ORNL's Amit Goyal

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GridWise program to test new electric grid technologies

DOE's Pacific Northwest National Laboratory has launched the Pacific Northwest GridWise Demonstration Projects, which are designed to test new smart grid technologies that can possibly defer the need to build transmission lines. About 300 homeowners in the Northwest will participate in two demonstrations. One is a real-time electricity pricing experiment that will help researchers determine if energy usage changes when customers know prices are high. Additional volunteers will test a Grid Friendly Appliance Controller in a clothes dryer that can sense frequency disturbances in the grid and turn off the heating element briefly to reduce the energy load, and give power operators a chance to stabilize the grid and offset a potential power outage.

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

Report investigates sub-freezing fuel cell operation

Proton Exchange Membrane Fuel Cells (PEMFC) are seen by many as a future replacement for internal combustion engines, but problems associated with sub-freezing temperature startup must first be resolved for widespread acceptance. PEMFCs convert hydrogen and oxygen into electricity, but during the conversion process, water is needed and produced but can freeze, damaging the fuel cell and delaying rapid startup of the vehicle. With support from DOE's Hydrogen Program, the National Renewable Energy Laboratory recently released a report, "PEM Fuel Cell Freeze and Rapid Startup Investigation," which identifies issues for rapid startup of PEMFC's in sub-freezing temperatures and investigates proposed solutions and strategies.

[Sarah Barba, 303/275-3023, sarah-barba@nrel.gov]

Tiny crystals promise big benefits

Los Alamos National Laboratory scientists have found that carrier multiplication, a phenomenon in which semiconductor nanocrystals respond to photons by producing multiple electrons, is applicable to a broader array of materials that previously thought. In research funded by DOE's Office of Basic Energy Sciences, scientists discovered that carrier multiplication is not unique to lead selenide nanocrystals, but also occurs in other types of nanocrystals like cadmium selenide, where the absorption of a single photon could produce two or even three electrons. The find increases the potential for nanocrystals use in solar cell materials that have higher electrical outputs than current solar cells.

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

SNS instruments get ready

DOE's Spallation Neutron Source is homing in on this year's completion, with focus being directed to the heart of the facility's mission—the scientific instrumentation that will provide unprecedented materials analysis capability using intense neutron beams. The SNS's instrument team has successfully installed the liquids reflectometer incident arm, goniostat and detector arm in one of its beam lines. A goniostat is a mechanism capable of more than two dozen precision motions, which will be required to position the instrument's detector arm and sample arm for performing neutron analysis. These advanced devices are indicative of the SNS's inclusion of state-of-the-art instrumentation and robotics to accomplish its neutron science mission.

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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).

DOE JGI collaborations bear fruit through USDA agreement and laboratory science program

Responding to the escalating demand for DNA sequencing to unlock the potential of plants and microbes, the DOE and the U.S. Department of Agriculture have announced they will collaborate to solve problems that are important to each agency's mission, while speeding the delivery of emerging technologies.

For first project growing out of the agreement DOE Joint Genome Institute (DOE JGI) will decode the DNA of the soybean, Glycine max, the world's most valuable legume crop. Soybean is of particular interest to DOE because it is the principal source of biodiesel, a renewable, alternative fuel. Biodiesel has the highest energy content of any alternative fuel and is significantly more environmentally friendly than comparable petroleum-based fuels-releasing only half of the pollutants and reducing the production of carcinogenic compounds by more than 80 percent.

Over 3.1 billion bushels of soybeans were grown in the United States on nearly 75 million acres in 2004, with an estimated annual value exceeding $17 billion, second only to corn and approximately twice that of wheat. The soybean genome is about 1.1 billion base pairs in size, less than half the size of the corn genome.

"The soybean represents an excellent example of how DOE JGI is playing a key role in 'translational genomics,' applying the tools of DNA sequencing and molecular biology for crop improvement, from clean energy generation to plant disease protection," said DOE JGI Director Eddy Rubin.

The Soybean Genome Sequencing for Biofuels project originally sprouted through the new DOE JGI Laboratory Science Program (LSP). The LSP provides DOE national laboratory researchers broader access to high-throughput DNA sequencing for DOE mission-relevant projects.

Recently, a LSP lead was tapped in Gerald Tuskan, senior scientist in the Environmental Sciences Division at Oak Ridge National Laboratory. Tuskan got together with DOE JGI's Daniel Rokhsar and colleagues from the National Center for Soybean Biotechnology, the USDA Agricultural Research Service, Purdue University and the National Center for Genome Resources.

"Sequencing the soybean genome will create new opportunities for the advancement of biodiesel as a economically viable transportation fuel," said Tuskan. "Having the catalog of all soybean genes at our fingertips will facilitate the discovery of metabolic processes that will lead to improved oil production in the seeds and possibly through out the entire plant. Greater yields of oil per unit area of land will reduce the cost of production and move soybean-based biodiesel closer to your local gas station."

Submitted by DOE's Joint Genome Institute

ORNL's Goyal pushes superconducting solutions

Amit Goyal

Superconducting technology is seen as a key to fortifying the nation's electric power grid. No one's working harder to make it happen than Amit Goyal.

Goyal, leader of the Superconducting Materials Research in the Metals & Ceramics Division at DOE's Oak Ridge National Laboratory, is inventor on 50 issued patents in a portfolio of processes and products relating to the development of superconducting cable.

He is the lead inventor of the RABiTS (rolling-assisted-biaxially-textured substrates) fabrication process, the Lab's dominant superconductivity project that has sparked several industry partnerships. Consisting of a single-crystal-like base metal tape and an epitaxially grown set of chemical and structural buffer layers, the RABiTS substrate allows the superconducting material yttrium-barium-copper-oxide to be highly aligned in all directions, which is crucial for efficient current flow through the superconductor.

Goyal, a Battelle Distinguished Inventor (inventor or co-inventor on 14 or more patents), has worked at ORNL in the field of electronic materials since 1991. He was issued his first patent in 1998. The majority of his 46 U.S. and four international patents are for processes and materials used in superconductivity applications.

"A patent alone is worthless," Amit says. "The key is creating a patent portfolio that provides coverage for all aspects of the process."

A native of Dehradun, India (north of New Delhi), Goyal received his bachelors in engineering from the Indian Institute of Technology and his masters and doctorate from the University of Rochester.

Goyal is a fellow of the American Association for Advancement of Science, the Institute of Physics, UK, the World Innovation Foundation, UK and the American Society of Metals. He is an author or co-author of over 300 papers in journals and conference proceedings.

Submitted by DOE's Oak Ridge National Laboratory