PPPL's Tiana Dodson

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

A plasmonic whispering gallery for future nanolasers

Nanoscale lasers promise intriguing applications like superfast communications and data handling and optical microchips for instant chemical analyses. Xiang Zhang of DOE's Lawrence Berkeley National Laboratory and physicist Kerry Vahala of CalTech led the team to a breakthrough in laser miniaturization with a silver-lined silica microcavity. Quantized oscillations of the metal's free-electron gas coupled with photons to form plasma polaritons, which pushed optical waves in a continual circle around the surface of the smooth, spherical cavity at low power loss. The result of this "whispering gallery" effect is an order of magnitude better quality than any previously achieved by a nanolaser.

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Mobile locator available for alternative fueling stations

Driving an alternative fuel vehicle used to require a little homework to find the nearest fueling station—but not anymore. Drivers on the go now can access DOE's Alternative Fueling Station Locator using a cell phone, BlackBerry, or other personal digital assistant (PDA). The station locator allows drivers to find the five closest biodiesel, electricity, E85 (ethanol), hydrogen, natural gas and propane fueling sites. Maps, detailed driving directions and an instant phone connection to the station can be accessed at www.afdc.energy.gov/stations/m/. The mobile station locator was developed by DOE's National Renewable Energy Laboratory as part of the Alternative Fuels and Advanced Vehicles Data Center Web site.

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LLNL donates water treatment units to research facility

Two water treatment units that had been inactive and stored at DOE's Lawrence Livermore Lab were recently transported to the University of California, Santa Cruz (UCSC), Center for Integrated Water Research. The reverse osmosis units will play an important role in the Center's Water Teaching and Research Laboratory, or WaterLab. Robin Newmark, deputy program leader in Energy and Environmental Security in LLNL's Global Security Principal Directorate, coordinated the relocation efforts. "Safe and reliable fresh water is critical to human life," Newmark said. "The water industry faces many challenges and is looking to higher education to help solve those problems."

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Fuel cells with liquid tin anodes studied

Researchers at DOE's National Energy Technology Laboratory completed the first in a series of studies of electrode behavior for a solid oxide fuel cell operating with a molten tin anode. The researchers focused on isolating and measuring the various kinetic parameters of the anode: tin oxidation at the anode/electrolyte interface, oxygen transport through the liquid tin anode, and fuel oxidation/tin reduction at the fuel/anode interface. Molten metal anodes can consume directly solid fuel sources such as carbon and coal dust, removing the need for a gasifier. Liquid tin anodes also offer a higher degree of tolerance to coal contaminants that poison conventional nickel-based anodes.

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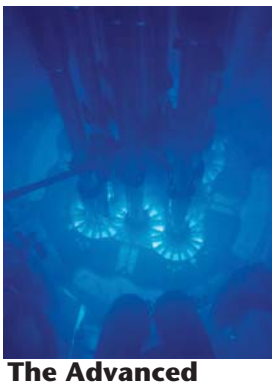
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. ***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).

Universities study materials in nuclear test reactor

Nuclear energy is receiving increasing attention as the nation strives to meet its energy needs while curbing carbon dioxide emissions. At least 30 nuclear plants are currently under construction around the world, with dozens more planned or ordered. But tomorrow's advanced nuclear reactors will require advanced materials.



The Advanced Test Reactor's serpentine fuel arrangement lets researchers irradiate materials under varied experimental conditions.

DOE's Idaho National Laboratory is leading collaborations with universities and other national labs to develop and test these materials. The Advanced Test Reactor National Scientific User Facility, which opened INL's unique nuclear testing capabilities to the academic community in 2007, recently selected new university partner experiments and facilities.

The experiments will use the ATR and partner facilities to study how aluminum-hafnium alloys, a new silicon carbide-based material, reactor pressure vessel steels and other advanced materials hold up under prolonged exposure to high temperatures and radiation.

Nuclear power reactors generate electricity by using heat from the fission of uranium fuel to drive a steam turbine. The fission process also releases neutron radiation, which can gradually degrade materials used in the protective fuel cladding and the reactor's core vessel where the fission occurs.

The ATR allows scientists to find out which materials can withstand such an extreme environment. Researchers can place samples into the ATR and bombard the material with neutrons to simulate the radiation in a nuclear power reactor. Each year, the User Facility solicits experiment proposals and evaluates university research submissions to choose experiments for testing.

Teams representing Utah State University, Massachusetts Institute of Technology, University of California-Santa Barbara and the University of Wisconsin were chosen from the most recent round of proposals. These teams include collaborators from two other universities and DOE's Oak Ridge National Laboratory. These projects join five experiments the user facility selected in 2008.

The University of Michigan Irradiated Materials Testing Laboratory and the Wisconsin Characterization Lab for Irradiated Materials were also selected as new partner facilities.

Submitted by DOE's Idaho National Laboratory

PPPL's Tiana Dodson lends metrology skills to German stellarator

Tiana Dodson

Tiana Dodson, a mechanical engineer at DOE's Princeton Plasma Physics Laboratory (PPPL), is applying her skilled background in metrology to process data on the Wendelstein 7-X stellarator in Germany. "It's going to be fantastically challenging. I'll be using two new software packages and working on a large piece of the project," says Dodson, who begins a six-month assignment in April at the Greifswald Institute of the Max Planck Institute for Plasma Physics (IPP). The stellarator is a large magnetic fusion energy experiment being built at IPP.

Dodson was the lead engineer on the photogrammetry software and systems at the National Compact Stellarator Experiment (NCSX) at PPPL, and worked on the NCSX closeout. Photogrammetry is remote sensing technology that employs photography and retro-reflective targets to make high-precision measurements. It is a method of metrology, the science of measurement.

"My work on the NCSX project included making high-precision measurements of as-built parts and assemblies," Dodson says. "At PPPL, I positioned targets where measurements were needed, took photos, and analyzed the data with photogrammetry software to determine the measurements." She looked for magnetic coil deformation following welding, which has a tendency of heating up the coils and could change their shapes. In Germany, she will be at the processing end of the project. She will employ her metrology skills to ensure that the complicated Wendelstein 7-X stellarator structure will be fabricated and assembled without spacial interferences.

Dodson joined PPPL as a summer intern in 2006 after receiving a bachelor's degree in mechanical engineering from Howard University and is now a regular employee. She is a member of the American Society of Mechanical Engineers and the Coordinate Metrology Systems Society. She also is active in PPPL's outreach activities, including co-organizing the Young Women's Conference, volunteering at science bowls, speaking to visiting student groups about careers in engineering, and serving as a tour guide.

Dodson says she intended to become a math teacher but a high school experience shadowing an engineer shifted her focus to engineering. "I was in the tenth grade when I spent a day at an engineering firm," she says. "And I always tinkered with things. I liked to take things apart and see how they worked."

Submitted by DOE's Princeton Plasma Physics Laboratory