NREL Bonnie Hames

Page 2

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

Number 183 May 9, 2005

Research Highlights . . .

Big hopes for tiny, new hydrogen storage material

Researchers investigating the compound ammonia borane at DOE's Pacific Northwest National Laboratory have found that it releases hydrogen quickly when incorporated into a nanostructured support. Their discovery furthers hope for developing an onboard hydrogen storage system that meets the requirements for fuel cell-powered automobiles. In the nanophase material, hydrogen comes off the ammonia borane approximately 100 times faster compared to bulk material and at temperatures that may allow efficient thermal integration with the fuel cell. As a bonus, at the nanoscale, there are no volatile chemicals produced such as borazine, which is harmful to fuel cells. Researchers say there are indications the material may eventually be designed to be regenerated or refilled, providing a sustainable hydrogen storage medium to enable longer drive times.

[Susan Bauer, 509/375-3688, susan.bauer@pnl.gov]

Dynamic fuel cell model tested

Scientists at DOE's National Energy Technology Laboratory have successfully tested a dynamic fuel cell model in Hybrid Performance Project facility, a control system test platform that provides simulation and test capabilities of advanced controls for future gas turbine/fuel cell hybrid power systems. System response to hardware output changes are studied so that control strategies can be evaluated and tested without damage to hardware components. The models must perform calculations in less than 5 milliseconds. Future developments will include fuel delivery and reforming thermodynamics to represent coupling of the fuel cell to other balance of plant hardware.

[Linda Morton, 304/285-4543, Linda.morton@netl.doe.gov]

Study uncovers bacteria's worst enemy

Scientists at Los Alamos National Laboratory have found that the successful use of bacteria to remediate environmental contamination from nuclear waste and processing activities may depend more upon how resistant the bacteria are to chemicals than upon how tolerant they are to radioactivity. The results of a study indicate that actinides are chemically toxic to bacteria only at high levels far above concentrations at contaminated sites, and that common toxic metals, such as cadmium, nickel and chromium, are more likely to cause problems for the bacteria. The discovery may help make bacterial bioremediation a more widespread method for cleaning up contaminated sites.

[Todd A. Hanson, 505/665-2085; tahanson@lanl.gov]

Growth in biomass could put U.S. on road to energy independence

Relief from soaring prices at the gas pump could come in the form of corncobs, cornstalks, switchgrass and other types of biomass, according to a joint feasibility study for the departments of Agriculture and Energy. The recently completed report from DOE's Oak Ridge National Laboratory report outlines a national strategy in which 1 billion dry tons of biomass—any organic matter that is available on a renewable or recurring basis—would displace 30 percent of the nation's petroleum consumption for transportation. Supplying more than 3 percent of the nation's energy, biomass already has surpassed hydropower as the largest domestic source of renewable energy, and researchers believe much potential remains.

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

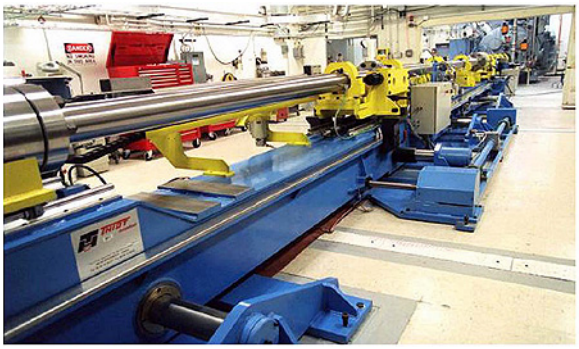
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***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).

Don't hedge your bets on JASPER

Not all the action in southern Nevada takes place in Las Vegas.

Sixty miles away at NNSA's Nevada Test Site, the JASPER team is on a roll. The team, from DOE's Lawrence Livermore National Laboratory, has staged 31 consecutive successful shots between March 19, 2001 and July 29, 2004. This includes a string of nine fully contained plutonium shots, all of which paid out valuable data and proved to be scientific winners.

JASPER, an acronym for Joint Actinide Shock Physics Experimental Research, is a nearly 100-foot, two-stage gas gun within Area 27 at NTS. It's also an important experimental technique to determine the properties of materials at high temperatures, pressures, and strain rates by shocking the material, and measuring its response.



JASPER can fire small projectiles at velocities of up to eight kilometers (five miles) per second. That's nearly 18,000 miles per hour or more than 24 times the speed of sound. When a tantalum projectile strikes a plutonium target at those speeds, the impact produces a high-pressure shock wave that passes through the target in a fraction of a microsecond. During this extremely brief period, diagnostic equipment measures the properties of the shocked plutonium inside the target.

These shock-physics experiments complement the on-going subcritical experiment program currently at NTS. In the absence of full-scale nuclear testing, JASPER's role in Science Based Stockpile Stewardship is to help assess the aging of nuclear weapon components, to verify that aging weapons can perform as designed.

Currently, the $3.5M JASPER facility and infrastructure are capable of executing about 24 experiments per year, costing about $6 million annually over a ten-year life. That's approximately $250K per shot; plus variable Pu costs that typically run ~$100K per target. While the Livermore Lab operates JASPER, the gun provides multi-laboratory experimental use.

Color animation showing how the JASPER gun works appears at: http://cmg-rr.llnl.gov/llnl/06news/NewsMedia/jasper.html

Submitted by DOE's Lawrence Livermore National Laboratory

Hames takes interest in plants to higher level

Bonnie Hames

Bonnie Hames traces her interest in biomass chemistry back to her days as a Girl Scout leader when she taught workshops on edible and medicinal plants. A comment made during one of these workshops inspired Hames to pursue a career in converting plants to useable energy.

"After listening to one of my talks, someone said they didn't know I was a scientist. I had never thought about it before but I was a scientist of sorts, I just didn't have the credentials" said Hames, team leader for the Chemical Measurement Sciences team and Biomass Analysis Technologies team at DOE's National Renewable Energy Laboratory. "That comment inspired me to go back to school."

More than 18 years later and three degrees later, Hames is using her experience in biomass (plant materials used as a source of fuel) chemistry to develop rapid methods for the chemical characterization of biomass feedstocks based on infrared spectroscopy and advanced multivariate analysis techniques.

"The ability to obtain an accurate chemical composition of a biomass sample using quick and inexpensive methods is a key element to the commercialization of processes that convert biomass to fuels and chemicals," Hames said.

Traditionally, it could take days or weeks to get results from one sample at a cost of $800-$2,000 per sample. Rapid biomass analysis allows researchers to characterize biomass in minutes rather than days for an estimated $20 per sample.

Hames and her co-workers support 25 different projects within NREL's biomass program. They maintain a large inventory of standard biomass samples as reference materials and a large database on the chemical, thermal, and mechanical properties of various forms and kinds of biomass materials.

"The research community knows that we in the biomass program have years and years of experience with different types of biomass and biomass processes," Hames said. "It doesn't matter if someone is talking about sugar beets or corn stover, we've seen it all."

Submitted by DOE's National Renewable Energy Laboratory