ORNL's Rebecca Efroymson

Page 2

Research Highlights . . .

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

Number 135 June 23, 2003

Interface tuning is giant step for microelectronics

A team led by Rodney McKee of DOE's Oak Ridge National Laboratory has demonstrated a method to make atomic-level changes in the functional components of semiconductor switches. The finding by ORNL, North Carolina State and the University of Tennessee will likely have major implications to the semiconductor industry because it solves a problem that has existed for decades. In a paper published in the June 13 issue of Science, the researchers explain how to "tune" the atomic-level zone between the substances that make up transistors (metals, oxides and silicon). McKee describes the work as "a unifying concept for understanding and designing" this aspect of semiconductor physics.

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

NREL speeds biomass analysis

DOE's National Renewable Energy Laboratory has developed new technology that takes near-infrared spectrometry, coupled with multivariate analysis, to a new level of sophistication, allowing scientists to analyze a biomass for energy content in minutes. Previously it took days to determine the wide range of physical and chemical characteristics of raw or processed biomass. Quicker analysis promises to reduce the cost of converting biomass to fuel or electricity. Rapid Biomass Analysis can be applied profitably at almost any point in any industrial biomass process, including pulp and paper manufacture or cellulosic ethanol production. NREL is working to develop the Biomass Rapid Analysis Network (BRAN), a consortium of industry partners that will have access to training, technical assistance and the equipment to use the technology.

[Sara Huntley, 303/275-4317, sara_Huntley@nrel.gov]

SNS's first production cryomodule delivered

Jefferson Lab delivered its first production cryomodule for the Spallation Neutron Source's superconducting linear accelerator this month. JLab is part of a team of DOE laboratories assisting in the design, engineering and construction of the SNS, being built in Oak Ridge, Tenn. JLab built the prototype cryomodule last year and sent it on a trial road trip to ensure the rigors of travel wouldn't damage the extremely sophisticated and sensitive mechanisms within the cryomodule. After a final round of tests ensured its road-worthiness, the cryomodule was delivered to Oak Ridge. Since then, JLab's cryomodule production line has been in full gear.

[Debbie Magaldi, 757/269-5102, magaldi@jlab.org]

INEEL researches safer, 'greener' gasoline

DOE's Idaho National Engineering and Environmental Laboratory is seeking to make gasoline production "greener and cleaner." INEEL's research focuses on use of a solid acid catalyst "known as a zeolite catalyst" to replace liquid acids currently used to form isooctane from isobutene, increasing the fuel's octane rating. However, the catalyst has been found to "gum up," reducing its efficiency. Washing the catalyst periodically with a supercritical fluid extends catalyst life by a factor of 70. Postdoctoral researcher Lucia Petkovic is working to understand the chemical rejuvenation process. Her success could lead to safer, cleaner production processes for refineries everywhere.

[John Howze 208/526-6864, jhowze@inel.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).

Carbon Sequestration Technology Takes to the Field

Researchers from DOE's Los Alamos National Laboratory, Sandia National Laboratories and the National Energy Technology Laboratory, and from Strata Production Company have begun an experiment to see if underground geologic formations can be used to entrap and permanently sequester carbon dioxide gas from the atmosphere. The experiment is the first major field carbon sequestration experiment in the United States and part of an intensive 3-year scientific effort to trace the movement of CO_2 and determine whether it is likely to safely and permanently remain in the oil reservoir. Success of the approach might make it an option for President Bush's Global Climate Change Initiative.

"Oil and gas reservoirs are considered promising targets for CO_2 sequestration for a number of reasons," said Rajesh J. Pawar, a Los Alamos scientist working with the project. "Because the oil and gas that naturally accumulated in these reservoirs did not escape over geological time, the reservoirs should also be natural containers for CO_2. Also, because the geologic structure and physical properties of most oil and gas fields have been extensively characterized, that data should lower the cost of implementing the CO_2 sequestration projects."

From December 2002 until February 2003, researchers injected approximately 2,100 tons of CO_2 into Strata Production Company's West Pearl Queen reservoir near Hobbs, New Mexico. That quantity is comparable to a single day's CO_2emission from an average coal-fired power plant.

At the start of the project, an extensive three-dimensional geophysical survey was conducted to provide an image of the reservoir. As the CO_2 was pumped into the reservoir at a rate of about 40 tons per day, project scientists used highly sensitive equipment to obtain microseismic signals useful in tracking the CO_2 plume's movement. Researchers have been monitoring the post-injection pressure in the field now for several months. A post-injection, three-dimensional geophysical survey will be performed in early July. This survey will be compared with the pre-injection survey to determine extent of injected CO_2 plume in the reservoir. After the survey is finished, injected CO_2 will be allowed to escape and researchers will monitor the amounts and types of fluids coming out of the well. Researchers will also be collecting samples of these fluids for analysis of their compositions and the data will provide them with information on how CO_2 may have reacted with the reservoir. Finally the field and laboratory experimental data will be integrated with numerical models to provide insights into the long-term capacity and impacts of such CO_2 sequestration options.

The Hobbs project complements another field test underway in southeastern Canada where nearly 5,000 tons per day of CO_2 is being shipped from the Dakota Gasification Company's Great Plains Coal Gasification Plant outside Beulah, North Dakota to the Weyburn oil field. The Weyburn field's operator is injecting the CO_2 in order to extend the field's productive life another 25 years and extract as much as 130 million barrels of oil that might otherwise have been abandoned.

Submitted by Los Alamos National Laboratory

ORNL RESEARCHER OUT TO MAKE A DIFFERENCE

Rebecca Efroymson

Rebecca Efroymson from DOE's Oak Ridge National Laboratory isn't looking for fame, but she is looking to make a difference to the environment and in people's lives.

That quest to make things better was evident early, as Rebecca tutored prisoners in mathematics while earning a bachelor's degree in biology and English from La Salle University.

"Math comes easily to me, but it isn't easy for everybody," says Rebecca, who received master's and doctorate degrees in environmental toxicology from Cornell University. "I was also intrigued by the prison environment – what it feels like to have the door shut behind you, the social hierarchy of prisoners – and by the main person I tutored."

She is a co-author of *Ecological Risk Assessment for Contaminated Sites*, has published about 20 papers and dozens of reports and has played a significant role in developing a multimedia model for assessing risk from hazardous air pollutants. The task combined her interests in the application of mathematical modeling to environmental problems.

Rebecca recently saw her dedication and talent rewarded as she received the Environmental Sciences Division Distinguished Scientific Achievement Award for 2002 where she was cited "for excellence in ecological risk assessment."

What makes for a good day, Rebecca says, is learning something new, synthesizing new information or "writing a good chunk of a paper." All of this is driven by her desire to ensure that the best science is available to support policies that affect the environment and people's lives.

Where remediation is concerned, for example, we need to do a better job of evaluating risks and benefits of a particular action, Rebecca says. Sometimes digging up a site and hauling off dirt does more harm than good because it destroys vegetation, can cause erosion and can lead to longer recovery times than it would take the chemical contaminants to degrade.

Submitted by DOE's Oak Ridge National Laboratory