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 Center (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).

"One-Stop Shopping" for New Software Technology

Many of the powerful software programs and models developed at Argonne have commercial applications in business and industry. Argonne's Software Shop is a unique Web site that provides descriptions of the Laboratory's available software products and lists their prices. Interested parties can print out and sign convenient pre-approved agreements for licensing purposes. Written in nontechnical language, the software descriptions include examples of potential applications that help R&D managers and nontechnical readers easily identify how the software might provide a solution for their companies. *http://www.techtransfer.anl.gov/software/index.html*

Clean-Diesel Breakthrough Decreases Both Particulates and NO_x

R&D 100 Award Winner!

U.S. Department of Energy

Office of Science,
Laboratory Research Program

Researchers at Argonne have found a way to help diesel engines operate more cleanly and efficiently by *simultaneously* decreasing particulates and oxides of nitrogen (NO_x), two contributors to air pollution. Until now, attempts to reduce either one of the combustion components inevitably lead to an increase in the other. Demonstrated on a research locomotive engine in the laboratory, the process should work equally well in heavy trucks, buses, and light-duty vehicles such as cars and pickup trucks.

The new diesel emissions control strategy involves: (1) increasing oxygen in the engine air supply, (2) retarding the timing of the fuel injection, and (3) increasing the fuel flow rate. This three-step method requires a continuous supply of oxygen-enriched air to the engine from a compact, passive membrane unit that separates air into oxygen and nitrogen. Manufacturers will not need to redesign their engines, as the durable and relatively inexpensive membrane unit can be retrofitted on existing vehicles.

This technology reduces particulates by 60%, reduces NO_x by 15%, and increases gross engine power by 18%, at full engine load. DOE's Office of Energy Efficiency and Renewable Energy, Transportation Technology, Advanced Automotive Technologies, has provided funding to Argonne to verify this concept for light-duty applications. *http://www.techtransfer.anl.gov/techtour/clean-diesel.html*

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Gregar Extractor Offers Major Advance in Chemical Extractions

R&D 100 Award Winner!

U.S. Department of Energy
Office of Science,
Basic Energy Sciences

A new device developed at Argonne promises to render obsolete an essential piece of equipment found in virtually every school, industrial and university chemistry lab in the world. The Gregar Extractor features a revolutionary, yet simple, new mode of continuous extraction of chemicals from solids – or from liquids. It also eliminates many of the operational problems associated with the Soxhlet extractor, which has been the chemist's workhorse since the mid-1800s.

The Gregar Extractor improves on conventional extractors in a number of ways. It uses a porous glass "frit" instead of filter paper to eliminate filter ruptures and replaces cyclical siphoning action with a more efficient continuous solvent flow. In addition, the arms have been redesigned and two valves were added that allow the device to perform extractions not possible with the Soxhlet device, such as extracting liquids from liquids. One setting permits extracting liquids that are denser than the solvent, while another extracts liquids that are less dense.
http://www.techtransfer.anl.gov/techtour/gregar.html

Chemically Bonded Ceramic Borehole Sealants

U.S. Department of Energy
Office of Environmental Management
Office of Science,
Laboratory Technology Research

Argonne originally developed Chemically Bonded Ceramic (CBC) material for use by the Department of Energy in cleaning up radioactive and hazardous wastes. Its developers soon discovered that its unusual properties also made it ideal for a wide range of commercial applications, and the material has been licensed to several companies for a variety of uses and products.

Most recently Argonne has found that CBC is well suited for use as a borehole sealant in situations where conventional cement technology is not adequate. Los Alamos National Laboratory has designed engineering concepts to adapt CBC for this purpose. Typical applications include borehole wall sealing and stabilization; fluid diversion; plugging in vertical, deviated, and horizontal wells on- and offshore; sealing of lost-circulation zones; and cementing of an ocean floor area containing soft, friable muds, silts and sands. CBC sealant can be formulated precisely for specific downhole conditions.

The borehole sealant blend is a mixture of phosphate-based acid and alkaline oxide powders that can be premixed, bagged and transported to a site, where it can be mixed with water to produce a pumpable slurry using commercially available equipment and skills.

