornl.gov or 865-946-1861.

Sreekanth Pannala presents at the Transportation Science Seminar Series.

Next Transportation Science Seminar

"Dynamic Wireless Charging and its Effect in the Electric Vehicle Market"

Presented by Omer Onar and Zhenhong Lin

Friday, July 18, at 10 a.m.
JICS Auditorium (Building 5100, Room 128)

UT EcoCAR 2 team meets with Secretary Moniz

The UT EcoCAR 2 team met with US Secretary of Energy Ernest Moniz, UT Chancellor Jimmy Cheek, Senator Lamar Alexander, UT President Joe DiPietro, and ORNL Director Thom Mason *(pictured center to right)*. ORNL researchers Scott Curran *(back row, right)* and David Smith *(not pictured)* mentor the EcoCar team, as part of appointments at UT, along with UT's David Irick *(back row, left)*. UT recently got the green light to compete in the EcoCAR 3 challenge. Both EcoCAR competitions are sponsored by DOE.

Photo courtesy of Nick Myers, UT

ORNL-mentored high school students receive honors at Science and Engineering Fair

ORNL researcher Todd Toops mentored Oak Ridge High School students Thomas Colburn and Simon Mason as they performed research at the National Transportation Research Center (NTRC) for a science project, "Biofuel Production from Various Lignocellulosic Nuisance Species of the Southeastern United States." The students placed third overall at the recent Southern Appalachian Science and Engineering Fair (SASEF) and were recognized with a SASEF certificate of excellence and a special award from the regional chapter of the American Chemical Society for the best project in the chemical sciences. The project was submitted to the 2014 Google Science Fair, a global online science competition.

ASM hosts inaugural battery symposium

Claus Daniel, director of the DOE Battery Manufacturing R&D Facility (BMF) at ORNL, worked with the Oak Ridge Chapter of ASM International to host an educational symposium on electrochemical energy storage. The event brought together speakers from industry, academia, and national laboratories to review state-of-the-art lithium-ion batteries, the future of electrochemical energy storage at the materials and device level, and advances in characterization techniques.

Claus Daniel gives ASM symposium attendees a tour of the BMF.

Visits & Events

- Reuben Sarkar, deputy assistant secretary for transportation in the DOE Office of Energy Efficiency and Renewable Energy (EERE), visited ORNL and toured numerous facilities actively conducting cutting-edge transportation research. Sarkar also heard presentations on renewable super premium fuels; ORNL's roles in the SuperTruck DOE-industry partnerships; and HPC, with emphasis on the potential for virtual cars.

- Anant Agarwal, DOE EERE senior advisor for WBG technology, visited ORNL's PEEM laboratory and WBG evaluation facility. Agarwal also toured the Manufacturing Demonstration Facility, High Temperature Materials Laboratory, and supercomputing facility during his visit.

- Dennis Smith, DOE VTO national Clean Cities director and deployment manager, visited and reviewed ORNL's efforts in maintaining the fueleconomy.gov website, which is managed by CTA and populated with data generated through FEERC vehicle research.

- Alicia Lindauer from BETO visited ORNL and met with several teams of researchers. Lindauer is responsible for projects related to global land use change, energy security, and the use of high octane fuels in dedicated vehicles.

- Kevin Stork, DOE program manager for the VTO Fuel and Lubricant Technologies program, visited FEERC to discuss ongoing and future research at ORNL. His visit included a tour of the FEERC facilities and presentations from lead researchers within FEERC.

- Robert Wagner traveled to King Abdullah University of Science and Technology in Saudi Arabia to participate in an invitation-only workshop to discuss the forces that shape global transportation energy scenarios, engine development trends, and the implications of both for future transportation fuels.

- The Coordinating Research Council (CRC), a nonprofit organization with members from the automotive and oil industries, met at NTRC to launch the AVFL-20 project. FEERC is leading the study, which investigates "efficiency advantages for increased octane number fuel quality" potentially available from ethanol or other blend components.

- Keith Kahl and Andreas Malikopoulos participated in the 2014 Global Symposium on Connected Vehicles and Infrastructure at the University of Michigan's Transportation Research Institute. The event was paired with a DOE workshop on energy and environment benefits of automation.

- Researchers Virginia Dale and Esther Parish participated in a Knoxville climate resiliency roundtable chaired by Knoxville Mayor Madeline Rogero, who is serving as a member of the President's Task Force on Climate Preparedness and Resilience. The event was cohosted by Director of Intergovernmental Affairs and Deputy Assistant to the President David Agnew and Michael Boots, acting chair of the White House Council on Environmental Quality.

