



NETL's Terry Ackman

Research Highlights . . .



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Cryomodules delivered to SNS

DOE's [Jefferson Lab](#) has delivered all 23 cryomodules it was contracted to fabricate, assemble, and test for the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory. The cryomodules will accelerate protons into a mercury target to produce a beam of neutrons that's 10 times brighter than any other. Detectors will take snapshots of the neutrons as they penetrate a variety of materials, allowing researchers to measure changes in the behavior of materials subjected to different temperatures, pressures and magnetic field strengths. Potential applications include providing an understanding of microscopic cracks in airplane wings and the design of superconducting wires to improve the energy efficiency of motors and power lines.

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New glass durability model

DOE's [Savannah River National Laboratory](#) has developed a new glass durability model that has the potential to allow those facilities that vitrify radioactive waste to increase the amount of waste that can be incorporated into a quantity of glass. Glass durability models predict the durability of the final glass product from the composition of the melter feed. The SRNL model, called the Activated Complex Theory model, is based on new theories about the role of activated surface complexes on glass durability. Because it is based on elemental ratios of well analyzed sludges and glass formers, it has the potential to eliminate time-consuming analysis of individual melter feeds once implemented in a vitrification facility.

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Novel ultrafast laser detection of cancer cells

To investigate tumors, pathologists currently rely on labor-intensive microscopic examination, using century-old cell-staining methods that can take days to complete and may give false readings. A lightning-fast laser technique, developed by a team led by researcher Paul Gourley at DOE's [Sandia National Laboratories](#), has provided laboratory demonstrations of accurate, real-time, high-throughput identification of liver tumor cells at their earliest stages, and without invasive chemical reagents. The technique generates a **laser beam** in single human cells that is altered by what it encounters, and these changes, registered by an imaging spectrometer, instantly identify cancer-modified mitochondria in cells gone wrong. The techniques could be critical to advancing early detection, diagnosis, and treatment of disease.

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Super-heavy nuclei take shape in 'extreme' new theories

Advanced computational methods and supporting experiments, including work performed at DOE's [Oak Ridge National Laboratory](#), are giving scientists a better understanding of the **nature and stability of superheavy nuclei** and the heaviest elements that lie beyond the borders of the periodic table. A recent review article in *Nature* describes collaborative work exploring the behavior of super-heavy nuclei—those chock full of protons and neutrons to the point that they tax the physical forces that hold them together. Predicting the stabilities of extremely heavy nuclei has been a long-term goal of nuclear scientists toward determining if these atomic species can exist or be created synthetically.

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CFCC to emphasize development of Colorado fuel cell industry

DOE's [National Renewable Energy Laboratory](#) has joined with academic and industrial partners to help Colorado foster the growth of fuel cell development.

The Colorado Fuel Cell Center, established through a competitive process managed by the Colorado Governor's Office of Energy Management and Conservation (OEMC), will combine state of the art research, education and public outreach to promote the development of fuel cell technology and economic development in the state. Partners in the CFCC are NREL, the Colorado School of Mines (CSM), the Gas Technology Institute (GTI) and Versa Power Systems, Inc. (VPS).

"We are so happy to be partnering with such exceptional colleagues on this exciting venture," said Sue Hock, director of NREL's Center for Electric and Hydrogen Technologies and Systems. "We expect to contribute our technical skills to support the development of improved technologies for a future hydrogen economy."

NREL will provide support for the CFCC as well as continue work on the DOE-funded Hydrogen, Fuel Cells, and Infrastructure Development (HFCIT) program. The research of hydrogen production, storage and end-use technologies such as fuel cells is a major component of the HFCIT program and NREL has a highly active role in the development of these technologies with specific emphasis on the link to renewable energy.

Researchers at NREL are currently helping to acquire equipment necessary for the CFCC to fabricate and test advanced fuel cells. The new equipment includes testing stations capable of performance-testing fuel cell stacks.

Besides access to a sophisticated research laboratory, companies will have the opportunity for collaboration with researchers, students and faculty from the partnership as well as other users of the CFCC.

"The state wanted to support education and one of its goals was to introduce fuel cell research to students," Hock said.

CSM students and faculty will perform part of the research on electrochemical technology, materials and fuel processing. CSM has plans to add fuel cell courses to the existing curriculum and oversee all student and faculty research programs.

As an additional part of the CFCC education and public outreach efforts, curriculum will be developed for distribution to local high schools, technical schools and colleges for inclusion in chemistry and science courses. Materials will also be available for use at technical and business conferences as well as on the CFCC Web site.

NREL, CSM, GTI and VPS contributed \$1 million to match OEMC's \$2 million investment for the establishment of the CFCC. The CFCC will be located in the General Research Laboratory at CSM and will be managed by GTI.

Submitted by DOE's [National Renewable Energy Laboratory](#)

TERRY ACKMAN: AN OVERHEAD PERSPECTIVE

Whether he's knee-deep in water or flying over it, Terry Ackman still has his feet firmly planted on the ground as he leads the internationally recognized Water and Energy Team at DOE's [National Energy Technology Laboratory](#) (NETL).



Terry Ackman

The Team, which conducts basic and applied research into regional and national water pollution problems within NETL's Geosciences Division, initially pioneered the passive treatment of coal mine drainage by developing techniques*now commercialized*to cost-effectively treat polluted mine drainages. With that success, the Team expanded its expertise to encompass research into watershed issues as diverse as examination of options for power plant cooling water to bioremediation of soil contaminated by oil and natural gas wells.

Having a personal interest in outdoor activities such as boating and fishing, Terry is no stranger to water. His research has required that he don hip-boots to extract samples from streams and rivers; at other times, he has participated in helicopter flyovers of watersheds and mine sites. By dangling technology called a "frequency-domain electromagnetics" 100 feet beneath a helicopter flying at 200 feet, Terry's efforts have pioneered three-dimensional imaging of groundwater flow over areas ranging from Pennsylvania to the Wyoming-Montana border to California. Those efforts have been recognized by the Pennsylvania Department of Environmental Protection, the state's Environmental Council, the U.S. Department of Interior, and Pollution Engineering magazine.

Not resting on their laurels, Terry and his team are now addressing safety and stability issues at 14 different coal slurry impoundments, conducting flyovers with alternative technology to locate underground mine pools at deeper depths and refining a prototype water-powered treatment system, which hopefully will allow power generation from a hydro microturbine to offset chemical costs.

Whether Terry's research is focused above, on, or below ground, the net effect is that it has a direct, positive impact on the environment.

Submitted by DOE's [National Energy Technology Laboratory](#)