Science & Technology HIGHLIGHTS

Published by Oak Ridge National Laboratory's EERE and OE Programs

No. 2 2006

Carbon Fiber Research Facilities Dedicated

ORNL and its industrial partners are making steady progress in developing more affordable ways to produce carbon fiber and process it into composite materials. New equipment installed in late 2006 provided the missing pieces for a suite of facilities at ORNL to test fiber and composite manufacturing processes developed at the Lab.

The full set of equipment in ORNL's low-cost carbon fiber processing and manufacturing research facilities includes a new melt-spinning setup; a robotic preforming machine; the test machine for automotive crashworthiness (TMAC), which analyzes how composite parts respond to crushing; a slurry former; a mold press; and a pilot-scale carbon fiber conversion line.

The equipment collection illustrates the "vertical integration" of research and applied technology to speed the commercialization of cost-effective carbon fiber and composite material production methods. The objective is to demonstrate and transfer improved technologies to producers of carbon fiber and composites.

Carbon composites (carbon fibers in a resin base) are as strong as steel but weigh 50% less, making them ideal structural materials for vehicles. Unfortunately, they cost much more than steel, largely because of the high cost of carbon fiber. The price point at which vehicle manufacturers could use large amounts of carbon fiber in vehicles is $3–5 per pound; commercial-grade carbon fiber is currently $8–15 per pound. ORNL researchers expect commercialization of the technologies they are developing to shave several dollars from that price.

The cost of precursor materials for carbon fiber accounts for 27–50% of its price. ORNL has developed the baseline technology to use lignin, an inexpensive byproduct of paper making, as a feedstock for carbon fiber. A key challenge is purifying the lignin to an acceptable level and spinning it into a suitable fiber. ORNL, Pacific Northwest National Laboratory, and MeadWestvaco are developing a commercially viable purification process. ORNL's new melt-spinner is being used to establish process conditions for melt-spinning of lignin fiber tows. In 2007, the spinning operation will be scaled up to produce lignin-based carbon fiber for composite testing.

Equipment in ORNL's carbon fiber research facilities includes a robotic preforming machine, a melt-spinning setup, and the TMAC crusher.

Converting spun fibers into finished carbon fibers requires four heat-treatment steps— stabilization, oxidation, carbonization, and graphitization. ORNL and Atmospheric Glow Technologies are developing atmospheric pressure plasma processing methods to oxidize fibers quickly and cost-effectively. A pilot unit has cut processing time to less than half that of conventional oxidation. A line speed of 6 in./min has been demonstrated, and researchers hope to increase that speed by 5 to 10 times, which would reduce estimated production costs by over $1 per pound.

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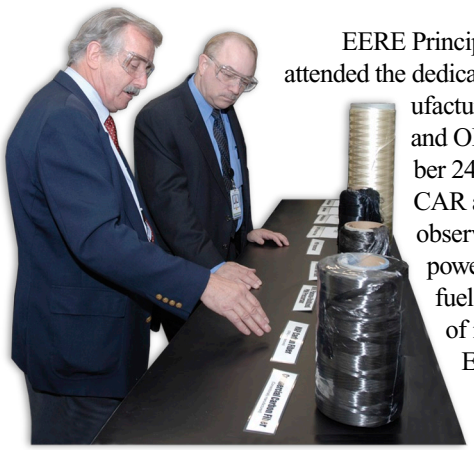
DOE EERE's Mizroch Tours ORNL Facilities



EERE Principal Deputy Assistant Secretary John Mizroch attended the dedication of ORNL's low-cost carbon fiber manufacturing and testing facilities and toured EERE and OE projects during a visit to the Lab on October 24. Mizroch and Ed Wall (Office of FreedomCAR and Vehicle Technologies Program manager) observed FreedomCAR-funded technologies in power electronics and electric machinery and in fuels, engines, and emissions. Representatives of industrial partners SemiSouth and Cummins Engine also participated in the tour.

Mizroch toured near-zero energy homes in Lenoir City, Tennessee, and was shown the effort to develop affordable houses that produce as much energy as they consume over a year. He also toured the Buildings Technology Center and overviewed research in biomass technologies, hydrogen, and energy and water. The High Temperature Materials Laboratory, Industrial Technologies program facilities, and hybrid solar lighting laboratory were also on the tour. Industrial partners were included in all the tour stops.

