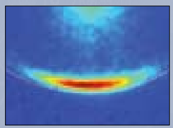
FLC NewsLink

April/May 2008

T2 Inside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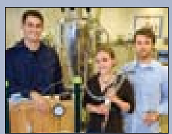
Nano X-Ray Resolution, page 6

T2 Events

Aberdeen Proving Ground Industry and Technology Event Focused on C4ISR
Aberdeen, Md.
June 18-19, 2008

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AUTM Central Region Meeting
Cleveland, Ohio
July 14-16, 2008

•

SPIE Optics & Photonics 2008
August 10-14, 2008
San Diego, Calif.

•

LES Annual Meeting 2008
Orlando, Fla.
October 19-23, 2008

•

2008 Mid-Atlantic Bio
October 22-24, 2008
Dulles, Va.

T2 Fact

The microwave oven was a by-product of another technology. During a radar-related research project around 1946, Dr. Percy Spencer, a self-taught engineer with the Raytheon Corporation, noticed something very unusual. He was testing a new vacuum tube called a magnetron when he discovered that the candy bar in his pocket had melted. This intrigued Dr. Spencer, so he placed some popcorn kernels near the tube, and he watched as the popcorn sputtered, cracked and popped all over his lab.

- Mary Bellis, About.com

Argonne researchers load a lithium-ion battery pouch into an insertion device x-ray beamline in order to evaluate the electrode material structure stability during charging and discharging.

Argonne, Industry Fast-Track New Battery

High power lithium-ion batteries are a promising alternative to the nickel metal hydride batteries currently used in hybrid electric vehicles, offering much higher power and energy.

However, these lithium-ion batteries have been limited by their calendar life, thermal abuse tolerance, cost, and cold startup performance.

To address these limits, Argonne National Laboratory researchers have invented new, stabilized electrode materials. The battery industry has previously focused mainly on a lithium-ion battery system with a graphite anode—a system with flaws related to calendar life, safety, cost, and low-temperature performance. Argonne scientists have discovered a new battery system based on manganese oxide and nano lithium titonate. This new system—which shows the highest power ever reported—provides long life, with outstanding safety characteristics and good low-temperature performance.

Argonne's structurally integrated composite cathodes utilize a highly active material layered with a stable, less active structure for safety, enhancing the stability, electrochemical capacity, and safety of electrode materials in lithium-ion batteries. "These new composites have great promise to improve battery performance significantly," said Argonne's Mike Thackeray.

The new composite material is the cathode component of electrochemical cells in these advanced lithium-ion batteries. This invention's composite cathode structure substantially improves the performance of lithium-ion batteries. These benefits include increased

Argonne's New Battery, page 4

The State of U.S. S&T Enterprise

by Gary Jones
FLC Washington, DC Representative

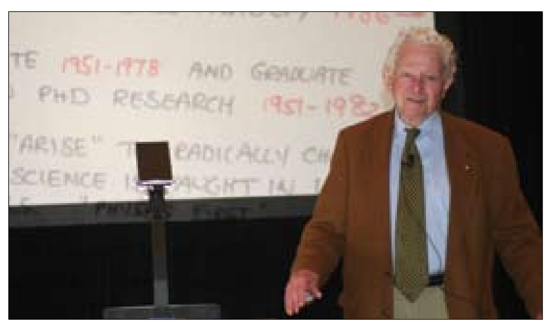
Greetings from DC. The National Science Foundation (NSF) recently issued "Science and Engineering Indicators 2008," the 18th in a series of biennial reports "designed to provide a broad base of quantitative information about U.S. science, engineering and technology for use by public and private policymakers." As noted in this column on the occasion of the 2006 report, this document is one of the best sources of data on the general state of the U.S. science and technology (S&T) en-

DC on T2, page 5

FLC Conference Attracts Record Number

From May 5-8, 2008, Portland, Oregon became the epicenter of technology transfer (T2) activity as over 380 researchers, scientists, and technology commercialization experts met for the 2008 FLC national meeting, *On the Innovation Trail.*

The conference provided attendees with everything from technology transfer training to a presentation by a high-energy, Nobel Prize-winning physicist.



Nobel Prize-winning physicist Dr. Leon Lederman presents during the FLC national meeting in Portland, Oregon, May 6, 2008.

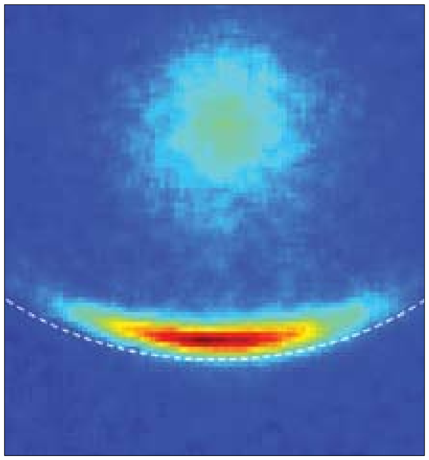
Leading off the conference were the Fundamentals, Intermediate, and Advanced training sessions.

