PPPL's Charles Skinner

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

Number 230 March 12, 2007

Research Highlights . . .

Screening tool helps detect explosives

Airport screeners, law enforcement and military personnel and others have a new ally in the war against terrorism —a portable, sensitive and accurate explosives detector developed by Lawrence Livermore National Laboratory researchers.

The new explosives detector, called the Easy Livermore Inspection Test for Explosives, or ELITE, is highly sensitive to more than 30 different explosives, making it one of the most effective explosive detection systems available, said John Reynolds, who led the technology's development and is the deputy director of LLNL's Forensic Science Center.

"Our goal is to develop new technology or take existing technology, make it better, and then adapt it for use in the field," Reynolds said.

Using the ELITE card, security personnel, law enforcement officials and others can determine in real-time—within the space of one to four minutes—whether explosives are present, according to Reynolds.

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A new target for the treatment of breast cancer

The active ingredient in a drug currently being tested to treat rheumatoid arthritis might also one day serve as an effective means of treating one of the deadliest forms of breast cancer. Researchers with DOE's Lawrence Berkeley National Laboratory (Berkeley Lab) have demonstrated that inhibiting the activity of the protease enzyme known as TACE can deprive tumor cells of a key factor needed for their proliferation. TACE is strongly present in a form of breast cancer which responds poorly to current therapies.

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NREL, Xcel release study on Smart Grid, plug-in hybrid electric vehicles

DOE's National Renewable Energy Laboratory and Xcel Energy recently announced the results of a six-month study related to plug-in hybrid electric vehicles (PHEVs) and how an increase in their popularity could affect Colorado's electricity grid. The study found PHEVs could reduce the overall expense of owning a vehicle and, with the help of smart-grid technologies, eliminate harmful vehicle emissions by up to 50 percent. The study also revealed these cars could save owners more than $450 in fuel costs each year compared to a traditional combustion engine vehicle. Future studies will include PHEV field tests and evaluate the ability to manage recharging in conjunction with the availability of renewable energy sources.

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NETL joins forces with medical school to develop sorbents

DOE's National Energy Technology Laboratory is working with the West Virginia University School of Medicine and the University of Pittsburgh Chemical and Petroleum Engineering Department to produce sorbents for removing carbon dioxide from fossil energy combustion gases using electrostatic layer-by-layer self-assembly (LBL). LBL is used to treat surfaces of medical implants to prevent infections to the patients or to deliver precise doses of medicine. It is regarded as the most promising method to prepare multilayer nanocoatings of controlled thickness and composition. The researchers will use LBL to apply a uniform deposition of amines onto substrates to produce more effective sorbents.

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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).

Bilateral Collaboration Fosters Advances in Neutron Capture Therapy Research

DOE's Idaho National Laboratory is entering its seventh year of collaborative research with the National Atomic Energy Commission of Argentina (CNEA) on experimental Boron Neutron Capture Therapy (BNCT) treatments for a lethal form of brain cancer and other malignancies. The project is funded through the DOE's National Nuclear Security Administration (NNSA).

Scientists at INL have been researching these techniques for some 20 years. The new work in this important field of nuclear medical research will be conducted under the terms of the US-Argentina arrangement for "Technical Exchange and Cooperation in the Area of Peaceful Uses of Nuclear Energy" that was signed in October 1997. The treaty calls upon all parties to the Treaty to facilitate the fullest possible exchange of equipment, materials, and technical information for the peaceful use of nuclear energy. NNSA's Sister Laboratory Program is one way the United States meets these obligations.

The Sister Laboratory Program has been of tremendous value for both sides. The BNCT area has achieved its objectives on every front, and the technology transfers, personnel exchanges, joint publications and other activities that this program has enabled have set the stage well for possible expanded future INL collaboration with CNEA.

Specifically, the collaboration has involved experimental dosimetry and neutronic characterization of three reactor-based neutron sources used for BNCT research in Argentina, development and implementation of state-of the art experimental techniques for analytical chemistry, and a multiyear joint effort in BNCT preclinical radiobiology studies using mixtures of boron delivery agents having complementary uptake mechanisms. One of these agents is synthesized using a process that is partially based on technology developed and patented by INL. This collaborative effort has contributed to the understanding of the radiobiology of BNCT, to improving the therapeutic efficacy of this technique, and to extending its potential application to the treatment of oral cancer and, more recently, to liver metastases, which will be the primary subject of work conducted during 2007.

Submitted by DOE's Idaho National Laboratory

Dust in fusion plasmas fascinates Charles Skinner.

Charles Skinner

A physicist at DOE's Princeton Plasma Physics Laboratory (PPPL), Skinner is involved in experimental research and diagnostics on the National Spherical Torus Experiment (NSTX). His work on the fusion experiment includes studies of dust, deposition, and spectroscopy support to track plasma purity. Plasma is a hot, ionized gas used as fusion fuel. Contaminated plasma dilutes the fuel, reducing power output.

"I have been working on dust since the deuterium-tritium days on the Tokamak Fusion Test Reactor (TFTR), circa 1995. There we observed that tritiated dust, which is a safety concern since it is radioactive, could self-charge due to the beta decay and levitate in electrostatic fields. Tritiated particles are more mobile than other particles, and this should be considered in assessing tokamak accident scenarios and in occupational safety," says Skinner. TFTR operated at PPPL from 1982 to 1997, performing extensive experiments with plasmas composed of 50/50 deuterium/tritium - the fuel mix required for practical fusion power production. Deuterium and tritium are isotopes of hydrogen.

"Dust levels will be much higher for next-step tokamaks such as ITER, a large international fusion experiment being built in France. Dust must be diagnosed and controlled for safety reasons and to prevent plasma contamination," Skinner says. "The technology to do this is in its infancy and the best way to develop it is to do trials on small tokamaks such as NSTX."

Skinner says his desire to tackle physics problems began as a youngster. "I have always been amazed and curious about the world and been eager to find out how it worked. One of my earliest memories is of standing on a chair, looking out the window at some newly fallen snow, and deciding that snow was white to reflect sunlight so it would last longer. As a teenager I was fascinated by relativity and atomic physics, and really excited to see Schrödinger's equation in a book at high school. Even though I didn't understand it at the time, I knew it was a powerful clue as to how the universe was made," Skinner notes.

Skinner grew up in post-war England, received a BSc and a Ph.D. from Imperial College, University of London, and joined PPPL in 1980 as a researcher working on X-ray lasers. Later he became involved with tritium diagnostics for TFTR. His NSTX deposition and dust studies are an evolution of his tritium retention work on TFTR. "Dust is both a mundane object of housekeeping and absolutely fascinating," Skinner says.

Submitted by DOE's Princeton Plasma Physics Laboratory