CTA director David Smith (left) shows DOE visitors Anant Agarwal (center) and Reuben Sarkar the Vehicle Systems Integration Laboratory.

Alicia Lindauer tours FEERC with ORNL researchers Jim Syzbist (left) and Brian West.

CRC members met at NTRC.

Visits & Events (cont.)

Reporter Mark Phelan interviews David Wood at the BMF.

- Mark Phelan, automotive writer for the *Detroit Free Press*, toured the facilities at NTRC and visited the OLCF and Carbon Fiber Technology Facility. He interviewed researchers on topics including lubricant additives, fuels and engines, wireless power transfer, and battery manufacturing.
- Mike Kass attended "Smithsonian Magazine's 2014 Future Is Here Festival" as a special guest of the president of Underwriters Laboratories (UL). ORNL and UL have partnered on several fuel compatibility projects.
- NTRC researchers recently hosted members of the Daimler SuperTruck team, Sandeep Singh, Heinz Oelschlegel, and Thomas Streule. An ORNL team led by Dean Edwards is supporting Daimler's SuperTruck effort in the areas of waste heat recovery and advanced combustion.
- Brian West traveled to Israel to participate in an energy dialogue with the Israel Ministry of Energy, US DOE, and US Embassy officials. West reported on his work for the DOE mid-level ethanol blends program, sharing information that Israel could use in conducting a similar program for methanol.
- Professor Huei Peng, director of the US-China Clean Energy Research Center (CERC) Clean Vehicles Consortium, presented a seminar at ORNL, "Recent Activities in Connected, Automated, and Electrified Vehicles at the University of Michigan." ORNL's partnership on the CERC Clean Vehicles Consortium is led by Robert Wagner, director of FEERC. Professor Peng's seminar was hosted by CTA's Andreas Malikopoulos.
- Diane Davidson recently gave an invited lecture on sustainable and resilient transportation systems for passenger and freight operations at the University of Illinois at Urbana-Champaign. The seminar was jointly sponsored by the university's Sustainable and Resilient Infrastructure Systems Program and the Transportation Engineering Program of the Department of Civil and Environmental Engineering.

Employee Excellence

The Minerals, Metals and Materials Society (TMS) honored ORNL researcher Phil Maziasz and coauthors with the 2014 AIME Champion H. Mathewson Award for the paper "Structure and Composition of Nanometer-Sized Nitrides in a Creep-Resistant Cast Austenitic Alloy," published in *Metall. Mater. Trans. A*, 41A, December 2010. The TMS Honors Committee and Board of Directors selected this work as best in class, representing "a notable contribution to metallurgical or materials science." The paper details the characterization of an R&D 100 award-winning alloy, CF8C-Plus, which ORNL developed in partnership with Caterpillar.

Robert Wagner, director of FEERC, will receive the ASME 2014 Internal Combustion Engine Award in October. The honor recognizes his "leadership in innovative research in the area of unstable combustion fundamentals in internal combustion engines" and his "distinctive contributions in the scaling and harmonization of low-temperature combustion processes to production-viable multicylinder engines."

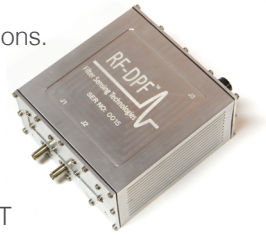
Sustainable Transporation Program wins four R&D 100 Awards

Researchers with ORNL's Sustainable Transportation Program have received four R&D 100 awards, presented by *R&D Magazine* in recognition of the year's top technological innovations.

Across the lab, ORNL won eight awards, bringing the lab's total of R&D 100 awards to 187 since their inception in 1963. Congratulations to the scientists and engineers who received 2014 awards for the following technologies:

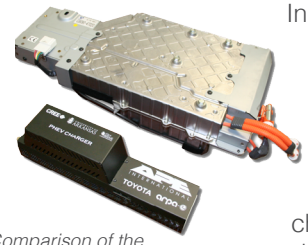
The RF-DPF™ Diesel Particulate Filter Sensor was developed by Filter Sensing Technologies, Inc. (FST) in collaboration with ORNL and Massachusetts Institute of Technology. The ORNL team consisted of James Parks II, Vitaly Prikhodko, and John Storey.