These sessions included an interactive technology commercialization course given by author and industry executive Wendy Kennedy

2008 FLC Meeting, page 4

FedLabsFlash | Technology Transfer Notes

NIST Researchers Cool Rare Element



Color-enhanced image of a cloud of erbium atoms trapped and cooled, and a narrow-line MOT using a single laser beam. The laser beam is coming down from the top of the image, which measures about 1 millimeter square. The atoms collect along the ellipse of a constant magnetic field (dashed line) where they come into resonance with the laser.

A research team from the National Institute of Standards and Technology (NIST) and the University of Maryland has succeeded in cooling atoms of a rare-earth element, erbium, to within two-millionths of a degree of absolute zero using a novel trapping and laser-cooling technique.

Their recent report is a major step toward the capability to capture, cool and manipulate individual atoms of erbium, an element with unique optical properties that promises highly sensitive nanoscale force or magnetic sensors, as well as single-photon sources and amplifiers at telecommunications wavelengths. It also may have applications in quantum computing devices.

The strongly counterintuitive technique of "laser cooling" to slow down atoms to very low speeds—temperatures close to absolute zero—has become a platform technology of atomic physics. Laser cooling combined with specially arranged magnetic fields—a so-called magneto-optical trap (MOT)—has enabled the creation of Bose-Einstein condensates, the capture of neutral atoms for experiments in quantum computing and ultra-precise timekeeping and spectroscopy experiments. The technique originally focused on atoms that were only weakly magnetic and had relatively simple energy structures that could be exploited for cooling; however, two years ago a NIST team showed that the far more complex energy structures of erbium, a strongly magnetic element, also could be manipulated for laser cooling.

Navy Techs for MBAs

The Office of Naval Research, in collaboration with the Center for Commercialization of Advanced Technology (CCAT) and SSC San Diego, is in its second semester of a pilot program that puts viable Navy technologies in the hands of promising MBA students at San Diego State University. The students form teams and attempt to commercialize the technologies.

Three Navy technologies were undertaken in fall 2007 with promising results, and five technologies are currently being worked by the student teams for spring 2008. The goal of the program is to offer commercialization assistance to Navy technology transfer offices, tap into MBA student knowledge and expertise, and capitalize on the already growing intellectual property licensing market.

A successful pilot program could lead to a national rollout into MBA programs across the country.

For further information, contact Stephen Lieberman at 619-553-2778 or Stephen.lieberman@navy.mil.

Personius Added to Reclamation Leadership

Tim Personius of Boise, Idaho, has been selected as the new Deputy Regional Director for the Bureau of Reclamation's Pacific Northwest Region, announced Regional Director Bill McDonald.

Personius replaces Karl Wirkus, who accepted a position as Deputy Commissioner of Operations for Reclamation in Washington, D.C.

"Tim is a problem solver, focused on customer service, and truly understands what Reclamation is all about. I am extremely confident in the work that he will continue to do for the Region and Reclamation in his new position," said McDonald. "His involvement in complex and controversial water resources management issues has been invaluable."

"I am honored and humbled to be selected for this position," said Personius. "These are extraordinary times for water resource management. Water delivery in the face of climate change, growing populations, and endangered species is a tremendous challenge for the arid west. I'm excited to be able to play a part in tackling these issues, and proud that Reclamation has a leadership role in solving these complex problems."

CINT Wins DOE Secretary's Achievement Award

DOE Secretary Samuel Bodman (far left) conveys the Award of Achievement for the timely and efficient construction of the CINT complex to (left to right) William Ortiz, NNSA Sandia Site Office federal project director; Altaf Carim, DOE's Office of Basic Energy Sciences CINT program manager; Neal Shinn, Sandia CINT User program manager; and Ingrid Kolb, DOE Office of Management director.

Secretary of Energy Samuel Bodman presented the Sandia National Laboratories/Los Alamos National Laboratory (Sandia/LANL) Center for Integrated Nanotechnologies (CINT) with the Department of Energy Award for Achievement at the biannual DOE project management workshop in held in late March in Washington, D.C.

The $75 million project, completed on schedule and under budget, was one of two DOE engineering/construction projects to receive recognition in project management. The CINT project team was praised for effective management of the construction and instrumentation of two new research facilities totaling over 130,000 square feet of laboratory, cleanroom, office, and storage space.