Fred Baker and John Mizroch at the lignin melt-spinner looking at spools of various carbon fibers.

Ultrathin MIST Coatings

Spark plugs, catalytic filters, and fuel cells will benefit from the same new technology that lengthens the lifespan of industrial tools. Metal infusion surface treatment (MIST), a metal coating technology developed by C3 International in conjunction with ORNL, received an R&D 100 award recently for introducing a technique that allows coatings to be applied to surfaces by dipping or spraying them with a patented fluid. The coatings are then thermally treated at temperatures of not more than 450ºF, producing an extremely thin protective coating that is anchored to the substrate at the molecular level.

Cutting tool inserts and die-casting molds and accessories are two of the most cost-effective applications of this technology to date. MIST has outperformed conventional coatings by 10 times for cutting tool inserts and by 40 times for aluminum die-casting tools and accessories. This technique for extending tool life is being put to use successfully in several industries, including steel, aluminum, and food packaging, and in special automotive applications.

MIST also offers several potential automotive applications that can increase U.S. fuel economy, ranging from improved spark plugs and catalytic filters to more efficient fuel cells. Testing of cerium-oxide–based coatings on the ceramic insulators of spark plugs demonstrated that MIST-treated plugs lasted three times as long as uncoated spark plugs. Catalytic filters treated with MIST catalytic coatings can burn carbon at lower temperatures without clogging the filters. In fuel cells, the ceramic electrodes can be coated with several nanometer-thick layers of electrolyte film, which is an order of magnitude thinner than is now commercially possible. MIST could enable the manufacture of a much thinner electrolyte that can convert energy more efficiently.

MIST nanocoatings extend the life of cutting and casting tools.

For more information about MIST, see www.cccintl.com.

Contact: Craig Blue, 865-574-4351, blueca@ornl.gov

Sponsors: DOE/EERE Industrial Technologies and FreedomCAR and Vehicle Technologies

Designer Stainless Steels Can Take the Heat

Two new types of stainless steel developed by ORNL researchers—TMA 6301 and TMA 4701—can take more heat and therefore operate more efficiently than other stainless steels. Preliminary estimates show that the new alloys could save as much as 15 trillion Btu/year of energy when used in potential applications in the chemical, steel, and heat-treating industries, with corresponding cost savings of over $60 million/year.

These two heat-resistant steels were developed using a computer-aided design methodology that assisted the researchers in their quest for materials with improved durability and higher maximum operating temperatures. This technology, which won an R&D 100 Award in 2006, is the first known instance of the successful application of computer-aided methodology to the design of new heat-resistant cast austenitic stainless steels, resulting in steels with superior creep rupture life at higher operating temperatures.

TMA steels operate at higher temperatures and maximize efficiency in industrial processes.

The availability of the new materials is a boon in addressing today's energy costs. Natural gas prices have increased dramatically in recent years, forcing industrial users to demand the highest energy efficiencies in process operation. The improved properties of both TMA steels will enable operators to use higher operating temperatures (50°C higher) in industrial processes with no increase in materials cost, while maximizing process efficiency without sacrificing component life. The result will be significant energy and cost savings.

The computational microstructure design methodology used by the ORNL team to develop the TMA steels enables more efficient sampling of composition space, reducing the time required to develop new alloys to about 3 years instead of the 6 to 10 years typically required by traditional trial-and-error methods. The new alloys have about 3 to 5 times the creep rupture strength of existing competitor alloys at high temperatures, comparable to alloys that are significantly more expensive than the TMA steels. The new alloys have many potential applications in energy-intensive industrial processes.

Contact: Govindarajan Muralidharan, 865-574-4281, muralidhargn@ornl.gov

Sponsor: DOE/EERE Industrial Technologies

Characterizing Nanoparticles in Real Time

Industry groups that provide input to the National Nanotechnology Initiative have identified the capability to characterize materials smaller than 50 nanometers in real time, during production, as a key R&D need for accelerating commercialization of nanotechnology.

In response to that challenge, researchers at ORNL developed a unique method of measuring the real-time distribution of inorganic and carbon-based nanoparticles in two types of synthetic processes. The technique works at varying temperatures, feed rates, and positions within a system. The characterization technique was developed by a multidisciplinary team of researchers working under the MPLUS (Metals-Processing Laboratory User Facility) activity.

