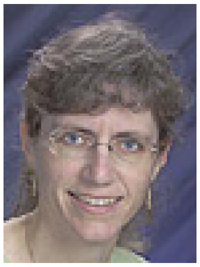

PNNL's Karen Wahl

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

PNNL launches NASA micro-mission

Scientists at DOE's Pacific Northwest National Laboratory will begin development of an extraordinarily lightweight and compact system to produce rocket propellant in space, and regenerate breathable air for interplanetary travel. Designed for NASA under a new $13.7 million contract, the microtechnology system will use modular banks of identical microchannel components, providing redundancy while enhancing safety and reliability. PNNL researchers say gravity independence and reduced size and weight make microtechnology an ideal approach. Eventually, researchers hope to use the same principles on a larger scale for a manned mission to Mars in the 2030 timeframe. The NASA contract is four times larger than any PNNL has previously had with NASA.

[Geoff Harvey, 509/372-6083, geoffrey.harvey@pnl.gov]

Fingerprint detection device developed

A researcher at DOE's Savannah River National Laboratory has developed an innovative, lightweight tool for fingerprint detection. The BritePrint™ device, designed to be low-cost, is a small, battery-powered, high intensity light source that uses light-emitting diodes (LEDs) to produce light that causes areas brushed with dye to be visibly fluorescent. Wearing light-filtering goggles makes markings in these areas easily detectible by the human eye. The BritePrint device would typically be worn on a headset for hands-free operation. Its small design allows it to illuminate hard-to-reach places. It can also be used with a video camera for recording critical crime scene evidence. Sequiam Corporation of Orlando, Fla., has licensed BritePrint to manufacture and commercialize the patented device.

[Angeline French, 803/725-2854, Angeline.French@srs.gov]

X-rays illuminate work of ancient mathematician

Researchers at DOE's Stanford Synchrotron Radiation Laboratory have used synchrotron X-rays to read the work of Archimedes.The writings, copied by a scribe in the 10th century, hide beneath the text of a 13th century prayer book. To conserve expensive parchment, the pages were scraped clean and reused. Scholars reconstructed many pages with UV light. But several pages are completely obscured by 20th century forgeries of Byzantine religious illuminations. Researchers used X-ray fluorescence (XRF) to peer underneath the forgeries. Iron pigment in the ink fluoresces when hit with X-rays, allowing researchers to see the text for the first time.

[Neil Calder, 650/926-8707, Neil.Calder@slac.Stanford.edu]

First single-crystal niobium accelerating cavity

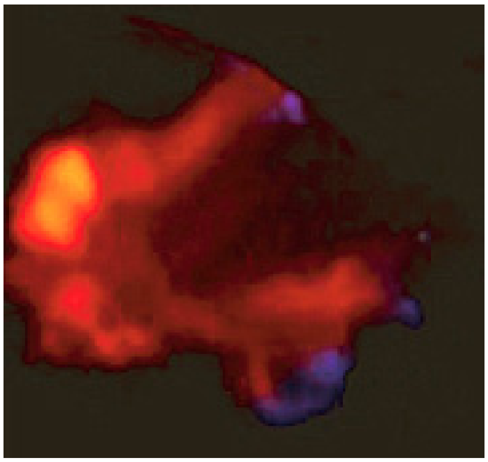
The Institute for Superconducting Radiofrequency Science & Technology at DOE's Jefferson Lab has fabricated and tested a single-cell accelerating cavity made from a single crystal of niobium. Like salt crystals, niobium crystals can be grown in a range of sizes. Usually, these crystals are crushed to a small, uniform size during the accelerator cavity fabrication process to make the metal easier to stamp into a desired shape. A JLab team instead used a process called deep drawing to coax a single, large crystal of niobium into the correct shape. This new fabrication process could reduce the cost and assembly time of world-class accelerator cavities.

[Kandice Carter, 757/269-7263, kcarter@jlab.org]

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).

SLUG: Seeing light-emitting diodes in a new light

A collaboration between Los Alamos and Sandia National Laboratories scientists has resulted in a new the development of the first completely inorganic, multi-color light-emitting diodes (LEDs) based on colloidal quantum dots encapsulated in a gallium nitride (GaN) semiconductor. The work represents a new "hybrid" approach to the development of solid-state lighting. Solid-state lighting offers the advantages of reduced operating expenses, lower energy consumption and more reliable performance.



A close-up of one of the nanocrystals LED structures operating in air at ambient room temperature. The emission wavelength of ~620 nanometer (orange) was obtained by using nanocrystals of 5.2 nanometers in diameter.

In research published in a recent issue of the scientific journal Nano Letters, the team reports on the first successful demonstration of electroluminescence from an all-inorganic, nanocrystal-based architecture where semiconductor nanocrystals are incorporated into a p-n junction formed from semiconducting GaN injection layers. The new LEDs utilize a novel type of color-selectable colloidal quantum dots and takes advantage of emerging GaN manufacturing technologies.

According to Klimov, who leads the nanocrystal-LED research effort at Los Alamos, "there are a number of technologies could benefit from energy efficient, color-selectable solid-state lighting sources ranging from automotive and aircraft instrument displays to traffic signals and computer displays. Semiconductor nanocrystals, known also as quantum dots, are attractive nanoscale light emitters that combine size-controlled emission colors and high emission efficiencies with chemical flexibility and excellent photostability. The use of nanocrystals in light-emitting technologies has, however, always been hindered by the difficulty of making direct electrical connections to the nanocrystals. By putting the quantum dots between GaN injection layers, we've gotten around this difficulty. The GaN substrates used for the LED structures were provided by researchers at Sandia National Laboratories."

The research was funded by DOE's Office of Basic Energy Sciences and the Los Alamos Laboratory-Directed Research and Development program.

.Submitted by DOE's Los Alamos National Laboratory

Wahl uses love of problem solving to address national security issues

Karen Wahl

A college chemistry professor helped fan Karen Wahl's passion for science and problem solving leading her to a career in analytical chemistry. It's a path that both Karen and DOE's Pacific Northwest National Laboratory have found to be rewarding.

"I love the world of chemistry because the work is challenging and always different. It provides an opportunity to use math, physics, chemistry and biology to solve real-world problems. And the ability to conduct that work in a multi-disciplinary research laboratory is what drew me to PNNL," says Karen, an analytical chemist at the laboratory.

Karen came to PNNL in 1991 from Michigan State University on a postdoctoral appointment to work under Richard D. Smith who was developing new mass spectrometry techniques. For the past eight years, Karen's focus has been on using mass spectrometry for microbiology studies in support of national security.

She had a key role in the development of MALDI-MS for pathogen identification. MALDI-MS is designed to quickly identify bacteria for safe detection and post analysis in the event of biological terrorism. MALDI-MS is an acronym for Matrix Assisted Laser Desorption/Ionization—Mass Spectrometry.

Karen balances her time in the laboratory helping to solve national security issues with raising two small children and enjoying the outdoors in the Northwest. She and her family enjoy snowboarding, wind surfing and biking.

Karen shares that her eight-year-old daughter and six-year-old son frequently march into the kitchen to "do experiments," seeing what dissolves and what happens when different things are mixed together. What do you expect when both your parents are analytical chemists at a national laboratory?

Karen's research has resulted in three U.S. patents and more than 30 peer-reviewed scientific publications.

Submitted by DOE's Pacific Northwest National Laboratory