Formally completed in April 2007, initial operations in the new facilities were able to start much earlier in 2006.

The integrated Sandia/LANL project team credited extensive intra-team communication and planning for their ability to respond to unanticipated challenges such as the LANL "stand-down," federal budget continuing resolutions, and construction cost escalations.

Now in its second year of operations, CINT is managed by a joint Sandia/LANL team, led by Codirectors Robert Hwang (Sandia) and Antoinette (Toni) Taylor (LANL).

FLC NewsLink

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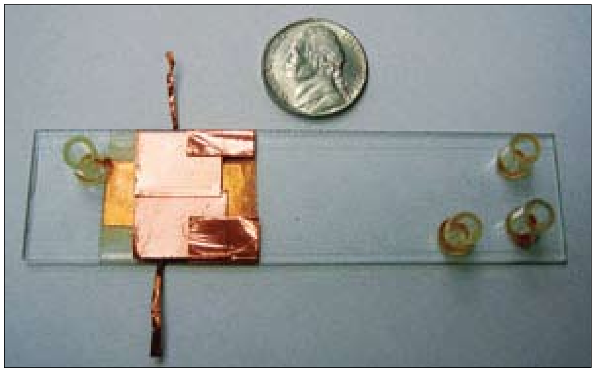
Tech Watch | *Laboratory Techs Ready for Transfer*

Food & Beverage Analysis



The Naval Research Laboratory has developed a tool – chip-based CE – with demonstrated capabilities for food and beverage analysis. Conventional chemistry is used in a highly miniaturized, "lab-on-a-chip" environment to detect sodium monofluoroacetate (a rodent poison) and various poisonous alkaloids, such as nicotine, strychnine, and aconitine, in beverages.

Additionally, this tool is being advanced for Navy use in the detection of explosives and other biological toxins in a liquid environment.

The tool is faster than other non-chip-based methods and is potentially portable. Applications include toxin testing in the manufacturing and analysis of foods and beverages, as well as explosive and other biological agent detection in a liquid environment.

NRL is seeking CRADA partners for the continued refinement of this technology.

For further information, contact the Technology Transfer Office at the Naval Research Laboratory, techtran@utopia.nrl.navy.mil.

NIH Tech for HIV Vaccinations

A National Institutes of Health technology pertains to conjugate polypeptide compositions that are designed to elicit antibody response against HIV. The peptides are conjugates of one gp41 capable of forming a stable coiled-coil structure and another gp41 capable of forming an alpha-helical structure. These structural elements of gp41 were identified as important for playing a role in HIV-1 cell entry. Compositions that elicit neutralizing antibodies against HIV have been elusive to date, but the subject technology may be important in realizing that goal.

Applications include HIV vaccines and neutralizing antibodies against HIV

More info: Susan Ano, Ph.D.; 301-435-5515; anos@mail.nih.gov

ARS's New Rubber-to-Latex Technology

Agricultural Research Service (ARS) scientists have developed a new technique for transforming guayule plants into a latex substitute. This technique allows more efficient transformation than earlier methods, allowing more rapid guayule improvement that should add value to guayule. Guayule is a shrub that is native to the desert regions of southwestern Texas and Mexico.

Guayule produces a latex rubber that is valuable because it is an alternative to conventional rubber. Guayule latex also possesses hypoallergenic properties, which may have significant medical implications. With this new technique, agronomically important genes can be more effectively transformed into guayule lines and ultimately boost the latex yield of guayule plants.

ARS's transformation technique uses pieces of leaves rather than the less efficient traditional method of transforming the shoot nodes.

This new technique is no more expensive than other techniques currently being used. This invention should lead to large-scale production runs for guayule transformation, which could have major industrial implications.

More info: Tara T. Weaver-Missick, tara.weavermissick@ars.usda.gov, 301-504-6965

In her laboratory, plant physiologist Katrina Cornish checks seedlings produced for use in experiments to improve guayule plants. The experimental, allergen-free latex products shown were made from guayule.

2008 FLC Meeting, from page 1

FLC Chair Scott Deiter discusses how the FLC can better work with members of industry with Joseph Fox of Ashland Industries during the 2008 FLC national meeting.

and courses on intellectual property, Cooperative Research and Development Agreements, licensing practices, managing a T2 office, and an introduction to T2 mechanisms.

Day 2 began with a keynote presentation by internationally renowned physicist Dr. Leon Lederman. Dr. Lederman addressed how educational techniques must change to ensure that students are better prepared to take on the ever-changing landscape of science and technology. "To teach physics last is backwards," said Lederman. "How can you expect kids to fully comprehend biology and chemistry when they don't understand the physics behind them?"