The RF-DPF™ is a radio frequency-based sensor and control system used to measure the amount, type, and distribution of contaminants on filters. This technology provides rapid real-time assessment of soot on diesel particulate filters, which allows greater precision in filter control, thereby reducing fuel consumption and GHG emissions. The RF-DPF™ can be used with light- and heavy-duty diesel vehicles and may enable longer filter life and overall system cost savings. The project was funded by FST and the DOE VTO.



High Performance Silicon Carbide-Based Plug-In Hybrid Electric Vehicle Battery Charger was jointly developed by Oak Ridge National Laboratory, Arkansas Power Electronics International, the University of Arkansas, and Toyota. The ORNL team consisted of Laura Marlino, Nance Ericson, Shane Frank, and Chuck Britton.

The new on-board battery charger technology for plug-in hybrid electric vehicles incorporates silicon carbide devices to provide 10 times the power density of current commercial charging systems, while delivering more efficient, higher power throughput for faster charging times. In addition, the charger significantly increases the vehicle's range, and the battery pack can be charged from any available single-phase AC power outlet, allowing for cheaper off-peak-hour charging while promoting a decreased dependence on expensive fossil-based fuels. The project was funded through an ARPA-e award.



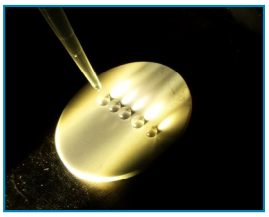
Comparison of the 2010 Toyota charger (top right) and the redesigned silicon carbide-based charger.

Ionic Liquid Anti-Wear Additives for Fuel-Efficient Engine Lubricants was developed by ORNL, General Motors Research and Development Center, Shell Global Solutions, and Lubrizol Corp. ORNL principal investigators were Jun Qu, Huimin Luo, Sheng Dai, Peter Blau, Todd Toops, Brian West, and Bruce Bunting.

The technology uses a group of ionic liquids that can be mixed with common lubricating oils to form a nanostructured protective film on bearing surfaces that effectively reduces friction and wear. This ionic lubricant technology has the potential to save the United States billions of gallons of oil each year. The research was sponsored by DOE VTO.

Super-Hydro-Tunable HiPAS Membranes were developed by ORNL. Inventors were Michael Hu, Matthew Sturgeon, Ramesh Bhave, Brian Bischoff, Tolga Aytug, and Tim Theiss.

This new class of HiPAS (High Performance Architectured Surface Selective) membranes can separate molecules in the vapor/gas phase and perform liquid-phase separations, which could be especially useful in reducing the cost of bio-ethanol, ethanol-gasoline blend fuels, and drop-in fuels from bio-oil processing. The membrane acts as an energy-efficient alternative to the distillation process by using a superhydrophobic or superhydrophillic surface to separate molecules.



A disc supports a HiPAS membrane demonstrating superhydrophobicity.

The membrane's larger pore sizes and architecture advantages drive never-before-achieved flow rates across membranes, sustaining characteristics key to repetitive or continuous operation under high pressures and temperatures. In addition to its potential in biofuel-based economies, these membranes could have a broad impact in chemical, pharmaceutical, petrochemical, and gas separation industries. This project was supported by DOE BETO and ORNL's Laboratory Directed Research and Development Program.

Researchers receive honors from DOE VTO

Congratulations to the three ORNL researchers who were recognized for their sustainable transportation projects at the DOE VTO Annual Merit Review and Peer Evaluation Meeting.

CTA's Stacy Davis received a DOE VTO Special Recognition Award for providing consistently high-quality data in the *Transportation Energy Data Book*, the *Vehicle Technologies Market Report*, and the Vehicle Technologies Fact of the Week.

Materials scientists Jun Qu and Andrew Wereszczak received DOE VTO R&D Awards. Qu was honored for developing ionic liquids as novel engine lubricants. When mixed with common lubricating oils, the ionic liquids can boost fuel economy by more than 2% compared to commercially available synthetic 5W-30 oil.

Wereszczak received recognition for his crosscutting research in materials and power electronics. One example is his development of low-cost, thermally conductive dielectric materials for power electronics applications.

In the News

- ORNL's partnership with Eagle Bend Manufacturing was featured by the *Knoxville News Sentinel* as part of an article about the Lab's focus on technology transfer and industry collaboration. The newspaper published a separate article about ORNL accelerating research and innovation for the Tennessee automotive industry.

- Brian West, John Thomas, and Shean Huff quantified the fuel economy costs of common practices like driving with the windows down and carrying rooftop cargo for driving tips on fueleconomy.gov. The study garnered regional and national media coverage including Green Car Congress, Science Codex, CBS MoneyWatch, and numerous TV affiliates and newspapers.