According to the industry experts, conventional methods of characterizing nanoparticles are either insufficiently accurate or unsuitable for in-plant operation. Consequently, operators often are unable to monitor and control production processes for nanoscale materials and thus unable to control variations in product quality.

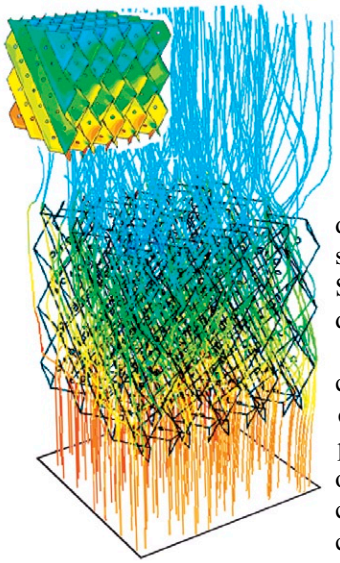
The ORNL team used a commercial differential mobility analyzer to sample and characterize in real time the nanoparticles produced in two different types of gas-phase processes: chemical vapor deposition for producing metal-oxide particles and laser ablation for synthesizing carbon nanomaterials. The analyzer employs the deflection of charged particles in an electric field to segregate particles in a gas stream by electrical mobility size.

Various process parameters were investigated, including precursor feed rate and furnace temperature, and the analyzer was used to observe their impact on the size distribution of the nanoparticles produced. The results of the analysis for particles below 50 nm were consistent with results from microscopic analysis. The potential capability of the analyzer to provide real-time data on the variation of the particle size distribution was demonstrated. The results indicate promising opportunities for rapid detection of process transients and for use of the instrument in process development.

Contact: David DePaoli, 865-574-6817, depaolidw@ornl.gov

Sponsor: DOE/EERE Industrial Technologies

Mengdawn Cheng and Emory Ford with differential mobility analyzer.



Flow paths through packing elements as modeled by GraSPI.

GraSPI Saves Energy, Cuts Emissions

DOE estimates potential savings of 53 trillion Btu/year in the petroleum industry from adoption of improved columns for distillation flow. A new tool for realizing these savings is the innovative software Graphical Structured Packing Interface (GraSPI), developed at ORNL.

Industrial distillation of crude oil and chemicals is typically performed in large, vertical distillation columns, which separate compounds by relative volatility. The performance of these processes depends on the efficient contacting of gas and liquid phases that flow countercurrently through the columns. The design of structured packings that are used to direct the gas and liquid flows is a significant opportunity for efficiency improvement and is a topic of industrial attention.

The GraSPI software improves the geometric modeling of distillation flow simulations. Better modeling enables improved distillation column design, leading to purer products, energy savings, and decreased emissions. GraSPI software is a plug-in for GAMBIT, a preprocessor used with the computational fluid dynamics code Fluent.

Contact: Sharon Robinson, 865-574-6779, robinsonsm@ornl.gov

Sponsor: DOE/EERE Industrial Technologies

Wamp at Nano Conference

Congressman Zach Wamp (R-TN) was among participants in a recent conference held in Oak Ridge, "The Next Industrial Revolution: Nanotechnology and Manufacturing." Wamp was the speaker at a reception, addressing the grand vision of nanotechnology. He was given a demonstration of ORNL's new superhydrophobic materials and briefed about ORNL capabilities in high-temperature superconducting wires; nano-strengthened alloys; nanofermentation; prosthetics; and materials and processes for energy production, storage, and conversion.

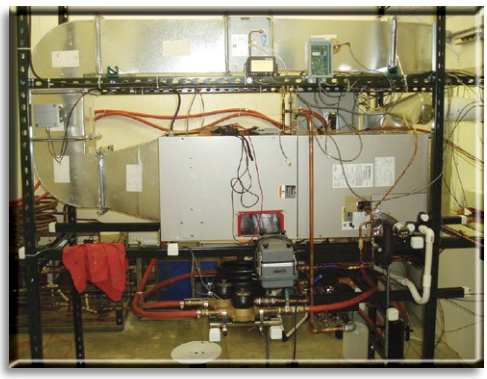
The 2-day Society of Manufacturing Engineers conference highlighted current, near-term, and future applications of nanotechnology and how it is transforming manufacturing with innovative top-down fabrication and bottom-up assembly techniques.

