Toshi Sugama's "surf & turf"

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DOE Pulse

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Research Highlights . . .

Appliances get the true wash-day test

Residents of a Reading, Mass. apartment complex are replacing their conventional washers and dryers, monitored for energy and water use since June, with new high efficiency Maytag Neptunes. DOE's Oak Ridge National Laboratory is helping to determine the savings in the field test. In a similar test in arid Bern, Kansas, a few years ago, the front-loading appliances used up to 60 percent less energy and nearly 40 percent less water. "Continuous economic growth and, in turn, depletion of natural resources could worsen energy and water shortages. That's why teaching people how to conserve simply and early could significantly help us today and tomorrow," says ORNL's John Tomlinson.

[Bill Cabage, 865/574-4399, cabagewh@ornl.gov]

Heat pipes to help cool car

Engineers at DOE's National Renewable Energy Laboratory are embarking on a demonstration project to examine the use of heat pipes to cool automobile instrument panels. The experiment uses water heat pipes to extract thermal energy from an instrument panel and transport it outside the vehicle. Engineers developed the heat pipe design based on software developed at Los Alamos National Laboratory. The goal is to cut automobile emissions by reducing the amount of energy it takes to keep car occupants comfortable. If the demonstration is successful, the prototype heat pipes will be incorporated into a car's instrument panel and tested outdoors.

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

Successful results for treated-wood burning

Readily available treated woods, such as telephone poles, transmission poles, and railroad ties can be used as renewable fuel when fired with coal into electric power plants. DOE's National Energy Technology Laboratory's Combustion and Environmental Research Facility conducted a pilot-scale test burn of treated woods cofired with coal. The test results indicated that treated woods could be successfully cofired at 10% energy-basis without increasing emissions of polycyclic aromatic hydrocarbons, volatile organic compounds, heavy metals, and particulates. These test results will help industry and regulators plan full-scale tests in coal-fired utility boilers.

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

Tags target Army inventory

Inventory control is getting easier and faster for the U.S. Army with a new radio-frequency tag developed at DOE's Pacific Northwest National Laboratory. Engineers there have designed a system that tracks small arms while stored in armories or checked out and used in the field. The tags, which are mounted inside an M-16 rifle's grip and include a rifle's serial number for identification, will allow military personnel to stand in a warehouse full of tagged M16s, inventory up to 50 weapons a second and quickly know which weapons are being stored and which are missing or in use.

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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 sandbox and the moon

Experimenters are certainly inventive. Give them a sandbox and pretty soon they want the moon. A group at DOE's Stanford Linear Accelerator Center (SLAC) has used a sandbox to test a theory about microwave signals from neutrinos that could eventually become an experiment using the moon.

Astronomer Peter Gorham from Cal Tech's Jet Propulsion Lab (JPL) in Pasadena; physicist David Saltzberg from UCLA, graduate student Dawn Williams, and SLAC physicists Al Odian, Clive Fields, Rick Iverson and Dieter Walz have sent a beam of gamma rays into a sandbox.

Dipole antennas were buried in the sand and microwave antennas were mounted along one side of the sandbox. They were used to observe and measure signals emitted when the energetic gamma rays (photons) generated electromagnetic cascade showers in a dielectric medium like dry sand. The technique and the results should help in the observation of energetic neutrino showers using the moon as an emitter.

Neutrinos are difficult particles to detect. They have a very small mass, no charge and only weak interactions. Like photons, neutrinos travel in fairly straight lines from their source to the point of detection. In addition, the neutrino will go through almost anything, hardly noticing that something is in their way. So to detect and observe neutrinos requires emitters and detectors with lots of material.

Enter the moon, nature's own emitter with lots of material. In 1988 a theory was proposed that large antennas used in ground-based radio astronomy should be able to detect radio pulses from neutrinos interacting in the moon's surface layers. Energetic neutrinos in the universe form a steady stream of particles and some of those pass through the moon's mass and a few interact. Those interactions will create a type of radiation known as coherent Cherenkov microwave radiation. If the interaction is close enough to the moon's sandy and dusty surface, then microwave signals might be detectable on earth. All that's needed are some radio telescopes to receive those signals, which could be provided by NASA scientists working at JPL, and of course, the ability to understand the nature of the signals.

David Saltzberg was thrilled to test the theory at SLAC. According to the UCLA scientist, it was like building a scale model. "We could not have done this without the help of so many people at SLAC. I am extremely pleased that we could propose an experiment in April and have it completed by August. This result would have been impossible without the incredible precision and stability of the beams at SLAC." SLAC's Final Focus Test Beam is uniquely suitable for this test since the combination of its energy and current creates showers comparable to those expected from very energetic cosmic neutrinos.

According to Peter Gorham, "The results of this experiment at SLAC will be hugely important to current efforts to detect ultra-high energy cosmic neutrinos. This remarkably large effect went undetected for almost 40 years." Results will be published in the fall.

Submitted by DOE's Stanford Linear Accelerator Center

Three-time Winner Sugama develops 'green' coatings

A three-time winner of the R&D 100 Award, Chemist Toshi Sugama, like his award-winning cement for geothermal wells, is hot stuff.

Toshi Sugama uses crustacian shells plus corn.

Sugama won this year's R&D 100 for developing high-efficiency "green" cement, using mainly recycled fly ash in an environmentally friendly process. Tested since 1997, the cement lasts twenty times longer than conventional cement in geothermal wells, and is also suited for oil wells, gas wells, and soil remediation.

In 1999, as part of a BNL/W.R. Grace team, Sugama won another R&D 100 for developing and testing a foam that chemically digests asbestos fibers in fireproofing and other materials, yet maintains the material's functional properties.

Back in 1988, Sugama's first R&D win was for an economical zinc-phosphate coating system that he and BNL colleagues created to reduce steel-surface corrosion. A water solution of three chemicals, the coating is also ductile and bonds with paint, polymer topcoats, and steel.

Coatings are a Sugama speciality, such as two corrosion and oxidation-resistant coatings he developed for the aircraft and aluminum-smelting industries in 1997. His patented "sol-gel grafting" process, more environmentally friendly than current techniques—and less expensive—made these coatings also qualify as "green."

Greenest of all is his 1999 "surf & turf" coating, which uses the ocean's shellfish shells and the earth's corn as key ingredients in protecting aluminum and other metals from corrosion.

This work is the payoff of 15 years of DOE investment in his basic research into 'green' materials, Sugama says. "To develop new, useful materials, we combine them in new ways or make small changes in their molecular structures to modify properties. To learn what we can do takes years of research. But once this foundation is established, we can use it to invent new applications needed by industry.

Submitted by DOE's Brookhaven National Laboratory