Other highlights from Tuesday included sessions about Federal Programs in Science, Technology, Engineering and Math, as well as the implication of patent rules.

Wednesday was highlighted by the popular Technology Transfer Town Hall Meeting, led by Rick Brenner of the Agricultural Research Service. Topics included the role of federal laboratories in economic development, marketing federal technologies and resources, and compensation for innovation and technology transfer success.

Another popular Wednesday session featured a panel of representatives from the biotech, information technology, and university communities discussing the implications of U.S. patent law with regard to "first-to-file vs. first-to-invent." The diverse panel included Mojdeh Bahar of the National Institutes of Health, Bradley Greenwald of Intel Corporation, and Martin Simpson of the University of California.

The last day of the conference showcased a panel moderated by Belinda Padilla of Los Alamos National Laboratory on how federal laboratories could be leveraged for regional success. This session explored best practices and areas in need of improvement when partnering with federal laboratories on state, regional and local technology-based economic development initiatives.

The conference ended with the presentation of the prestigious FLC Awards for Excellence in Technology Transfer.

Taking home the Laboratory Director of the Year awards were Dr. R. Ilker Adiguzel of the U.S. Army Engineer Research and Development Center; Captain Michael Byman, Donald Aker, and Dr. Paul Lefebvre of the Naval Undersea Warfare Center Division Newport; and Joe Sciabica of the Air Force Research Laboratory, Sensors Directorate.

Long-time FLC member Ed Linsenmeyer of the Naval Surface Warfare Center received the Harold Metcalf Award

The FLC Tech Fair was open throughout the week. This showcase provided local businesses the opportunity to meet with inventors to learn more about their commercially viable innovations.

The FLC 2009 annual meeting is scheduled for May 4-7 in Charlotte, North Carolina. For detailed 2008 meeting proceedings and presentations, visit the FLC website at www.federallabs.org.

Argonne's New Battery, from page 1

battery capacity, improved battery safety, and decreased battery cost.

Argonne researchers quickly realized that their new technology could be the necessary breakthrough. When EnerDel, Inc., approached Argonne seeking new battery technology, Argonne's technical staff recognized the great potential of an R&D partnership. Argonne's Dr. Khalil Amine said, "We pointed the company in the direction of the U.S. Department of Energy (DOE) and the U.S. Advanced Battery Consortium (USABC) in pursuit of research funding, and accompanied them to Detroit to thoroughly brief officials on the merits of the technology and explain how it could meet and in some aspects exceed the goals for HEV batteries …." EnerDel enlisted Argonne via a sponsored-research Work for Others contract.

In under a year, EnerDel was manufacturing prototype batteries that have performed like champions. "The success of the batteries," explained Dr. Amine, "is due in large part to our understanding of what was needed to get over the hurdles to commercialization—in particular, the challenges involved in applying the science to make practical quantities of the new material."

With colleagues, Dr. Amine established a dedicated laboratory at Argonne, working closely with EnerDel engineers throughout the process.

Recently, several other battery manufacturers have begun their own testing and design based on Argonne's new materials. "Our … commercialization-focused, tailored R&D and extensive interactions with EnerDel have put this company on the road to successful commercialization of a key energy technology that will affect the lives (and pocketbooks) of millions of consumers," said Dr. Amine.

Caught on Film, the 2008 FLC National Meeting

DC on T2, from page 1

terprise, and should be required reading for anyone interested in the continual policy debates on how we are faring in this most critical area.

The overarching conclusions in 2008: The S&T world continues to undergo rapid changes following trends that emerged in the late 1990s, "resulting in a shift in the epicenter of world S&T activities, led by China's emergence, toward several rapidly growing Asian economies." These shifts have produced variable impacts in the developed world, as China's emergence has been accompanied by the stagnation/decline of Japan and the European Union (EU) in a number of S&T-related indicators. The U.S. continues to "hold its own, thanks, in part, to its large, mature, and diversified S&T system. But, it too, faces robust challenges affecting its education, workforce, R&D, and S&T systems that arise from the far-reaching and rapid world-wide changes." A few selected U.S. highlights follow.

General Science and Engineering Indicators

R&D investment patterns

- The U.S. continues to invest the greatest absolute amount in R&D ($340 billion in current dollars), besting the other G-7 nations combined—as it has done for two decades.
- The U.S. federal government continues to be the largest source of funding for basic research, funding nearly 60 percent, while industry funds 17 percent (industry funds 83 percent of development with the federal government funding about 6 percent). The federal share of R&D funding overall is 28 percent.