An Integrated Heat Pump for Zero Energy Homes

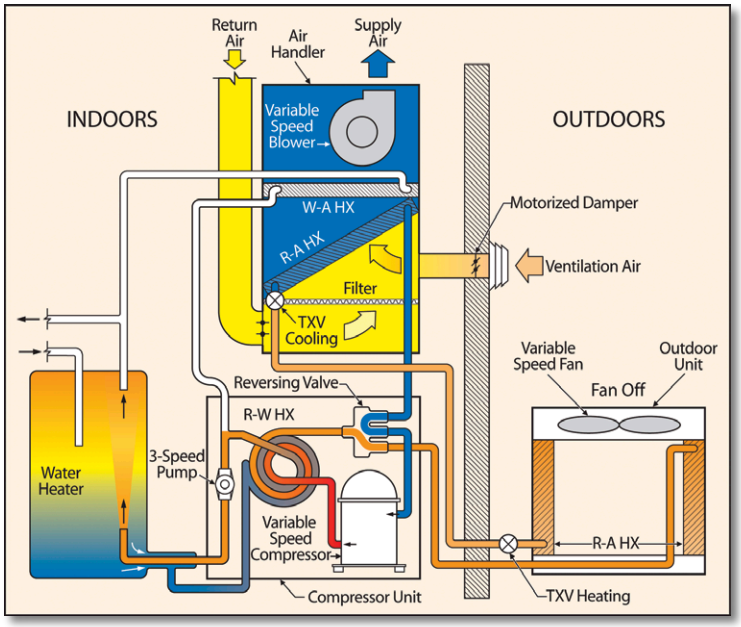
ORNL is developing equipment for zero energy homes (ZEHs) that will use at least 50% less energy than the equipment currently installed in new homes. (A ZEH is a home that, over the course of a year, produces as much electricity as it consumes.)

DOE's goal is to have ZEHs available to home buyers by 2020. Researchers at ORNL consider the development of an integrated heat pump (IHP) to be the most promising option for achieving the equipment energy savings that are necessary to reaching that goal. In comparison studies conducted in the mixed-humid climate zone (represented by Atlanta), it was estimated that the best available electric equipment could reduce energy use by only 17%, while the IHP could reduce it by 50%. Heating, cooling, and water heating are the main energy functions designers must account for in ZEHs, but they must also provide for ventilation and dehumidification.

The IHP's energy savings come primarily from hot water provided at heat pump efficiencies. Water heating efficiencies are extremely high at times when waste heat from another end use, such as cooling, is available. The IHP also benefits from the use of variable-speed components whose operating rates can be adjusted to meet current loads efficiently. Separate pieces of redundant equipment are eliminated, enabling the use of higher-cost but more effective components. The design is also facilitated by the availability of mass-produced, reasonably priced components such as brushless permanent magnet motors for compressors and fans, very small yet efficient modulating compressors, and bi-directional stepper motor refrigerant controls.



A laboratory prototype IHP unit already has been developed and tested at ORNL.



IHP schematic showing air, water, and refrigerant flow for simultaneous space cooling and water heating.

ORNL's research goal is to demonstrate the feasibility of this approach so that private industry will take over the development of IHPs for the domestic housing market. A manually operated laboratory prototype IHP unit already has been developed and tested at ORNL.

Work to improve and refine the IHP design continues, with the target of issuing a request for proposals either late in FY 2007 or early in FY 2008 to engage a commercial manufacturer to build a prototype for field testing.

Contact: Rick Murphy, 865-576-7772, murphyrw@ornl.gov

Sponsor: DOE/EERE Building Technologies

"Revolution" in Air Quality at Georgia Schools

Several hundred Georgia students are breathing easier each school day thanks to an integrated air-conditioning and dehumidification system developed by researchers at ORNL and SEMCO, Inc.

The SEMCO Revolution™—a rooftop air conditioner that can independently control humidity and temperature while delivering any specified percentage of outdoor air into commercial and institutional buildings—was installed at Marietta's Timber Ridge Elementary School in response to years of problems and complaints related to the building's indoor humidity. The system, which received an R&D 100 Award in 2005, now successfully controls the school's humidity, temperature, and air quality at reduced costs.

