PNNL's Seiders has worked at the highest levels. Page 2.

DOE Pulse

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Research Highlights . . .

Back to basics

DOE's Ames Laboratory is helping answer the fundamental question, "How much energy does it take to ionize or dissociate specific molecules?" If chemists can obtain accurate energy data for various molecular species, they can use the data to better predict reaction rates for the chemicals they want to combine—an essential step in modeling problems in atmospheric, plasma and combustion chemistry. Senior chemist Cheuk Ng is searching out this basic energy data, doing much of his research at the Vacuum Ultraviolet Facility he designed for the Advanced Light Source's Chemical Dynamics Beam Line, located at DOE's Lawrence Berkeley National Laboratory. The VUV facility is considered the best in the world for doing ion chemistry.

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New process promises more reliable micromachines

A new five-level polysilicon surface micromachining process pioneered at DOE's Sandia National Laboratories promises that future microelectromechanical systems (MEMS) will be more reliable and capable of doing increasingly complex tasks. The technology could become the industry standard, replacing more commonly used two- or three-level approaches. MEMS, complex machines with micron-size features, can be found in a variety of products, including optical devices, computer game joy sticks, car airbag sensors, inkjet printers, projection displays and more. They are so small that they are almost imperceptible to the human eye and have moving parts no bigger than a red blood cell.

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Machine reaches new level

Recently the PEP II collider at DOE's Stanford Linear Accelerator Center achieved the highest luminosity ever reached by any electron-positron collider, 10^{33} events per square centimeter per second. Luminosity is a measure of the rate at which interesting events occur—in this case, production of particles known as B mesons. Physicists hope that the study of these particles will lead to a better understanding of CP violation and the Standard Model. Three Bay Area labs collaborated in building PEP II: Berkeley Lab, Livermore Lab and SLAC.

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X-rays confirmed at Jefferson Lab

The Free Electron Laser (FEL) at DOE's Thomas Jefferson National Accelerator Facility (Jefferson Lab) has successfully demonstrated the production of sub-picosecond pulses of soft X-rays by Compton scattering of the IR laser pulse off of the electron pulse. There are very few ps or sub-ps sources of X-rays in the world and the addition of this capability to the suite of tools offered by the Jefferson Lab FEL is of value to scientists and researchers in atomic physics, materials science and accelerator physics.

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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).

Trapping the moveable beast

Researchers at the DOE's Idaho National Engineering and Environmental Laboratory are working on a way to sop up contaminating low-level radioactivity from groundwater and immobilize it underground until the radioactivity is spent. Robert W. Smith and colleagues propose to use calcite, a mineral that forms naturally in arid western environments such as INEEL's, to take up strontium-90 and other divalent metals from subsurface water.

INEEL geochemist Smith leads the multi-institution collaboration that includes INEEL microbiologist Rick S. Colwell, University of Toronto geomicrobiologist F. Grant Ferris, INEEL analytical chemist Jani Ingram, and Portland State University microbiologist Anna-Louise Reysenbach. Together, the researchers received a 3-year, $900,000 grant.

Since strontium-90 can replace calcium in the molecular structure of the calcite, conditions that increase the rate at which calcite is formed should remove the metal from the groundwater. And, calcite enveloping the contaminant should trap it within in the mineral for eons, long enough for the strontium-90 to decay completely.

This basalt core sample from between 200 and 400 feet below the surface contains air pockets in which calcite material crystals grew.

The researchers will enlist naturally occurring microbes to increase the pH in localized regions rich in strontium-90, thereby speeding up the process of calcite formation and strontium entrapment.

Initial laboratory experiments will focus on the chemistry of calcite formation in simulated subsurface conditions. While Smith will examine the geochemistry of the reaction, Colwell, Ferris, and Reysenbach will determine ways to characterize and stimulate the naturally occurring bacteria to speed the formation. Ingram will analyze the resulting mineral composition in the laboratory.

Smith brought together a large and diverse group of researchers because the natural world doesn't usually behave like isolated experiments in the lab. He said, "It is nontrivial to reproduce a 20-year process in a six-month experiment. And that's why collaboration is so important to the success of this project."

Submitted by DOE's Idaho National Engineering and Environmental Laboratory

From making policy to making policy work

Until five years ago, Barbara Seiders worked at the highest levels of international security policy. She served as science advisor to an ambassador and a special assistant in the office of the Director of the Arms Control and Disarmament Agency (ACDA) and worked directly with former Soviet President Gorbachev.

Seiders left the world of high-level policy-making for more "hands-on" experience when she joined DOE's Pacific Northwest National Laboratory in 1994. She now manages Pacific Northwest's Chemical and Biological Defense program, which she suggests is "the nation's best kept secret."

"Many people don't know that Pacific Northwest has outstanding scientists conducting leading-edge work in chemical and biological defense including detection, threat analysis and development of forensic tools," Seiders said. For example, Pacific Northwest is developing a rapid mass spectrometric characterization tool for real-time identification of biological organisms in the field.

Before leaving ACDA, Seiders was the science advisor to Ambassador James Goodby, who negotiated international agreements on the Safe, Secure Dismantlement of Nuclear Weapons. Pacific Northwest and other DOE laboratories support the Department of Defense Cooperative Threat Reduction Program, which was established to implement these agreements.

Having participated in the evolution of national and international policies, Seiders now enjoys the chance to be involved with the research needed to make these policies work. She particularly enjoys the opportunity to guide talented scientists making crucial contributions in chemical and biological defense.

Seiders offers simple advice when it comes to protecting against unconventional risks, such as biological weapons. "One of the strongest tools we have to protect ourselves against a planned terrorist or military attack by biological weapons is information," she said.

She shares her message about prtecting against biological threats with first responders, civic organizations and recently with more than 600 lab scientists from the Center for Disease Control and the Public Health Service. "Education is a different kind of defense," she said.

Submitted by DOE's Pacific Northwest National Laboratory