Science and engineering (S&E) workforce development

- In every decade since 1960, the U.S. S&E workforce has grown faster than the overall workforce (today, S&E workers comprise about 4 percent of the total U.S. civilian workforce, up from 2.6 percent in 1983).
- The number of S&E degrees awarded by U.S. colleges and universities continues to grow (S&E research doctorates peaked in 2006 at 30,000, driven in large part by a growing number of doctorates awarded to non-U.S. citizens).

Knowledge output

- U.S. S&E article output increased 1.3 percent annually between 2000 and 2005 (and accounted for 29 percent of the world total in 2005; Japan was second with 8 percent).
- The U.S. continues to be the leading source of triadic patent families (with 20,000 filings). (Note: A triadic patent family consists of those inventions for which protection is sought in the world's three largest markets: the U.S., E.U., and Japan).

Workforce Development - Education Indicators

- In 2004, about 59 percent of public secondary schools in the U.S. reported vacancies in math teaching positions, with one-third indicating difficulty filling them.
- The number of S&E B.S. degrees awarded to women and minorities has largely increased over the last two decades, but not in the physical sciences, math or engineering.

Global Marketplace Indicators

- The U.S. is second only to Japan among the G-7 nations in R&D intensity (R&D spending as a percentage of GDP). The U.S. spends about 2.6 percent (Japan is over 3.0 percent).
- The U.S. has held a 35 percent share of world revenue in all high-tech manufacturing since 2001, and leads in all high-tech manufacturing sectors except office and computing machinery (where China leads).
- The U.S. continues to lead in world revenue for all three market-oriented, knowledge-intensive service industries (business, communications and financial services), earning about 40 percent of world revenue annually between 1995 and 2005).

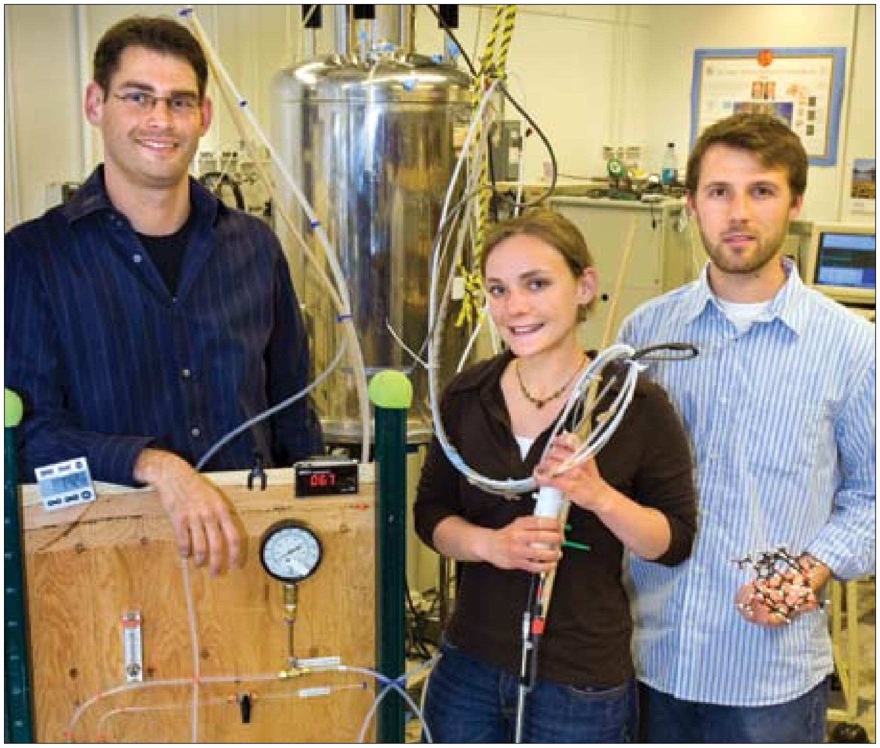
This year's edition is notable not only for the data it contains, but for the first-ever recognition of the data it does not contain. The report identifies numerous areas where insufficient data exist; including but not limited to data on teacher preparation and quality (particularly in the STEM fields), international S&T workforce characteristics, industrial R&D by line of business, and innovation indicators such as technology licensing and data on technology parks and incubators, among others.

Even with these data gaps, I believe this volume remains the single best source of information on the topics, and I encourage those interested in S&T policy to take a closer look.

"Science and Engineering Indicators 2008" and its two companion pieces, "Digest of Key Science and Engineering Indicators" and "Research and Development: Essential Foundations for U.S. Competitiveness in a Global Economy," can be found on the NSF website.

Gary can be reached at gkjones@flcdc.cnchost.com.