Compared with conventional air-conditioning hardware packages, the Revolution is more compact, cost-effective, and energy-efficient. Its flexibility allows operators to easily comply with building ventilation codes and maintain specific indoor humidity levels, helping to control mold and mildew that can cause long-term health and indoor air quality issues.

At Timber Ridge Elementary, effective control of space humidity by the system allows students and teachers to be comfortable at higher thermostat settings, resulting in energy savings. It also greatly reduces the chances of mold and mildew growth within ductwork, ceiling tiles, carpeting, and classrooms. The adequate amount of outdoor ventilation air also ensures low CO_2 levels during periods of high

building occupancy. And, in general, students and staff experience greater comfort and better air quality as a result of the installation of the system, resulting in an improved learning environment.

Several SEMCO integrated active desiccant rooftop (IADR) systems also are being installed in the 1,500-student Pepperell High School being constructed in Floyd County near Rome, Georgia. In an ORNL cost-shared project, four of the IADR systems will use electric power and waste heat provided by a 200-kW reciprocating generator to operate at significantly higher efficiencies than the retrofitted system at Timber Ridge.

Contact: Patricia Garland, 202-479-0292, garlandpw@ornl.gov

Sponsor: DOE/OE Distributed Energy

Hoffman Visits ORNL OE Projects

Patricia Hoffman, DOE-OE deputy director for R&D, toured ORNL OE projects in a recent visit to the Lab. She toured the EVEREST visualization facility in the Center for Computational Sciences, the Distributed Energy Communications and Control facility, and the Power Electronics and Electric Machines Research Center. ORNL staff presented information on load as a resource, superhydrophobic materials, plug-in hybrids, and ORNL's work with the Athens utility board. Hoffman was briefed on FY 2006 accomplishments and planned activities of the ORNL High-Temperature Superconductivity Program. She toured the rolling and materials processing facilities; labs for accelerated coated conductor research, cryogenic dielectric high-voltage testing, and applied superconductivity; and the cable test facility.

Pat Hoffman (L) and ORNL's Don Adams tour the power electronics lab.

CHP Systems Come Online in DOE-Industry Collaboration

Three institutions—two medical centers and a school—recently deployed cooling, heating, and power (CHP) systems as part of a cooperative DOE–industry effort to promote the use of these energy-saving systems in the public sector. ORNL engineers worked with industry partners in designing, developing, and testing the integrated energy systems, which generate power for use on site while they provide cooling and heating.

Eastern Maine Medical Center. In October 2006, a CHP system began full-time operation at the Eastern Main Medical Center in Bangor. This competitively solicited project was funded, in part, by the former Office of Distributed Energy. The $8.6 million system took about a year to construct and consists of a 4.6-MW Solar dual-fuel turbine, a 24,000 lb/h heat recovery steam generator, and a 500-ton, steam-driven absorption chiller. The CHP plant provides most of the electricity for the hospital and operates 24/7. Black-start capability allows it to support the hospital's energy needs even if the grid is down. This new system is expected to save the hospital approximately $700,000/year in energy costs.

Top: Rendering of Dell Children's Medical Center; center: Eastern Maine Medical Center; bottom: East Hartford High School.

East Hartford High School. In September 2006, East Hartford High School in Connecticut began generating its own electricity, heating, and cooling. The new UTC Power PureComfort™ system generates 240 kW of electricity and 120 tons of cooling. Waste heat from the system provides chilled water for air-conditioning in summer or heating in winter; thus, the system can achieve energy efficiencies greater than 80%, far greater than the 33% typical of a central power plant. The system also provides back-up power in the event of an emergency, allowing the school to qualify as an emergency shelter.

Dell Children's Medical Center. October 2006 marked the completion of a CHP system at Dell Children's Medical Center in Austin, Texas. The 4.3-MW, low-emission energy system will supply power, cooling, and steam with over 70% efficiency. Dell is one of the first hospitals in Texas to meet all its own energy requirements, and this on-site energy system ensures full operation even during a power outage. The advanced turbine technology will reduce nitrous oxide emissions to less than 5 ppm, meeting the very stringent Texas emission standards. The Center has been awarded an EnergyStar™ CHP Certificate of Recognition.