Argonne and Los Alamos are seeking partnerships with oil and natural gas firms and related service firms for full product development of a range of CBC products for use as borehole sealants.
http://www.techtransfer.anl.gov/techtour/CBC.html

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Radar-Based Sensor Offers Remote Detection of Chemicals

U.S. Department of Energy
Office of Nonproliferation and National Security

Argonne's open-path millimeter-wave (microwave) sensor provides real-time, precision measurement of airborne chemicals at 1-100 ppm under all weather conditions, day or night, at distances up to 2 kilometers. The sensor can remotely monitor emissions for many purposes, such as environmental compliance, arms control treaty verification, and fence line monitoring. The suitcase-sized, monostatic radar-based system sweeps 10-30 mW of millimeter-wave radiation through a chemical plume while a trihedral reflector, located behind the plume, returns the signal to a detector.

Previous attempts at using microwave spectroscopy in open-path monitoring were hampered by spectral line broadening from molecular collisions at normal atmospheric pressures. Argonne's new design employs fast, wide-frequency sweeps of millimeter wave radiation to mitigate broadening effects. The improved spectral line resolution permits comparing measured spectra to a spectral library for chemical identification. In addition to remote sensing, potential on-site applications include detection of pressurized system leaks as low as 10^{-5} scc/s and use as a fast-scan gas analyzer.
http://www.techtransfer.anl.gov/techtour/mmwave.html

Biosolids Used to Restore Habitat Contaminated By Sand Slag

U.S. Department of Energy
Office of Science,
Laboratory Technology Research

Aquatic Research Institute (ARI), a non-profit, public benefit corporation located in East Chicago, Indiana, took advantage of Argonne's expertise in ecosystem restoration, waste recovery and disposal, and plant sciences. ARI, in conjunction with the East Chicago Sanitary District and the City of East Chicago, was asked to develop a proposal for restoring large areas of brownfields in East Chicago. The soil contamination resulted when sand slag from steel production was disposed of by open stacking on the site. Argonne and ARI scientists determined that the relatively environmentally friendly slag could be converted into a fertile, soil-like substrate by adding other waste materials, such as yardwaste compost and biosolids. The yardwaste and biosolids are provided free by the East Chicago Sanitary District, which gains a cheap means of waste disposal. Future work will evaluate the environmental effects of the mixes, expand to other plant species, and further refine the mix composition through larger-scale experiments.
http://www.techtransfer.anl.gov/partners/aquatic.html

Software for Analyzing Vehicle Underhood Heat Factors

U.S. Department of Energy
Office of Science,
Laboratory Technology Research

Early diagnosis and remedy of existing and potential underhood heat problems can help increase vehicle reliability and reduce design time. Argonne and its cooperative research partners are helping to develop an improved, research-grade computer model that simulates underhood heat loads in vehicle engine compartments. The increasing complexity of modern automotive designs, combined with more stringent environmental regulations, have made the underhood engine space much hotter, more congested, and – with little room for adequate cooling flow – a hostile environment for today's precision automotive components. The initial focus is on developing a three-dimensional model for vital system components that affect heat transfer, such as fans and heat exchangers.
http://www.techtransfer.anl.gov/working/underhood.html

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Unique Process Produces Ultra-Pure Organoclays for Water- and Solvent-Based Systems

Water-based (aqueous) products, such as paints and cosmetics, are increasing in popularity at the expense of their oil-based counterparts because aqueous formulations are typically easier to use and are more environmentally friendly. This creates tremendous demand for water-based additives to modify a product's viscosity and flow properties. These additives include "organoclays," which are chemically treated, highly dispersed clay particles that are so small they are measured in nanometers (one billionth of a meter). Organoclays are used to improve many commercial products, including water-based paints, inks, food additives, lubricants, and adhesives.

Conventional organoclays repel water and are not compatible with water-based systems, so more expensive polymer-based thickeners have traditionally been used in these applications. Argonne has developed a unique method of preparing ultra-pure organoclays for use in water-based systems, as well as in solvent-based systems. The aqueous biphasic extraction (ABE) process simultaneously converts low-grade clay ores into a sodium form, separates the organoclay particles from the mineral impurities present in the ore, and generates a highly exfoliated (dispersed) organoclay without mechanical grinding or conventional, high-speed centrifugation. The ABE process is capable of removing ultrafine impurities, such as respirable silica and opal-CT, and provides a level of purity in organoclays that cannot normally be attained with conventional processing technologies. *http://www.techtransfer.anl.gov/techtour/organoclays.html*

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