ORNL's Laetitia Delmau

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

PNNL to lead $10 million NIH 'virtual lung' project

DOE's Pacific Northwest National Laboratory is leading a $10-million, five-year multi-institutional National Institutes of Health study to devise 3-D imaging and computational models of unsurpassed detail of respiratory systems in humans and other mammals. The grant will enable PNNL and its partners to devise imaging and simulation techniques that offer a better understanding of the fate of airborne contaminants in the respiratory system. The new tool could lead to improved treatments for asthma and other respiratory ailments. The research will culminate in a "pulmonary physiome," a web-based model for researchers and clinicians.

[Bill Cannon, 509/375-3732; cannon@pnl.gov]

Size matters in determining strength

A new research technique developed by a team of researchers including Jeff Florando of DOE's Lawrence Livermore National Laboratory has shown that the mechanical properties of nickel and some of its alloys—such as their ability to resist permanent deformation under stress—are directly affected by the material's dimensions. The research, reported recently in *Science,* suggests that as the size of a specimen shrinks to a few microns (millionths of a meter) or less, the mechanisms by which the sample deforms can be strongly affected. "This finding is important because of the increasing use of materials with micron-size dimensions in the miniaturization of electronic devices and other equipment," Florando said.

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ORNL scientists hang with fast crowd

NASCAR teams seeking a racing edge are making pit stops at DOE's Oak Ridge National Laboratory for high-tech tips to better performance. Racing teams, some of them national recognized, are turning to ORNL's High Temperature Materials Laboratory to study ways to enhance a car's ability to race at high speeds. The HTML helps solve problems in advanced energy conversion systems—such as race cars—to make them more efficient and reliable. The HTML's instruments have extensive capabilities for characterizing the microstructure, microchemistry and physical and mechanical properties of materials over a wide range of temperatures—valuable capabilities when dealing with high levels of heat and stress produced by stock cars..

[Fred Strohl, 865/574-4165; strohlhf@ornl.gov]

Advanced direct contact condenser

An advanced direct-contact condenser developed at DOE's National Renewable Energy Laboratory has improved production efficiency by five percent, cut the chemical cost for emission abatement in half and increased overall power generation by 17 percent at the Geysers geothermal power plant in California. This proven technology, licensed to Alstom Energy Systems, Inc., can be used for fossil-fuel power plants, food processing or any other industrial process where condensers are employed. The ADCC increases the efficiency and generating capacity in electric power plants while reducing pollution by using sophisticated geometric shapes to provide the most efficient mixing of steam and water.

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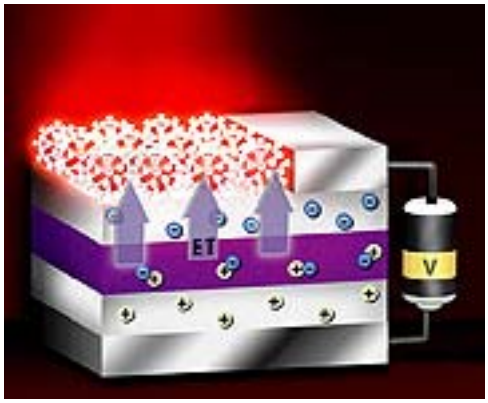
DOE Pulse highlights work being done at the Department of Energy's national laboratories. DOE's laboratories house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions.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

Wishing on a quantum well

A collaboration between scientists at Los Alamos and Sandia National Laboratories recently produced a new method for exciting light emission from nanocrystal quantum dots using a device called a "quantum well". A quantum well is a semiconductor structure in which an electron is sandwiched between two barriers so that the electron's motion is confined to only two dimensions.

The discovery provides a novel way to supply energy to quantum dots without wires and paves the way for a potentially wider use of tunable nanocrystalline materials in a variety of novel light-emitting technologies ranging from electronic displays to solid-state lighting.



Quantum Well

In research published earlier this summer in the scientific journal Nature, the team describes their method for using non-contact, non-radiative energy transfer from a quantum well to excite light emission from an adjacent layer of nanocrystals. In a real-life device, the quantum well would be pumped electrically in the same way a common quantum-well light-emitting diode is pumped.

According to Victor Klimov, a scientist in Los Alamos' Chemistry Division, the transfer of energy is fast enough to compete with exciton recombination in the quantum well, and that allows us to "move" more than 50 per cent of the excitons to adjacent quantum dots. This high efficiency of energy transfer in combination with the exceptional luminescent properties of nanocrystal quantum dots make hybrid quantum-well/nanocrystal devices feasible as efficient sources of light of any color—or even white light.

In addition to Klimov, other investigators on the nanocrystal quantum dot project include Daniel Koleske from Sandia along with Marc Achermann, Melissa Petruska, Simon Kos and Darryl Smith from Los Alamos.

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

ORNL's Delmau excels on land and water

Laetitia Delmau

Laetitia Delmau's progression from her native France to DOE's Oak Ridge National Laboratory has provided opportunities both in research and recreation. The Marseilles native, now a researcher in ORNL's Chemical Sciences Division, came to the United States and ORNL first as a student in 1992.

Following frequent stints at ORNL including summer terms and a postdoctoral appointment, Laeitia joined the Lab's research staff in 2000, where her work has focused on chemical separations work toward nuclear waste treatment.

Specializing in studies of separation science with an emphasis on thermodynamics, radiochemistry and physical chemistry, she was instrumental in the development of a selected process for removing radioactive cesium from nuclear waste material.

Those types of successes have recently brought recognition, including selection as one of this year's TR100 group of the world's top young innovators selected by the Massachusetts Institute of Technology's *Technology Review*.

Besides excelling in her research, Lætitia has also continued her French hobbies of playing clarinet, where she performs in a community pops ensemble, and scuba diving. Although she prefers diving in the clear waters off the Florida Keys, her many volunteer activities include local river and lake cleanups.

Add to those activities two American pursuits: target shooting and whitewater kayaking. Lætitia shoots weekly at a local sports society, enough to earn a distinguished expert rating with a .22 cal. rifle. Mountain streams have led to a newfound enthusiasm for another water sport.

"It's heaven around here for kayaking," she says.

On dry land, her energies have resulted in more than 40 open-literature publications including 15 journal articles, a book chapter and three patents.

Submitted by DOE's Oak Ridge National Laboratory