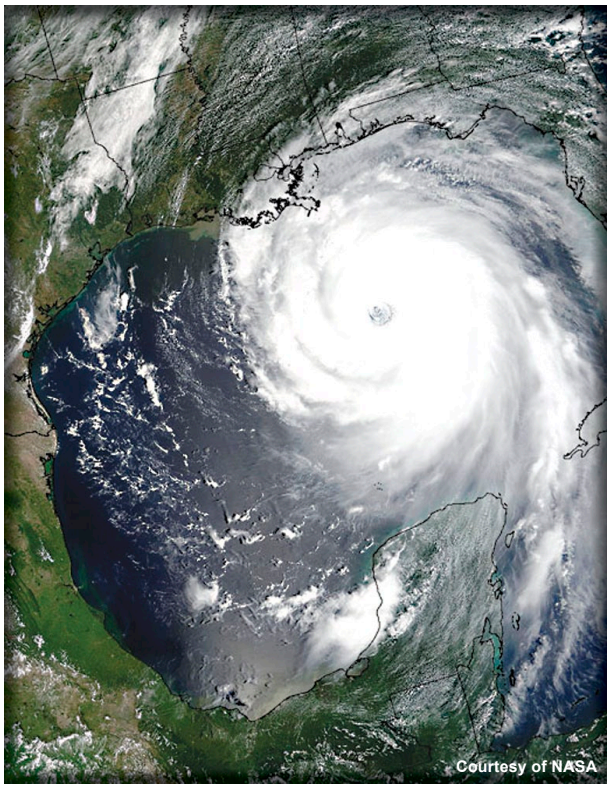
Contact: Patricia Garland, 202-479-0292, garlandpw@ornl.gov

Sponsor: DOE/OE Distributed Energy

Monitoring the Electric Grid during Hurricane Season

Hurricane Katrina nearly wiped out gasoline supplies to the northeastern United States because of lack of electrical power at several pipeline-pumping stations. The electric grid was restored with only a day to spare before that potential catastrophe became a reality. Katrina and other storms of recent hurricane seasons showed the need to more closely monitor the electrical transmission network. Because electricity is critical to other energy infrastructures, a real-time assessment of the status of major transmission lines is essential.

ORNL and the Tennessee Valley Authority (TVA) are working with the DOE Office of Electricity Delivery and Energy Reliability (OE) on an effort that will help to characterize the status of the electric transmission system infrastructure. The real-time, wide-area visualization of transmission line status across the Southeast will assist both transmission operators and government officials in determining the damage resulting from hurricanes. The visualization tools can also help in coordinating emergency personnel to enable them to respond rapidly to catastrophic events. This is the first time the electric grid from such a large region has been monitored in real time.



Katrina, a category 5 hurricane, churns toward the Louisiana and Mississippi coasts in August 2005. The storm wiped out power in some areas for weeks.

During a hurricane, individual utilities in the storm path will continue to use standard supervisory control and data acquisition systems to monitor and control their own networks. Now, however, a network is available to compile and share real-time information from these individual utilities with an area encompassing a large swath of the southeastern United States. This system, provided by the Interregional Security Network (ISN), is a private network operated by the utility industry. TVA acts as the host utility, and its existing communication and computing infrastructure gathers the information from the ISN. To gain a complete view of the storm's impact across affected utility systems, each utility is automatically queried to compile a status list of its high-voltage transmission lines.

This effort focuses on the big picture— monitoring transmission lines with a voltage rating of 230 kV and above. The bimodal status of these high-power transmission lines is monitored minute by minute. If the flow is less than its predetermined value, the line status is considered abnormal, indicating that the line could be operating with a very low power flow. The monitoring system also examines itself and indicates when a data communication failure may have occurred or when an updated status has not been obtained by the system.

A graphical representation of the transmission system is created using PowerWorld Retriever—an application used in some utility control centers around the country for daily operation. ORNL makes available the graphical representation (i.e., graphic file format) and a data table of the transmission line status on a private, secure web server, which is updated every 4 minutes.

