DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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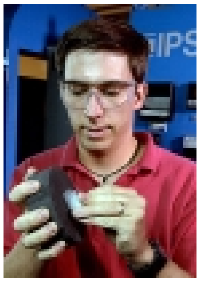


ORNL researcher's cool material, Page 2

Research Highlights . . .

Powerful magnet arrives

A powerful superconducting magnet has been delivered to DOE's Pacific Northwest National Laboratory for installation in the William R. Wiley Environmental Molecular Sciences Laboratory, a DOE scientific user facility at PNNL. The magnet will allow scientists to conduct more thorough studies of molecules, and examine larger molecules and combinations of molecules. The research will lead to a better understanding of illnesses and diseases, and possibly to new treatments and drugs. The superconducting magnet—weighing 16 tons and standing almost three stories high—will be part of a 900 megahertz wide-bore nuclear magnetic resonance spectrometer that will be set up over the next several months at EMSL. The 900 MHz NMR system will be available to scientific users from around the world.

[Staci Maloof, 509/372-6313, staci.maloof@pnl.gov]

New clean-up process reduces risks, costs

Preliminary projections indicate that DOE may save over $100 million by using an innovative decontamination process initiated through a partnership with the National Energy Technology Laboratory to accelerate closure of the Rocky Flats Site near Denver, Colo. Essentially, the process decontaminates the interior of gloveboxes, a structure that protects workers as they work with radioactive waste. After the gloveboxes themselves are decontaminated, they can then be packaged and shipped off-site in one piece, greatly reducing worker exposure to radioactive material, waste packaging and shipping costs. NETL manages this project and others for Environmental Management within the Office of Science and Technology.

[David Anna, 412/386-4646, anna@netl.doe.gov]

ORNL material could help pilots keep their cool

Staying cool under fire could take on a new meaning with a personal cooling system being developed at DOE's Oak Ridge National Laboratory. The system takes advantage of high thermal conductivity graphite foam, an ORNL material that boasts thermal conductivity five times greater than aluminum. As envisioned by James Klett of ORNL's Metals and Ceramics Division, the system would provide chilled air to circulate within the suit and helmet of a fighter pilot. While the initial use is expected to be for fighter pilots, developers envision the system being highly desirable for race car drivers, firefighters, hazardous materials workers and others who have to contend with protective clothing and hot working environments.

[Ron Walli, 865/576-0226, wallira@ornl.gov]

Prototype reflectometer shipped for evaluation

Hoping to gain feedback on a prototype photovoltaic reflectometer before it is licensed for commercialization, the National Renewable Energy Laboratory's National Center for Photovoltaics recently delivered the solar cell process-monitoring tool to Siemens Solar Industries, Camarillo, Calif. The reflectometer, designed to measure the reflectance -spectrum of an entire cell in less than 100 milliseconds, was delivered to Siemens on Feb. 15. Researchers from the NCPV will visit Siemens in early April to help optimize the system for Siemens' use and to help decipher the data gained from the machine.

[Sarah Holmes Barba, 303/275-3023, sarah_barba@nrel.gov]

DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***DOE Pulse*** (www.ornl.gov/news/pulse/) is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

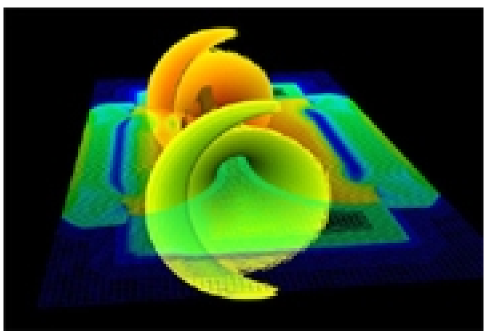
Labs simulate full-system nuclear weapon explosion

Scientists at DOE's Los Alamos and Lawrence Livermore national laboratories have completed two of the largest computer simulations ever attempted, the first full-system three-dimensional simulations of a nuclear weapon explosion.

The Crestone simulations are an important milestone in the NNSA's Stockpile Stewardship Program, which is responsible for maintaining the safety, security and reliability of the nation's nuclear deterrent.

Both calculations ran on the ASCI White machine in Livermore, California. Researchers at Los Alamos viewed the data using the Laboratory's 3.1 teraOPS Silicon Graphics Blue Mountain supercomputer and its EnSight graphics package.

Previously, Los Alamos and Livermore scientists completed the first 3D simulations of, respectively, a weapon secondary and a weapon primary, the two stages of modern nuclear weapons. These new simulations build on the experience gained in those achievements.



A visualization from the simulation of a nuclear weapon explosion shows an adaptive mesh (lower center region) in a single plane, and pressure variations in the imploding shock wave, with lower pressures in blue and higher ranges in red.

Being able to simulate a complete weapon system allows researchers to examine key physics issues through a combination of simulation, precision experiments, and analysis of data from past nuclear tests. Understanding these physics issues is crucial to the manufacture of replacement weapon components and the refurbishment of aging stockpile weapons.

Los Alamos' Crestone Project team worked with Science Applications International Corp. (SAIC) and Lawrence Livermore computer scientists on supercomputers at the two laboratories. The simulation used more than 480 million cells on 1,920 of the 8,192 processors on the Livermore machine. The actual time on the central processing unit was 122.5 days or more than 6.6 million CPU hours, which would be equivalent to computing continuously on a high-end home computer for more than 750 years.

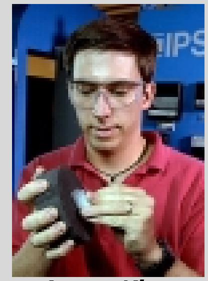
This latest achievement is part of the NNSA's Advanced Simulation and Computing effort, which involves NNSA employees, teams from Lawrence Livermore, Los Alamos, and Sandia National laboratories and key partners from the U.S. computer industry.

Submitted by DOE's Los Alamos National Laboratory

ORNL's Klett has cool stuff

James Klett gets credit for discovering one of the coolest new materials to come out of DOE's Oak Ridge National Laboratory in a while. It's especially cool if you hold a piece of graphite foam in your hand and place a piece of ice against it.

The cold shoots into your hand while the ice begins to melt as fast as ice cream on a sidewalk in August. That's because graphite foam has amazing heat transfer properties.



James Klett

"Graphite foam is as thermally conductive as aluminum at one-fifth the weight. It has a very high surface-area-to-weight ratio and a high heat transfer coefficient" says Klett.

"This interests engineers and designers because products that use energy wage an ongoing battle with heat."

Indeed, the foam—a porous, black solid—has received much attention from industries interested in applying it to a number of uses (see the ORNL highlight).

Other researchers at Klett's own lab, ORNL, have used the foam to develop a radiator for a natural-gas-fired engine that drives an industrial heat pump. The radiator efficiently transfers the waste heat, which is then used to regenerate desiccant that removes moisture from the air.

Graphite foam could also be used to cool electronic components and, because of its efficiency and light weight, lend itself to miniaturization of computer components.

Klett's discovery was one of those serendipitous scientific events. He was working with colleagues to find ways to make carbon-carbon components more dense. One experiment produced the dense material they were looking for.

"But there was also this foam material around the solid carbon-carbon," he recalls. It was formally named High Thermal Conductivity Mesophase Pitch-Derived Foam.

Graphite foam is easy to work with. Visitors to his lab area find it cookie-molded into a variety of shapes, including cartoon characters. Then they get the ice treatment—and go away with a warm feeling.

Submitted by DOE's Oak Ridge National Laboratory