PPPL's Rich Hawryluk

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Research Highlights . . .

DOE Pulse

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Combining coal and biomass in co-gasification

Researchers at DOE's National Energy Technology Laboratory are studying the co-gasification process in which various types of coal and biomass are combined and converted into synthesis gas for use in producing electricity, hydrogen, chemicals and liquid transportation fuels. The biomass includes energy crops such as wheat straw, corn stover, switchgrass, mixed hardwood and distillers' dried grains with corn fiber, and even algae. Using coal in co-gasification provides a steady supply that can be supplemented by biomass whenever available. The researchers are examining how best to couple the coals and biomasses that makes sense geographically. They are using a small-scale gasification system to evaluate various products.

[Linda Morton, 304/285-4543, Linda.morton@netl.doe.gov]

Detector monitors four threats at once

Security and law enforcement officials may have a new ally—a universal detection system that can monitor the air for virtually all major threat agents that could be used by terrorists. The system is under development by a team of scientists and engineers from DOE's Lawrence Livermore National Laboratory, and has been tested in laboratory and field experiments. In their latest advance, the team has conceptually shown that they can almost simultaneously detect four potential threat materials—biological, chemical, explosives and radiological—along with illicit drugs, using Single-Particle Aerosol Mass Spectrometry, or SPAMS.

[Steve Wampler, 925/423-3107, wampler1@llnl.gov]

The unique lessons of XPD for cancer, aging

XPD is an essential component of the molecular factory that performs DNA nucleotide excision repair. Now a group at DOE's Lawrence Berkeley National Laboratory and the Scripps Research Institute have solved XPD's structure, revealing how pinpoint mutations in its remarkable architectureas seemingly insignificant as a change in adjacent amino acid residues—lead to three diseases with completely different phenotypes: xeroderma pigmentosum's cancer-promoting sensitivity to sunlight; stunted growth and premature aging in Cockayne syndrome; and accelerated aging characterized by brittle hair and scaly skin in trichothiodystrophy. The structure of XPD gives novel insight into mechanisms of aging and cancer.

[Paul Preuss, 510/486-6249, paul_preuss@lbl.gov]

One molecule at a time

Researchers at DOE's Pacific Northwest National Laboratory have developed a new and improved computational model that describes the interactions and spectroscopic signatures of water molecules in different environments. "Until now, no model could as fully describe the vibrations of water molecules, from a single water molecule and small water clusters, to liquid water, ice and clathrate hydrates," said PNNL scientist Sotiris Xantheas. Researchers tested the new model by measuring thermodynamic and transport properties of liquid water. Close agreement of the simulation with experimental results validated the model's effectiveness. Understanding water at the molecular level is essential to advancing frontiers in such areas as aqueous chemistry, hydrogen generation and storage, and the transport of contaminants in surface and subsurface environments.

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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).

Idaho reactor attracts nation's academics, industry leaders

Idaho National Laboratory's new Advanced Test Reactor National Scientific User Facility (ATR NSUF) is hosting engineers from across the country this summer as representatives of 20 universities attend a weeklong information session and four new research teams start experiments at the facility.

"I think it's great," said ATR NSUF Education Coordinator Jeff Benson. "We're bringing experts in from around the country. It's a fantastic opportunity for the upcoming generation."

The User Facility Summer Session is intended as an introduction to the ATR, which replicates in a short amount of time the effects of radiation that a material would receive over years of use in a commercial nuclear reactor. The Department of Energy established the User Facility last year to make access to the ATR easier for new researchers.

The session's attendees included representatives of INL, private industry and 20 different universities. Participants listened to presentations from experts in modeling, fuels and materials, toured the ATR and other INL facilities, and networked with fellow researchers.

Heng Ban, a professor of thermophysical properties and materials at Utah State University, described the session as "one-stop shopping for everything."

"You really find a place to meet all these people in one place," he said.

Research teams from the University of Florida, the University of Illinois, North Carolina State University, and University of California-Santa Barbara have won the opportunity to stay the summer at INL.

ATR NSUF Scientific Director Todd Allen said he hopes to repeat the program in years to come.

"Our goal [is that] from now on out we'll have a continuing set of experiments in the reactor," he said.

Andrew Frerichs, a Ph.D student at Iowa State University, said he attended the facility's summer session partly in hopes of gaining a spot for his research team in an upcoming summer, calling the experience "very beneficial."

"It's an interesting networking experience," he said. "It's an interesting perspective with so many people from different universities."

Representatives of private industry expressed similar feelings. Dr. Edgar Vidal studies beryllium for Brush Wellman Inc. in Elmore, Ohio. He said the session helped him understand the impact nuclear science will have on his research and make contact with experts who will help him further his company's goals.

"It's great," he said. "The interaction, meeting people from universities."

Submitted by DOE's Idaho National Laboratory

Reflections of a fusion leader

PPPL Deputy Director Rich Hawryluk

An exhibit at the 1964-1965 New York World's Fair in Flushing Meadows piqued then youngster Rich Hawryluk—and the future fusion world was indelibly changed.

"The World's Fair actually had a fusion exhibit by GE," recalled Hawryluk, Deputy Director of the DOE Princeton Plasma Physics Laboratory. He wrote to the Atomic Energy Commission to find out more. "I hadn't yet taken physics and didn't really think my future would be fixed on physics, but I was interested in learning more."

Around the same time, Hawryluk scoured the limited offerings at his neighborhood library in Brooklyn for books of interest before encountering a shelf devoted to science and engineering, topics he'd gravitated toward.

"I was fascinated by what people had done and were doing. Reading about these endeavors sparked my interest and imagination in science and engineering," said Hawryluk, who received B.S. and M.S. degrees in physics in 1972 and a Ph.D. in physics in 1974, all from MIT, before joining the staff at PPPL. "I've had a long-standing and deep interest in science and its impact on society. It was clear to me even in the sixties that new sources of energy would be important in the future as it had been historically. Fusion was an option, but the science and technology needed to be developed to make it practical."

During the past three decades, the magnetic fusion energy research leader has headed past and present fusion projects at PPPL—including the Tokamak Fusion Test Reactor (TFTR) project when it produced record breaking results—and contributed to ITER, the international fusion project being planned for construction in France.

"One of the things I've enjoyed most about PPPL is the range of opportunities I've had here, from being a physics operator of the Princeton Large Torus project to leading the TFTR experiments, to performing computer simulations and most recently managing operations at the Lab," Hawryluk said.

Submitted by DOE's Princeton Plasma Physics Laboratory