Two visualization applications display the real-time electric grid and line status. The first is a custom graphical tool that combines the transmission line status information with the geospatial data of the weather, population, and transportation infrastructure. This application can animate the movement of a hurricane, showing its position and path relative to the transmission lines. The second visualization tool uses a commercial product, Google Earth, with the addition of two custom libraries to describe the electrical transmission network in the eastern United States and the status of each transmission line. These tools enhance knowledge of the health of the transmission grid. Weather, transportation, and other infrastructure layers can be added to enhance the capability for multipurpose analysis.

A large portion of the Southeast has already been captured by the system—Mississippi, Alabama, Louisiana, Georgia, and northeast Florida. Negotiations are under way to gather information from utilities in North and South Carolina to complete an initial target set of susceptible areas. This effort supplements the work of the Visualization and Modeling Workgroup created by OE to enhance modeling, analysis, and visualization for energy emergencies.

Contact: Tom King, 865-241-5756, kingtjjr@ornl.gov; John Stovall, 865-574-5198, stovalljp@ornl.gov

Sponsor: DOE/OE Visualization and Controls

S&T Highlights is a communication of Oak Ridge National Laboratory's *Energy Efficiency and Renewable Energy (EERE), and Electricity Delivery and Energy Reliability (OE) Programs*

Web sites: **www.ornl.gov/eere** and **www.ornl.gov/etd**
Managing editors: Robert Hawsey and Penny Humphreys
Technical editors/writers: Deborah Counce and Jeanne Dole
Designer: Jane Parrott

Your comments are invited and should be addressed to Penny Humphreys, ORNL, humphreyspm@ornl.gov, 865-241-4292; fax 865-576-7572

Oak Ridge National Laboratory is operated by UT-Battelle for the U.S. Department of Energy under contract DE-AC05-00OR22725.

OAK RIDGE NATIONAL LABORATORY
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Regional Partnerships Promote Transition to Bioenergy

ORNL hosted a Tennessee Bioenergy Summit in October to plan for transitioning the state from a hydrocarbon economy to a partial carbohydrate economy. Its purpose was to develop a path for Tennessee to become an industry leader in producing and converting lignocellulosic-based liquid fuels.

Tennessee's strengths include its research facilities and the diversity of bioenergy crops that can be grown in the state: corn, soybeans, hybrid poplar trees, and switchgrass. A poll shows 60% of Tennessee farmers would switch to growing switchgrass if a reliable market existed. Timothy Rials of the University of Tennessee offered a vision of more than 15,000 Tennessee farmers earning $50 million annually growing energy for sale to local biorefineries that would sell 600 million gallons of cellulosic ethanol and provide thousands of rural jobs.

Bringing trees to a chipper in a demonstration of biomass harvesting.

Udaya Kalluri of ORNL checks hybrid poplars growing in a greenhouse.

Tennessee Gov. Phil Bredesen issued a news release in conjunction with the summit calling for increasing biofuel availability at 70 retail fuel stations and using low-interest loans to help establish agricultural feedstock processing facilities to attract local fuel production plants.

Mark Downing of ORNL, who led the summit, noted Tennessee's partnerships in the agriculture, energy, environmental, and research sectors will be needed to make it a leader in the bioenergy industry. "Science is the key," he said, "but communication, education and outreach, policy changes, and validation of biomass technologies are also required to make this vision a reality."

Regional and state workshops are being held as part of a Biomass Initiative announced in President Bush's 2006 State of the Union Address. DOE, the Department of Agriculture, the Sun Grant Initiative, and other energy organizations will help to develop regional biomass energy feedstock partnerships to identify local opportunities for feedstock and ethanol production.

The Southeast Regional Feedstock Partnership held its first regional workshop in May in Knoxville, Tennessee. It consists of members from 13 states and territories and from state and federal agencies, environmental organizations, industry, academia, and organizations with farming and forestry interests. Its goal is to facilitate the development of biomass resources in the Southeast. For more information, see http://bioenergy.ornl.gov

Contact: Mark Downing, 865-576-8140, downingme@ornl.gov

Sponsor: DOE/EERE Biomass Program

UT-Battelle, Schrader Sign MOU

Officials of DOE, UT-Battelle, and Schrader Trucking Company of Jefferson City, Tennessee, signed a memorandum of understanding (MOU) in October that will allow ORNL to collect performance data on Schrader's long-haul trucks for a year in an effort to improve fuel economy and safety in the trucking industry.

