Tech Transfer Highlights

Vol. 11 No. 3 2000

Argonne National Laboratory

The latest technological innovations and scientific advances from Argonne National Laboratory

Many Argonne technologies are available for commercialization under a variety of agreements. For more information, contact the Office of Technology Transfer (800-627-2596, partners@anl.gov). For Media Relations, contact Catherine Foster (630-252-5580, cfoster@anl.gov).

X-Ray Detector Facilitates Sleuthing for New Drugs

U.S. Department of Energy

Office of Science, Office of Biological and Environmental Research

National Institutes of Health

2000 R&D 100 Award Winner

Argonne's large-area charge-coupled-device (CCD) X-ray detector allows researchers at high-brilliance synchrotron beamlines to map the structures of complex molecules with subatomic resolution at unprecedented speeds. The X-ray detector features a very large detection area (210 x 210 mm^2), up to 100 times faster readout speed (as fast as 1.8 seconds/frame), and very high resolution (69 x 69 micrometer pixels).

A phosphor film covering nine fiber-optic tapers intercepts X-rays diffracted by macromolecular crystals, converting them to visible light. The tapers then convey the light photons to nine CCD sensors, where they are transformed into electronic signals for data collection. Fiber-optic tapers increase the active surface area of each CCD sensor without introducing much loss in sensitivity or speed. The array of nine tapers and CCD sensors also permits each portion of the detector to be read out separately, enabling simultaneous data processing from all nine sensors. As a result, protein structures can be solved in under an hour, rather than hours or days with other methods.

The detector also captures a higher number of reflections (up to 100 per atom) than other detectors. This higher resolution makes the detector invaluable in drug development by providing detailed structural maps of toxins, receptors, enzymes, viruses, and metabolic and genetic regulators quickly and accurately.
http://www.techtransfer.anl.gov/techtour/detector.html

Argonne's large-area CCD X-ray detector helps characterize molecular structures in just minutes.

Tech Transfer Highlights by E-mail!

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Process Turns Landfill Clutter into Moneymaking Foam

U.S. Department of Energy

Office of Energy Efficiency and Renewable Energy, Office of Industrial Technologies

Argonne scientists have developed a process that recovers and cleans flexible polyurethane foam (FPUF) derived from automobile shredder residue (ASR). FPUF, which makes up over 30% of ASR volume, is generally a challenge to clean, as it is contaminated with automotive fluids, iron oxide, glass, and metals. Argonne's efficient, economical process separates and cleans the foam so thoroughly that it can be shipped directly to foam rebonders for use in carpet pads, furniture cushions, and automobile soundproofing material. The technology has been licensed to Salyp N.V. of Belgium.

The continuous process consists of six basic operations: (1) FPUF recovery and screening, (2) sizing, (3) washing, (4) rinsing, (5) drying, and (6) baling. As FPUF and other non-ferrous materials are conveyed together in a stream, a trommel rejects fines measuring less than 5/8 inch and then an eddy current separator removes non-ferrous metals. Next, a two-stage trommel recovers the dirty FPUF from the remaining non-metallic fraction.

Since the recovered foam pieces vary considerably in size, they then go to a ring mill that reduces them to consistent dimensions. Size reduction is necessary to clean and dry the foam effectively and to help free entrained dirt and metals. The sized foam proceeds to a washing station and on to a special dryer that is designed to dry the foam in less than 15 minutes, instead of the 3-4 hours needed by conventional dryers. The clean, dry foam is then baled for shipment to the rebond industry.
http://www.techtransfer.anl.gov/techtour/autoshredder.html

X-Ray Microprobe Can Characterize Everything from Bacteria to Microchips

U.S. Department of Energy

Office of Science, Office of Basic Energy Sciences

Argonne's versatile hard X-ray scanning microprobe is a noninvasive tool that is suitable for a very broad array of samples and sample configurations. The technology makes feasible the microcharacterization of specimens as diverse as semiconductor materials, fine airborne particles, and bacteria, all at submicrometer resolution. No specimen preparation is needed even with samples that are tens to hundreds of micrometers thick. The device can image fully hydrated biological specimens.

