Terumi Kohwi-Shigematsu

Page 2

DOE Pulse

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Research Highlights . . .

NREL and company researchers team up on thin film solar cells

DOE's National Renewable Energy Laboratory is helping HelioVolt Corp., an Austin, Texas-based company, move toward commercial production of advanced solar cells by providing facilities and staff to demonstrate the viability of patented technology it has developed for making thin-film Copper Indium Gallium Diselenide solar cells. The HelioVolt process, which involves depositing two thin chemical reactant layers and rapidly heating them to bond CIGS films to sheets of glass or other surfaces, is one of several innovative thin-film technologies that hold the promise of significantly lowering the cost of solar cells for the commercial market.

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

Cleaning up contamination the natural way

Hundreds of sites around the country contaminated with chlorinated solvents such as trichloroethylene may be candidates for monitored natural attenuation. Researchers are evaluating whether the process, which exploits natural physical, chemical and biological processes in the subsurface, could be applied more broadly nationwide and harnessed more effectively to contain and break down contaminants. At DOE's Oak Ridge National Laboratory, researchers are exploring ways to enhance these natural processes to improve on nature's ability to minimize or eliminate the impact of contaminants in the environment. Testing of promising approaches for enhancing some of these processes will take place on the Savannah River Site. DOE funds the three-year project led by the Savannah River Technology Center.

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

Saliva spits out information on chemical exposure

Home testing of saliva to measure personal hormone levels is gaining popularity. Scientists at DOE's Pacific Northwest National Laboratory envision a day when it may be nearly as easy to detect chemical exposure or even nerve gas poisoning—simply by analyzing a victim's saliva. And the results would be almost immediate. Using sophisticated mass spectrometry equipment at PNNL, researchers have been able to identify breakdown products of a common pesticide in the saliva of rats exposed to known amounts of the pesticide. The researchers are working now to develop a simpler, portable microanalytical sensor system to quickly diagnose pesticide exposure in humans and a modeling method than can estimate the dose. Researchers say the technology could be adapted to test for a variety of contaminants, including chemical warfare agents.

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

NETL vehicles run on corn-derived fuels

With the recent installation of its first refueling station that dispenses ethanol, a renewable energy source made from corn, DOE's National Energy Technology Laboratory has begun to boost its use of alternative fuels and meet a number of environmental goals. Fiscal year 2004 plans call for another ethanol station and two quick-fill compressed natural gas stations. Currently, 44 of NETL's 71 vehicles run on alternative fuels, a net gain of five over last year. These actions support the Energy Policy Act of 1992, which requires that 75 percent of all light duty vehicles acquired by federal agencies be alternative-fuel vehicles by 2005 and 90 percent by 2010.

[Otis Mills, 412/386-5890; mills@netl.doe.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).

Transportation researchers share expertise with solar program

Researchers with the Center for Transportation Technologies and Systems (CTTS) of DOE's National Renewable Energy Laboratory are working with DOE's Solar Energy Technology Program to help develop simulation and analysis software designed to estimate a photovoltaic (PV) systems' performance and value.

The PV system simulator, known as PV SunVisor, will include both performance and financial modules, allowing the user to analyze technical performance and cost/price sensitivity on a complete PV system for a given location and an assumed system lifetime. PV SunVisor will help researchers determine whether the cost of research toward technological advancement will be worthwhile based on increased energy production.

Sam Sprik

Sam Sprik, a CTTS engineer, is working with the Solar Energy Technology Program's David Mooney to code the PV SunVisor, using MATLAB, a high-performance language for technical computing.

PV SunVisor is planned as an open model, similar to CTTS' ADVISOR[a] (ADvanced VehIcle SimulatOR) software, and will be available to anyone who wishes to use it.

The project began less than a year ago. An initial software model was drafted with support from Ray Sutula, program manager for DOE's Solar Technology Program and from David King and Charlie Hanley with Sandia National Laboratories.

The software was originally intended for internal use at the National Renewable Energy Laboratory's National Center for Photovoltaics to help direct research and development. After the initial model was drafted, Mooney began meeting with representatives from the PV industry to gauge their level of interest.

"It became clear very quickly that our industry partners were interested in a simulation model to both help direct their internal R&D as well as help predict a system's performance," Mooney said.

The team plans to have a model ready for peer review by April. PV SunVisor will be upgraded often because of changing variables and technologies. The long-term goal is to integrate the current model with a buildings model, a solar hot water systems model and a concentrated solar power systems model.

Submitted by the National Renewable Energy Laboratory

Terumi Kohwi-Shigematsu: Unraveling secrets of DNA

Terumi Kohwi-Shigematsu

Terumi Kohwi-Shigematsu of DOE's Lawrence Berkeley National Laboratory has learned how the bundle of DNA and proteins called chromatin rearranges itself to allow gene expression in cells known as thymocytes.

She and her colleagues discovered that a particular protein in the nucleus of these cells, SATB1, forms a cagelike network. The places where chromatin loops attach to this framework serve to divide it into distinct domains. SATB1 also provides a "landing platform" where enzymes can go to work on the chromatin, rearranging it to access specific genes in the domains.

Thus SATB1 is both a structural element of the cell's nucleus and a crucial factor in the biochemical processes that regulate gene expression, acting at different stages of a thymocyte's development into mature immune-system cells.

Kohwi-Shigematsu's interest in biochemistry began in high school in the Washington, D.C., area, where her father, a Japanese official, was stationed with his family. She recalls being "fascinated that living things could be entirely made out of chemicals."

She majored in chemistry at Washington College, got a master's degree in physical chemistry at Johns Hopkins University using x-ray crystallography to study DNA, then returned to Tokyo University to study biochemistry. There she met Yoshinori Kohwi, the only other graduate student dedicated enough to work in the lab in the hot summer months.

As newlyweds with Ph.D.s in hand, they faced a problem. "Nori was offered a tenured university position, but as a female in Japan I knew I would not get an independent research position." They both obtained fellowships and subsequent appointments to work in the United States.

Wherever they have traveled they have worked together and independently to unravel the secrets of DNA.

Submitted by Lawrence Berkeley National Laboratory