The MOU is part of ORNL's heavy-vehicle duty cycle project, an effort to collect and analyze data related to heavy-truck operation in real-world highway environments. Dana Corporation and Michelin Tire are also partners in the project.

ORNL researchers equipped six Schrader tractors and nine trailers with instruments to gather data on operating parameters while the trucks make their regular routes.

From left, Gary Capps and Oscar Franzese, ORNL, Joe Petrolino, NTRC, Inc., and Pedro Otaduy, ORNL, examine instrumentation on a Schrader truck.

Facilities continued from p.1

ORNL and its partners are researching ultraviolet and radiation processing techniques to stabilize or cross-link precursor fibers, microwave-assisted plasma processing for carbonization and graphitization, and plasma-based surface treatment to improve fiber-resin bonding. The pilot-scale carbon fiber conversion line will be used to evaluate these new processes on a comparable basis against conventional industrial processes.

They also are developing techniques for high-volume, cost-effective processing of carbon fiber, hybrid glass-carbon fiber, and reinforced thermoplastic material forms. The preforming machine supports this effort. Its robotic arm chops and sprays fiber and a binder to create a fiber mat called a preform. After the binder is set, the preform is injected with resin in a mold and consolidated under pressure to create the final part. Total process time is about 2 minutes, compared with many hours for labor-intensive conventional methods. Preforming is the first step in creating actual composite auto parts.

ORNL's focus is on developing efficient processes that increase production rates, reduce capital and processing costs, and save energy to spur increased use of carbon composite materials in vehicles. The ultimate goal is lighter vehicles that use less energy and produce less harmful emissions without sacrificing safety.

Contact: Bob Norris, 865-576-1179, norrisrejr@ornl.gov

Sponsor: DOE/EERE FreedomCAR and Vehicle Technologies

News Briefs

FLC Awards for EERE Projects

Two technologies sponsored by DOE EERE earned Excellence in Technology Transfer Awards recently from the Southeast Region of the Federal Laboratory Consortium for Technology Transfer.

The two winners are hybrid solar lighting and a computer-design methodology to produce steel alloys. Hybrid solar lighting uses roof-mounted solar collectors and fiber optic cables to transfer sunlight to solar-electric lighting fixtures that illuminate building interiors. TMA 6301 and 4701 are highly durable, heat-resistant steels developed using computer-aided microstructural design techniques that can develop new alloys several times faster than traditional methods (related article on p. 2).

The consortium's South region includes federal laboratories in Tennessee, Kentucky, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana.

Lee Heads Superconductivity Program

Dominic F. Lee has been named manager of the ORNL Superconductivity Program, responsible for leading and implementing ORNL's R&D effort for DOE-OE's Superconductivity for Electric Systems Program. Lee has been responsible for ORNL Superconductivity Program activities for several months. He has worked on a wide range of superconductor types, including bulk and 1st- and 2nd-generation superconducting wires. He holds ten U.S. patents on high-temperature superconductivity and has published more than 180 articles.

Lee holds a B.S. from Notre Dame, an M.S. from the University of Houston, and a Ph.D. from the University of Houston Texas Center for Superconductivity. He is a member of the Materials Research Society and the American Ceramics Society. His work has received an R&D 100 Award, an Energy 100 Award, and numerous other honors.

King Named ORNL OE Program Manager

Tom King is ORNL's new program manager for Electric Transmission and Distribution Technologies. He has technical and business oversight of ORNL's high-temperature superconductivity, distributed energy, transmission reliability, visualization and controls, and power electronics and energy storage R&D. He also will coordinate other OE-funded projects and will continue to lead DOE's GridWorks project.

King has worked in ORNL's materials research programs and in the Strategic Planning Office since coming to the Lab in 2003. He holds a B.S. degree from Clarkson University, an M.S. in materials engineering from Rensselaer Polytechnic University, and a business degree from the University of Tennessee.

Correction

A photo on page 4 of issue 1 of 2006 pictured the Sacramento Municipal Utility District, rather than the San Diego Municipal Utility District as stated in the caption.

Included In This Issue:

Science and Technology Highlights
P.O. Box 2008
Oak Ridge, TN 37831-6186