Breaking the Barrier Toward Nanometer X-ray Resolution



Team leader Leif Schröder (left) with Monica Smith, who holds a probe housing a phantom target, and Tyler Meldrum, holding a model of a biosensor's cryptophane cage. These members of the Alexander Pines and David Wemmer laboratories, working with team members Lana Chavez and Thomas Lowery, developed temperature-controlled molecular depolarization gates for NMR and MRI.

Standard magnetic resonance imaging (MRI) is a superb diagnostic tool; however, it suffers from low sensitivity, requiring patients to remain motionless for long periods of time inside noisy, claustrophobic machines.

A promising new MRI method that is much faster, more selective — able to distinguish even among specific target molecules — and many thousands of times more sensitive has now been developed in the laboratory by researchers at the Department of Energy's Lawrence Berkeley National Laboratory (LBNL) and the University of California at Berkeley (UCB).

The key to the new technique is called "temperature-controlled molecular depolarization gates." It builds on a series of previous developments in MRI and the closely related field of nuclear magnetic resonance (or NMR, which instead of an image yields a spectrum of molecular information), by members of the laboratories of Alexander Pines and David Wemmer at LBNL and UCB. Pines is the Glenn T. Seaborg Professor of Chemistry at UCB and a senior scientist in LBNL's Materials Sciences Division. Wemmer is Professor of Chemistry at UCB and a member of LBNL's Physical Biosciences Division.

The technique was developed by a team of past and present Pines and Wemmer lab members headed by Leif Schröder of LBNL's Materials Sciences Division and includes Lana Chavez, Tyler Meldrum, Monica Smith, and Thomas Lowery.

The researchers outlined their results in the international edition of the journal *Angewandte Chemie*.

"The new method holds the promise of combining a set of proven NMR tools for the first time into a practical, supersensitive diagnostic system for imaging the distribution of specific molecules on such targets as tumors in human subjects," said lead author Schröder, "or even on individual cancer cells."

MRI and NMR make use of the quantum-mechanical phenomenon known as nuclear spin. Nuclei with odd numbers of protons or neutrons have net magnetic moment and will orient themselves like tiny bar magnets, spin "up" or spin "down," in a strong magnetic field. If the spinning nuclei are knocked off axis by a jolt of radio-frequency (RF) energy, they wobble or precess at a characteristic rate, a rate that is strongly conditioned by their immediate chemical neighbors. During a certain relaxation time (typical of each atomic species in a specific environment), the nuclei reorient themselves and emit a radio signal that reveals both their position and their chemical surroundings.

The spin-up state requires fractionally less energy, so there is typically a slight excess of spin-up nuclei, about one in a hundred thousand (0.001 percent), and it's this tiny difference that yields a useful signal. In clinical settings, MRI is usually done using hydrogen nuclei, protons, which are ubiquitous in the human body. But other nuclear species, notably the noble gas xenon, offer advantages over hydrogen that in the case of xenon include a virtual absence of background signal, since there is no xenon in biological systems.

Xenon is particularly useful in MRI and NMR because the spins of its nuclei are readily polarized, in a process involving contact with rubidium vapor irradiated with a laser beam. In such "hyperpolarized" xenon, the excess of spin-up nuclei can be as much as 20 percent, which gives a far stronger signal than hydrogen's 0.001 percent spin-up excess. Moreover, hyperpolarized xenon has a much longer relaxation time than hydrogen.

Now add the ability to associate a single xenon nucleus with a specific molecular target, for example, a protein or sugar on the surface of a cancer cell. To do this, the Pines and Wemmer labs have created biosensors equipped with cages that take up and hold on to xenon atoms; the cages, molecules called cryptophanes, are linked to ligands that target specific molecules of interest. Xenon biosensors engineered with several different ligands can be used at the same time; once in place, biosensors carrying hyperpolarized xenon can localize the MRI signals from a range of different molecules on the target.

The final advance underlying the new technique is called Hyper-CEST: hyperpolarized xenon chemical-exchange saturation transfer. While biosensors can bring the xenon to specific molecular targets, in realistic applications relatively few of these are present, only about one percent compared to the total amount of free xenon injected near that target. The signal from the polarized xenon inside the biosensor cages is consequently much fainter than that from the uncaged polarized xenon nearby.

"About 60 percent of the biosensor cages are filled with xenon," said Schröder, "but the problem is, you get only a tiny, broad NMR signal from the xenon when it is inside the cage. On the other hand, you have thousands of xenon nuclei just sitting around the cage."

The trick then is to depolarize the xenon nuclei in the immediate vicinity of the cages, which will serve to outline the target in high contrast against the surrounding hyperpolarized xenon pool. This is done through chemical exchange, as xenon atoms are constantly entering and leaving the biosensor cages.