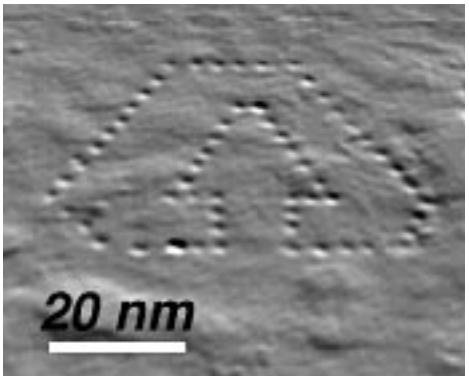
The capabilities of the X-ray microprobe include a detection limit of 10-100 ppb; better than 0.01% accuracy in structural analysis; and a capacity for investigating chemical speciation, atomic arrangements, and even 3-D volumetric distributions at submicrometer resolution. These excellent analytical characteristics along with a capacity for analyzing specimens "as is" make the hard X-ray scanning microprobe suitable for applications in microelectronics and materials science, biomedical research, and the environmental sciences. Likely uses for the Argonne X-ray microprobe include studying infectious diseases and new drug candidates; highly refined techniques for studying environmental contaminants; and developing faster, less expensive, and more reliable microelectronic and communications devices and lighter, safer, and stronger materials in general.
http://www.techtransfer.anl.gov/techtour/microprobe.html

Argonne Attracts Ultra-Small-Magnet Research

U.S. Department of Energy

Office of Science, Office of Basic Energy Sciences, Materials Sciences

As part of its focus on nanoscience research, the U.S. Department of Energy has granted Argonne $1.2 million to coordinate investigations into nanomagnetism, which could lead to breakthroughs in miniaturizing many magnetic devices. Argonne will facilitate the multidisciplinary research at the Advanced Photon Source and provide access to Argonne's experts in leading-edge materials characterization.



The world's smallest Argonne logo, just 50 billionths of a meter across, was created using "nanotechnology" techniques.

Work will focus on laterally confined nanomagnets, which are magnetic systems best measured on a nanometer (one billionth of a meter) scale. The goal is to understand how magnetic and other properties change as the dimensions of magnetic structures approach the ultimate limits of miniaturization.

Researchers will first use lithographic methods to create submicrometer arrays of composite structures to probe for exotic physical phenomena. Then researchers will study self-assembly methods of nanomagnet fabrication to transcend the size limitations of lithography. Finally, molecular magnets will be fabricated to study physical changes that arise when purely quantum mechanical phenomena begin to dominate as magnetic structures approach atomic limits of spatial confinement.
http://www.techtransfer.anl.gov/techtour/nanomagnetism.html

Fast X-ray Microtomography System Can Take 3-D Snapshots as Samples Change

U.S. Department of Energy

Office of Science, Office of Advanced Scientific Computing Research

A new imaging system at Argonne's Advanced Photon Source could help researchers determine the microstructure of static samples, study the evolution of dynamically varying samples, or examine large numbers of samples faster and in finer detail than ever before.

Argonne's 3-D X-ray tomography system is designed for high-throughput 3-D imaging of millimeter-sized samples at micrometer-scale resolution. A complete tomographic data set can be collected, reconstructed, and displayed in as little as 20 minutes. Rendered images can be viewed interactively on a live monitor display, in a virtual-reality environment, or remotely via the World Wide Web.

The system's principal advantage is operating speed: the time between data acquisition and viewing is just minutes, compared with tens of hours or days for other systems. This dramatic increase in throughput makes many experiments feasible for the first time, such as real-time study of failures in microelectronic devices, material transport in porous media, curing of adhesives and coatings, and medical growth and depletion processes.

The Advanced Photon Source is a Department of Energy User Facility; there is no charge for nonproprietary use of the instrument for projects that qualify based on scientific merit.
http://www.techtransfer.anl.gov/techtour/microtomography.html

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Argonne Leads New Midwest Center for Structural Genomics

National Institutes of Health

National Institute of General Medical Sciences

A new research center based at Argonne will lead efforts to find a quicker and more efficient method of characterizing protein structures. The Midwest Center for Structural Genomics, funded by the National Institutes of Health (NIH), will receive approximately $4 million each year for five years. The center is part of an initiative to characterize the structures of thousands of proteins over the next decade. Understanding the structure of a disease-related protein can provide insight into how the protein works normally and how a faulty structure can cause disease. This same structure may reveal how to design drugs to treat that disease.

The centerpiece of the Midwest effort is Argonne's Structural Biology Center at the Advanced Photon Source, which in 1999 determined more new protein structures than any other synchrotron beamline. Such high-throughput facilities are essential to the success of a structural genomics program. The new center is one of seven funded this year by NIH, which expects to spend $150 million on the projects over the next five years.

http://www.anl.gov/OPA/news00/news000926.htm

Tech Transfer Highlights

Tech Transfer Highlights is produced by Argonne's Office of Transfer Technology in cooperation with Argonne's Office of Public Affairs. Publishing support services are provided by Argonne's Information and Publishing Division.

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Argonne National Laboratory is operated by the University of Chicago for the U.S. Department of Energy under Contract W-31-109-ENG-38.

ISSN 1062-1784

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