Retired physicist still attracted to work.

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Better pollution traps may lie ahead

Better catalytic converters and smokestack scrubbers could help free the air of more pollutants. Using Brookhaven National Laboratory's National Synchrotron Light Source and other DOE facilities, BNL Chemistry Department researchers are conducting structural and thermodynamic studies of how pollutants and catalysts interact at the molecular level. Their results may make it possible to develop new or improved catalysts. The team has shown that when hydrogen sulfide adsorbs on magnesium oxide, two or three uniform layers form at distinct intervals as the gas pressure increases. Also, their studies show that the adsorption process can be reversed if the magnesium oxide is heated to release the trapped gases. Thus, the sorbant can be reused.

[Karen McNulty, 631/344-8350, kmcnulty@bnl.gov]

EcoNest to enhance research into women's health issues

A new mouse facility, designed and built at DOE's Argonne National Laboratory, allows scientists to collect waste products from pregnant or nursing mice. The facility, designed to allow mice to give birth inside a standard metabolism cage, means that mice do not have to be moved to a separate birthing area, for the first time allowing data to be continuously collected before, during and after birth of the offspring. Argonne's EcoNest has a significant potential for application by pharmaceutical companies using animal models to examine the effects of drugs on pregnant and lactating females.

[Catherine Foster, 630/252-5580, cfoster@anl.gov]

How to tell a neutrino experiment from a hole in the ground

Those who would fathom the secrets of that exotic will-o'-the wisp of the particle kingdom, the neutrino, must first deal with a more prosaic form of matter: dirt. They'll have to dig over a thousand cubic yards of it from its place near the Main Injector accelerator at DOE's Fermilab. Then they'll blast their way through 130 feet of rock. All that digging and blasting, which began in early April, will produce a 200-foot deep hole in the ground—and the main shaft for the target hall for Fermilab's NuMI/MINOS experiment, the next step in the world-wide effort to understand neutrino mass.

[Judy Jackson, 630/840-4112, jjackson@fnal.gov]

New technique to guarantee strength in metal parts

A nondestructive technique under development at DOE's Ames Laboratory may guarantee strength in mass-produced parts made from powdered metals. As a pressed powdered-metal part sinters in a furnace, a commercial, custom-built electromagnetic acoustic transducer produces eddy currents that create sound waves inside the part. Sound pulses respond to the metal's bonds by dying out when weak or bouncing back and forth in pinball fashion when strong. Electrical voltage from the waves is read by an oscilloscope and visible on a computer monitor. The technique may eventually guarantee the strength of parts on automotive assembly lines and will be a valuable inspection tool for new alloys.

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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).

The answers are blowing in the wind tunnel

The first-ever tunnel test of a full-scale research wind turbine is scheduled to begin April 17. Researchers at DOE's National Renewable Energy Laboratory and NASA engineers have set up the experiment in the world's largest wind tunnel at NASA's Ames Research Center in California to find out more about the aerodynamics of rotating blades. That information will be incorporated into computer models, helping to design and build state-of-the-art wind turbines.

The three-week test of the NREL "Unsteady Aerodynamics" research wind turbine will be conducted in Ames' 80-foot (24.4 meter) by 120-foot (36.6 meter) wind tunnel. The wind tunnel is primarily used for determining low and medium-speed aerodynamic characteristics of full-scale aircraft and helicopters (rotorcraft).

"Some of the problems encountered by wind turbines are very similar to those experienced by rotorcraft," explained Bob Kufeld, NASA project director. "NREL contracted with us to use our wind tunnel and our helicopter computer models that predict rotorcraft characteristics for the test," he said.

"If we can better understand the aerodynamics of rotating airfoils, then we can more accurately predict how the wind turbines will behave," said Dave Simms, NREL project director. "This research will help us learn how to build better turbines."

The research wind turbine is designed to measure structural loads and aerodynamic responses of a rotating airfoil. It is mainly constructed from steel, but has two lightweight carbon-fiber blades which measure 33-feet (10-meters) in diameter. The entire turbine weighs about 15,000 pounds (6,800 kilograms). During the wind tunnel test, the turbine will be mounted on a 40-foot tall stand.

NREL engineers developed the test objectives to meet recommendations of an international panel of wind turbine aerodynamics experts. During most of the tests, wind speeds in the tunnel will vary from 5 to 25 meters per second (11 to 56 miles per hour) while the turbine operates at a constant speed of 72 revolutions per minute. Researchers will vary blade pitch, turn the rotor out of the wind at various angles and operated the rotor both downwind and upwind of the turbine's tower. In other tests, the rotor will turn at 90 or 110 rpm. Additionally, "parked blade" tests are planned, in which the rotor is locked in place while the tunnel blows at higher speeds—up to 40 meters per second (89 mph).

The NREL research turbine has been field-tested in various configurations since 1989 at NREL's National Wind Technology Center. It has been operated in outdoor atmospheric turbulent wind conditions up to 70 mph, and has been exposed to winds faster than 145 mph with the rotor locked in position. Test data have shown that turbulent winds create complex operating environments for wind turbines.

"Testing in a controlled wind tunnel environment will eliminate these factors, and produce valuable data that will help researchers to better understand how turbines operate under diverse conditions," Simms said. "We need data to improve and validate enhanced engineering models for designing and analyzing advanced wind energy machines. Hopefully, this test will provide that data."

Submitted by DOE's National Renewable Energy Laboratory

Unretiring physicist is pulled by magnetic technologies

When physicist Dick Post retired at DOE's Lawrence Livermore National Laboratory in 1992, he knew he still had some unfinished business. What he didn't know was that a new career awaited him after his retirement-or how busy his retirement would be.

Now 81, Post still works four days a week at the Lab. And his projects are sprouting wings and flying off successfully in all directions.

A particle physicist who joined LLNL within months of its founding in 1952, Post devoted four decades of research to pushing the frontiers of magnetic fusion energy. He remains a firm believer that fusion will in time be shown to be an economically viable and environmentally attractive energy source, but thinks that day will be at least a couple of decades away.

Meantime, "It's been great," Post says of his second career. "I've been able to develop new ideas and work in areas where other researchers haven't already plowed the ground."

The newest area where Post has found a fertile soil is magnetic levitation, where the Livermore researcher has proposed the use of permanent, room-temperature magnets in systems for launching rockets and for moving trains.

Post's team, which has garnered $1 million in NASA funding, is building its second prototype track-one that will speed a cart at better than 60 mph.

An earlier project, a collaboration to develop flywheel batteries with a San Francisco-based company, is starting to bear fruit as the firm shipped three batteries last year and expects to build another 20 this year.

The basic technology for the maglev and flywheel projects-magnetic bearings that are passive-is also attracting interest from companies. Already, three firms in different fields have come calling to evaluate the use of these bearings in their products.

Submitted by DOE's Lawrence Livermore National Laboratory