A polarized xenon atom from the pool enters the cryptophane cage, which alters the xenon's resonance frequency, allowing it to be depolarized by RF radiation tuned to a specific frequency. The depolarized xenon atom is then exchanged for a new, incoming polarized atom and reenters the pool. In this way, the buildup of nearby depolarized nuclei quickly outlines the target.

Because it produces a much stronger signal, Hyper-CEST acquires images thousands of times faster than imaging the caged xenon directly. Yet it retains the great advantages of cryptophane biosensors, including their ability to "multiplex," or detect different targets at the same time.

"Slight differences in cage composition,

Nano X-Ray, page 8

Lab Classifieds | Available Technologies, Facilities, and Partners

Thermal Rectifier

Alex Zettl, Arun Majumdar and colleagues at Lawrence Berkeley National Laboratory (LBNL) have invented the first solid-state thermal rectifier.

The LBNL nanoscale solid-state device is to thermal systems what the diode is to electronics. Controlling the direction of heat flow could lead to radical improvements in thermal management across a range of products.

Applications include thermal management for microelectronic devices, solar cells and solar energy management systems, refrigerators, hybrid biological/inorganic systems, and nanoscale calorimeters.

More info: TTD@lbl.gov

NCI's Tumor Suppressor

Snorri Thorgeisson of the National Cancer Institute led a team of researchers in the development of BOG (B5t Over-Expressed Gene) with the gene product pRb of the well-known tumor suppressor gene RB, retinoblastoma susceptibility gene.

The complex formed between Rb and BOG typically does not contain E2F-1 in vivo. This binding property suggests that cells that are transformed/transfected with cDNA or other functional nucleotide sequences that encode the BOG gene product will be useful as tools for studying cell cycle control and oncogenesis.

Applications include a method to diagnose and treat liver cancer; a method to study cell cycle control and oncogenesis; and liver cancer therapeutics.

More info: Dr. John Hewes, 301-496-0477, hewesj@mail.nih.gov

Cardio CRADA

The Department of Health and Human Services (HHS) seeks a CRADA and/or license(s) with a pharmaceutical or biotechnology company to develop and commercialize amphipathic helical peptides potentially useful for the treatment and prevention of cardiovascular disease. The CRADA would have an expected duration of one to five years. The goals of the CRADA include the rapid publication of research results and timely commercialization of products, methods of treatment or prevention that may result from the research.

More info: Dr. Denise Crooks, crooksd@nhlbi.nih.gov

Thwarting Terrorism, Pollution

A new award-winning innovation developed at the Department of Energy's Argonne National Laboratory (ANL) can covertly detect chemical plumes at great distances and may help thwart future chemical- or nuclear-based terrorist attacks.

The technology has a number of other uses as well, from detecting environmental pollution to determining the extent of tissue damage in burn victims without physical contact.

Passive millimeter-wave spectroscopy (PmmWS) was pioneered by Sami Gopalsami, Sasan Bakhtiari, Paul Raptis and Thomas Elmer, all of ANL's Nuclear Engineering Division. The technology has the capacity to identify chemical plumes at ranges of up to a few kilometers and at concentrations as low as 100-1000 ppm.

The ANL team designed PmmWS primarily to monitor chemical signatures emitted by processing facilities suspected of unauthorized nuclear activity.

More info: Steve McGregor, 630-252-5580, or media@anl.gov

Air Traffic

Dr. Todd Truitt, an engineering research psychologist with the Federal Aviation Administration's (FAA) William J. Hughes Technical Center and member of the Human Factors and Ergonomics Society, has created "Concept Development and Design Description of Electronic Flight Data Interfaces for Airport Traffic Control Towers."

Dramatic projected increases in air traffic and focused modernization efforts have led the FAA to consider replacing paper flight progress strips with an electronic alternative. Electronic flight data (EFD) interfaces can potentially increase a controller's ability to acquire, track and record information, as well as communicate and coordinate that information with others. More importantly, EFD can improve controller efficiency by providing new methods of flight data management that integrate information into a single source, enhancing safety.

More info: Deborah Germak, deborah.germak@faa.gov

LANL's Particle Detection

Los Alamos National Laboratory researchers have developed a particle detection system comprised of drift cells, which can track incoming and outgoing charged particles as they pass through a target placed within the scanner. Applications include detection of shielded and unshielded special nuclear materials, as well as detection and identification of other high-density materials that may represent threat objects.

