Tech Transfer Highlights

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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 Industrial Technology Development Division (800-627-2596, partners@anl.gov). Visit the ITD web site at http://www.techtransfer.anl.gov. For Media Relations, contact Catherine Foster (630-252-5580, cfoster@anl.gov).

New Plastics Recovery Process Rises to the Top

U.S. Department of Energy

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

2000 Discover Award Finalist

Plastics recovered from shredded refrigerators by Argonne's froth flotation process were successfully recycled in test runs to produce injection-molded automobile headlamp backcans.

Researchers at Argonne have developed a unique "froth flotation" process that separates individual high-purity plastics from waste streams containing a mixture of plastics. The technology separates equal density plastics, such as acrylonitrile-butadiene-styrene (ABS), high-impact polystyrene (HIPS), and polypropylene (PP), from each other and from other plastics during scrap shredding and metal recovery operations.

Argonne's technology has already recovered selected plastics from obsolete appliances, auto shredder residue, disassembled car parts, industrial scrap plastics, and consumer electronics. The economics for recovering and recycling plastics, such as for recovered ABS, are typically very attractive, with a payback of approximately two years. For example, clean and recycled ABS sells for $0.30 - $0.45 per pound, compared with about $1.00 per pound for virgin material.

Froth flotation is highly selective, producing products of greater than 98 percent purity and typically recovering more than 80 percent of a targeted material. ABS from shredded refrigerator scrap, for example, is recovered by modifying the surfaces of the equal-density HIPS and ABS particles. When the particles are placed in a special aqueous mixture, HIPS particles float and separate from the sinking ABS particles. Reusing reclaimed plastics reduces the energy consumed by producing new plastics and decreases disposal costs, while helping improve the environment. Recovered polymers are compatible with virgin materials and can be used for such products as computers, office equipment, telephones, and home appliances. The process is a 2000 Discover Award finalist. Argonne is seeking licensees for this technology. Contact the Industrial Technology Development Division (800-627-2596, partners@anl.gov).
http://www.techtransfer.anl.gov/techtour/froth.html

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Diamond Films Help Smooth the Way for Microscopic Machines

U.S. Department of Energy

Office of Science, Basic Energy Sciences

A revolutionary new process for growing diamond films promises to bring the superior mechanical, tribological, and thermal properties of diamond to the rapidly expanding field of microelectromechanical systems (MEMS) technology.

Argonne scientists have developed an "ultrananocrystalline" technology that is the first to produce diamond-film components with the smoothness, detail, and structural stability necessary for practical use. Argonne's ultrananocrystalline films are free of intergranular flaws and non-diamond secondary phases that degrade the properties of conventionally produced diamond films. The crystals are 50 to 200 times smaller than those in conventional diamond films, which makes them 10 to 20 times smoother.

The films are deposited by a chemical vapor deposition method developed at Argonne and shaped by photolithography and other techniques common in the semiconductor industry. The resulting freestanding diamond structures are as small as 300 nanometers (nm) thick with features as small as 100 nm and friction coefficients as low as 0.01. The achievable tolerance of components is limited by the resolution of the lithographic patterning method, rather than by the intrinsic material properties. This makes it possible to create precision fits and smaller features, such as gears with teeth the size of bacteria. Multilayer deposition methods are being developed that permit integrated fabrication of complete devices without manual assembly, such as micron-sized pinwheels, gears, turbines, and micromotors.

Basic research for this innovation was funded by the U.S. Department of Energy, Office of Science, Basic Energy Sciences, Materials Sciences.
http://www.techtransfer.anl.gov/techtour/diamondmems.html

Ultrasonic Sensor Detects Gases and Particulates in One Swift Whiff

U.S. Department of Energy

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

National Center for Manufacturing Sciences

Argonne scientists have developed a new ultrasonic gas and particulate matter sensor that is portable, accurate, and affordable for applications in almost every industry and work environment. The sensor is the first handheld instrument of its kind to accurately detect and quantify levels of trace gases and particulate matter in air with real-time monitoring. This technology can offer an early warning about the presence of invisible toxic gases or fumes to help prevent loss of life in a wide range of industrial and hazardous settings. It could be used for applications such as checking seals on industrial equipment, finding leaks in jet aircraft fuel systems, and guarding firefighters against unseen toxins in the air.