Researchers evaluated the fuel efficiency of several vehicles with rooftop cargo carriers.

- Researcher Sujit Das analyzed the total fuel economy benefits of new aluminum vehicles and confirmed they offer the smallest total carbon footprint among competing materials. His work was featured in Digital Journal and other media outlets.

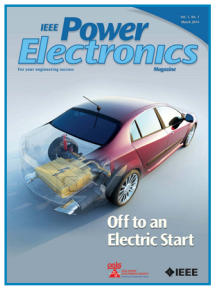
- *SAE Automotive Engineering* magazine published an article about a new ORNL microscopy method that allows researchers to image and measure electrochemical processes in batteries in real time and at nanoscale resolution. The same edition featured Ron Graves and research from FEERC in an overview of challenges associated with future development of alternative fuels. To view these articles, subscribe at www.sae.org.

- The Daily Times published an article about ORNL's cooperative research agreement with DOE, Chrysler, and Nemak of Mexico to develop a new high strength cast aluminum alloy for use in manufacturing engine heads.

- DOE Pulse featured researcher Omer Onar of the PEEM group. Onar and his team developed the world's first dynamic wireless charging system with coils.

- *Green Car Congress* featured two ORNL projects recently. Researchers Jim Szybist, Derek Splitter, Josh Pihl, Vickey Kalaskar, and Stuart Daw are pursuing in-cylinder reforming for control of advanced combustion. Researcher Andreas Malikopoulos completed a comprehensive survey of major control algorithms for hybrid and plug-in hybrid electric vehicles that suggests a future need to consider the vehicle as part of a larger system that can be optimized.

- The first edition of IEEE Power Electronics Magazine featured an extensive article on ORNL's dynamic wireless power transfer technology by John Miller, Omer Onar, Cliff White, Steven Campbell, Chester Coomer, Larry Seiber, Raymond Sepe, and Anton Steyerl.



- CTA's "Can a Hybrid Save Me Money?" calculator was featured on The White House Blog describing tools you can use to increase energy efficiency.

New patents issued for STP technologies

Four new ORNL-developed technologies recently received patents. Congratulations to all of the researchers involved in the following innovations.

Microwave-Assisted Plasma-Processing of Carbon Fiber

US patent 8,679,592 B2.

Researchers Terry White, Felix Paulauskas, and Timothy Bigelow have developed a method for continuously carbonizing materials to produce carbon fiber using microwave-assisted plasma (MAP). MAP conversion technology can reduce the manufactured cost of carbon fiber and the energy required to produce it by cutting conversion time by one-third to one-half compared to conventional methods. Carbon fiber produced through the MAP process can be used in transportation, wind energy, infrastructure, and oil drilling applications. Research for this project was funded by DOE VTO.

Atmospheric Carbon Fiber Surface Treatment

US patent 8,741,395 B2.

ORNL researcher Felix Paulauskas collaborated with Remaxco Technologies, LLC, to patent a new apparatus and process for carbon fiber composite production that allows carbon fibers to be exposed to plasma heat processing at or near atmospheric pressure. This new technology eliminates the need for vacuum equipment usually required for plasma-assisted surface treatment of carbon fiber, resulting in reduced equipment and energy costs. Research for this project was funded by DOE VTO.

Lithium Sulfide Compositions

US patent 8,597,838 B2.

Chengdu Liang and a team of researchers at ORNL have patented a new technology for lithium sulfide batteries that provides a solution-based approach for the synthesis of sulfide-based solid electrolytes and the application of these solid electrolytes as coatings on cathode materials. Used mainly for solid-state batteries, this technology offers greater energy density and safer operation than conventional batteries. For conventional batteries, the new coating works as a protective layer on the electrodes. Research for this project was funded by DOE VTO.

Lithium-Ion and Lithium-Air Batteries

US patent 8,722,256 B2.

ORNL researchers Chaitanya Narula, Jagjit Nanda, Brian Bischoff, and Ramesh Bhave patented a new integrated approach for making lithium-ion and lithium-air batteries where the cathode, anode, and electrically insulating separator can be formed as a single unit using a layer-by-layer approach. Unique aspects of this invention include control of the porosities of the individual electrodes and separator layers, creation of a gradient porosity across the thicknesses, and chemical bonding of the separator materials on both sides of the electrodes. Research for this project was funded by ORNL.

Do you have news or information you would like to share?

Please submit to Kim Askey,
ORNL Sustainable Transportation Program Office
(865) 946-1861 or askeyka@ornl.gov

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