More info: Erica Sullivan, 505-667-9219, eab@lanl.gov

Heat-Resistant Fabric

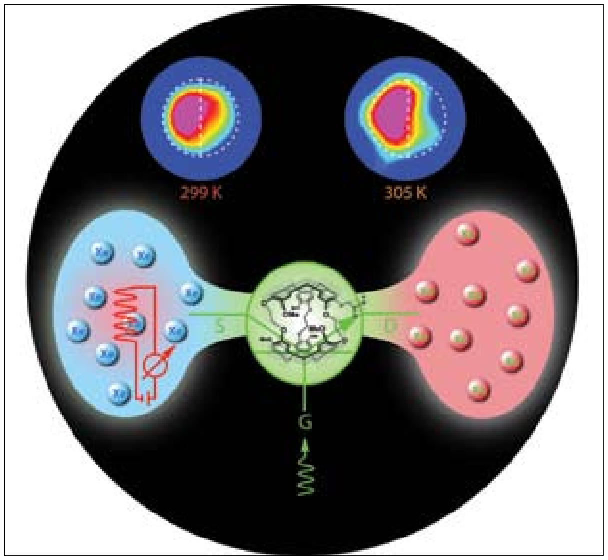
Agricultural Research Service scientists Jeanette Cardamone and Anand Kanchager have discovered a new heat-resistant material that can be applied to wool and other fabrics to prevent them from burning. This material is applied within the fabric structure. Current fabrics that come in contact with fire or extreme heat can cause physical injuries. Underwear currently worn by U.S. soldiers can burn with a perpetuating flame and form a hard bead that drips into an open wound, causing physical trauma. ARS's technology uses a polymer applied with additives that are nonhazardous. It can provide safety and protection from high-temperature ignition in fire-hazard situations. Applications of technology can be made from a water solution in textile mills during the wet finishing process that occurs after dyeing, and before or after finishing with existing mill equipment.

More info: www.ars.usda.gov/research/patents/

Fluid Control

Idaho National Laboratory (INL) researchers have developed a system, apparatus and method of controlling the flow of a fluid. In accordance with one embodiment of the present invention, a flow-control device includes a valve having a flow path defined through, and a valve seat in communication with, the flow path with a valve stem disposed in the valve seat. A gear member is coupled with the rotary stem and a linear positioning member includes a portion that complementarily engages the gear member.

More info: David R. Anderson, 208-526-0837



In the technique known as "temperature-controlled molecular depolarization gates," an atom of hyperpolarized xenon from the pool at left enters a cryptophane cage, center, which is part of a biosensor attached to a specific molecular target. A burst of tuned RF energy depolarizes the xenon, which is then ejected back into the pool by chemical exchange with the next incoming xenon atom. Depolarized xenon (right) stands out in the larger hyperpolarized pool, and thus enhances the contrast of the nearby target molecule. At top, a phantom half-filled with agarose beads, to which biosensors are attached, shows how image contrast can be enhanced and controlled by temperature.

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involving only a carbon atom or two, affect the frequency of the signal from the xenon and produce distinct peaks in the NMR spectrum," said team member Tyler Meldrum of the Materials Sciences Division. "If we design different cages for different xenon frequencies, we can put them all in at once and, by selectively tuning the RF pulses, see peaks at the frequencies corresponding to each kind of cage."

The processes described above — hyperpolarizing the xenon, caging it in biosensors, and building up depolarized xenon in the immediate vicinity of the target through chemical exchange and selective bursts of rf radiation — led to the development of Hyper-CEST MRI. But until now, Hyper-CEST MRI has only been tested at room temperature.

Using biosensor cages as temperature-controlled molecular depolarization gates makes Hyper-CEST MRI possible at a range of higher-than-room temperatures. Because the technique regulates the exchange rate of hyperpolarized-to-depolarized nuclei through the cages, biosensors regulated this way have been nicknamed "transpletors," by analogy to the transistors that act as gates for the flow of electrons from source to drain in electronic systems.

Hyper-CEST at a range of temperatures has many advantages. Most basic is that biomedical MRI must operate at body temperature.

Aside from this practical consideration, temperature determines the rates at which different kinds of cryptophane-cage hosts react with their xenon-atom guests. And increasing temperature dramatically increases chemical exchange rates.

"At room temperature, a xenon atom will stay approximately 50 milliseconds inside the cage before it leaves again," said team member Monica Smith, of LBNL's Physical Biosciences Division. "Approaching body temperature, the time inside the cage decreases by at least factor of 10."

The ability to achieve high-contrast images, multiplexed to identify a range of molecular targets, and to do so in a short time, offers many benefits to patients and physicians.

Enabling fast, sensitive, molecule-specific NMR and MRI in humans and other living subjects is perhaps the most evident advantage of the new technique, but possible applications don't end there.

For example, the method offers a better way to study chemical exchange in nanostructures like zeolites, which are important in catalysis, or in versatile carbon nanotubes. Temperature-controlled depolarization is a breakthrough for NMR and MRI that will find uses in a variety of fields.

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