The sensor uses an ultrasound pulse to measure the concentration of trace gases or particulate matter. A new signal-analysis technique enhances sensitivity, and a narrow cell improves response time (less than one second versus many seconds for existing products) while reducing the size of the sensor so it fits on the end of a probe that can be inserted into confined areas. The sensor is several times less expensive than any competing technology (from $1,000 to $4,000, based on the application).

The sensor was developed by Argonne jointly with the National Center for Manufacturing Sciences, in conjunction with Ford Motor Company's Advanced Manufacturing Technology Development Center.
http://www.techtransfer.anl.gov/techtour/gassensor.html

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New Rodent Nest Performs Heads and Tails Over Others in Metabolic Studies

National Institute of Environmental Health Sciences

The EcoNest design is based on the natural nesting behavior of rodent mothers.

EcoNest, a unique burrow-like nest developed at Argonne for rodent mothers and their pups, allows researchers for the first time to conduct metabolic studies on pregnant and lactating rodents without excluding the periods immediately before, during, and after the birth of the pups. It can be placed inside a standard metabolism cage to permit total recovery of feces and urine, because rodent mothers keep their nest boxes meticulously clean by producing excreta only within the metabolism cage area outside the nest box. Recovering feces and urine throughout the prepartum, birth, and postpartum periods could positively affect studies into the safety of medicines for pregnant or nursing women. Currently, testing drugs via metabolic studies often requires researchers to interrupt their work during this time because of difficulties in collecting excreta.

EcoNest is unique because it provides conditions that relate to the natural behavior and maternal instincts of rodents. The nest has a dark top and translucent sides, with an opening at one end to offer a secluded, covered area for nesting at the opposite end of the box. The opening is sized to gently brush off nursing pups when the mother exits the nest. EcoNest also provides a warm, secure environment for lab animals during postsurgery recovery and could be modified for space flight studies on mice and rats.

The EcoNest was developed jointly by Argonne, Oregon State University (Corvallis, OR), and Benedictine College (Lisle, IL).
http://www.techtransfer.anl.gov/techtour/econest.html

Internet-based System Solves Problems Submitted by Business and Science

U.S. Department of Energy

Office of Science, Office of Computational and Technology Research

National Science Foundation

Argonne and partners Northwestern University and Intel Corporation have developed the first computational server that makes extensive problem-solving resources available to scientists, engineers, and businesspersons quickly and simply via the Internet. The NEOS (Network-Enabled Optimization System) Server 3.0 approach streamlines the solution process for users, allowing them to concentrate on formulating the problem to be solved while letting NEOS use a unique combination of advanced interfaces, solvers, and geographically distributed computing resources to accomplish the computation process. NEOS 3.0 is portable across architectures, web servers, and e-mail servers. Users choose the solver and submit problems via the Web, e-mail, or the NEOS Submission Tool.

The NEOS Server for Optimization provides access to an emerging technology with vast potential for applications such as creating optimal shift schedules for airport ground operations or designing communication networks. NEOS also could help businesses offer services to customers or to employees in multiple offices with software resources spread across locations. The era of software use provided over the Internet has begun, and companies are developing application service providers (ASPs) as an alternative to distributing software. NEOS 3.0 is designed as a general ASP and is a forerunner in the delivery of software solutions.
http://www-neos.mcs.anl.gov

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Argonne-Developed Cleanup Method May Save Oil and Gas Industry Millions

U.S. Department of Energy

Office of Fossil Energy, National Petroleum Technology Office – Tulsa

Oil and gas producers may save millions of dollars in cleaning up soils contaminated with naturally occurring radioactive materials thanks to an on-site soil sampling and testing method developed by Argonne environmental scientists.

Naturally occurring radioactive material accumulates when the production of oil and natural gas from underground reservoirs carries small quantities of radium to the surface. Over time, the radium — usually radium-226 and to a lesser extent, radium-228 — can concentrate in pipe scale and sludge deposits, which in turn can contaminate soil and equipment.

The traditional approach to cleaning up such sites involves complicated soil sampling techniques and shipping these samples to offsite laboratories for analysis — a time consuming and costly process. But a recent demonstration has shown that using Argonne's Adaptive Sampling and Analysis Program (ASAP) can dramatically cut the time and money needed to characterize and remediate sites contaminated by naturally radioactive materials. ASAP combines real-time data collection techniques with in-field decision making for faster and more precise site characterization.
http://www.techtransfer.anl.gov/techtour/asap.html

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