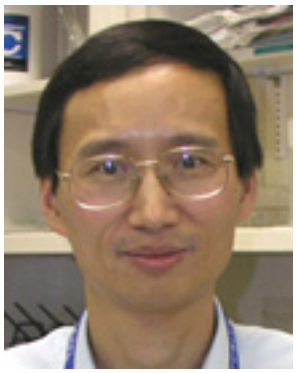

LANL's Yuntian Zhu

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Research Highlights . . .

DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Sunny future for nanocrystal solar cells

Researchers with DOE's Lawrence Berkeley National Laboratory (Berkeley Lab) have developed the first ultra-thin solar cells comprised entirely of nanocrystals made from two semiconductors, cadmium-selenide and cadmium-telluride. As cheap and easy to fabricate as solar cells made from organic polymers, these cells, which are about a thousand times thinner than a human hair, offer the added advantage of being stable in air because they contain no organic materials. Laminating the rooftops of residential homes and commercial buildings with such cells could one day convert enough sunlight into electrical power to provide virtually all of our electricity needs.

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NETL mercury control patent licensed to private industry

DOE's National Energy Technology Laboratory recently issued a license to Mobotec, USA, Inc., of Walnut, Calif., to commercially develop a promising low-cost mercury control technology termed the Thief Process. The process is a cost-effective alternative to activated carbon because it produces thermally activated sorbents by extracting partially combusted coal. Since the cost of coal is relatively inexpensive, the cost of the Thief sorbent is estimated to be between $90 and $250 per ton, much less than the estimated $500 to $3,000 per ton of activated carbon. The Thief Process was patented by five NETL researchers.

[Linda Morton, 304/285-4543, Linda.morton@netl.doe.gov]

BlueGene/L sets another mark

NNSA Administrator Linton Brooks announced Oct. 27 that the IBM BlueGene/L supercomputer developed through the Advanced Simulation and Computing (ASC) program for stewardship of the nation's nuclear deterrent has performed 280.6 trillion operations per second on the LINPACK benchmark, the standard used by industry to measure computing speed. This is more than double the speed the machine displayed running at half its current size when it made number 1 on the Top 500 computer list in June 2005. This performance was achieved in the Terascale Simulation Facility (TSF) at DOE's Lawrence Livermore National Laboratory's. Brooks made the announcement at a ceremony dedicating the BlueGene/L and Purple IBM systems, and marking the 10th anniversary of the Advanced Simulation and Computing (ASC) program.

[Don Johnston, 925/423-4902, johnston19@llnl.gov]

NREL helps develop tool for evaluating hybrid vehicles

DOE's National Renewable Energy Laboratory (NREL) recently collaborated with outside partners to develop a new software tool that compares the costs and emissions of hybrid electric vehicles (HEVs) to conventional vehicles. The tool, called the Hybrid Electric Vehicle Fleet Cost and Benefits Calculator Tool, allows fleets to evaluate the full costs and benefits of a HEV in comparison to a conventional vehicle. Fleets also may use the tool to determine the cost and benefits of a fleet of HEVs versus a fleet of conventional vehicles. The tool can be accessed from the EERE Web site.

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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).

Industry, DOE lab team to tame diesel emissions

As demands increase for the transportation sector to reduce vehicle emissions, DOE's Pacific Northwest National Laboratory is teaming with engine manufacturers and catalyst suppliers to develop new systems that will help the automobile and trucking industries meet future emission standards.

Vehicles contribute heavily to four of the air pollutants monitored and regulated by the Environmental Protection Agency: hydrocarbons, carbon monoxide, oxides of nitrogen and particulate matter. The EPA's requirements for diesel engines in heavy-duty trucks include a 90 percent reduction in particulate matter emissions by 2007 and a 90 percent reduction of oxides of nitrogen, also known as NOx, by 2010. NOx reacts with the hydrocarbons in the atmosphere to form ozone, a major component of smog.

Vehicle manufacturers are exploring several approaches to meeting the new requirements because no widely applicable technology exists to solve the problem. "Regardless of which technology comes out on top, the science doesn't change – and this makes for excellent partnering opportunities," said George Muntean who oversees emissions research at PNNL.

The Exhaust Emissions Science Laboratory, where much of this work takes place, is a multidisciplinary research center with a primary focus on supporting the mission of DOE's Office of FreedomCAR and Vehicle Technology, particularly the Advanced Combustion Engine R&D Program.

Researchers working in the emissions laboratory apply their expertise in surface chemistry, catalyst mechanisms, materials synthesis, aerosols and modeling of multi-phase flow and chemical processes to the challenges associated with diesel engine exhaust emissions abatement.

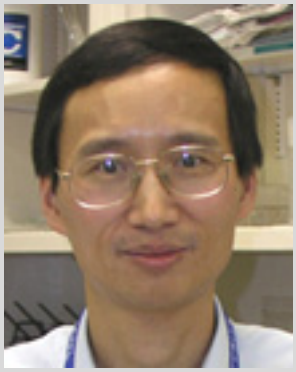
Current activities to improve aftertreatment include research with DOW Automotive to develop a highly fuel efficient diesel particulate filter, a NOx absorber sulfur study with Cummins for to increase durability and work with General Electric on a system for off-highway applications. PNNL also is collaborating with Caterpillar on a low temperature oxidation catalyst for the next generation diesel engine.

The emissions laboratory also integrates the exhaust research capabilities of DOE's Environmental Molecular Sciences Laboratory, as well as PNNL's Exhaust Chemistry & Aerosol Research Center and advanced high performance computing resources.

For example, one multi-year simulation project aims to predict the complex patterns of exhaust flow through the twisting and branching of a filter's microscopic pores. Early work indicates that the model will provide precise information about the size, shape, consistency and location of the soot deposits within and upon the filter material.

Submitted by DOE's Pacific Northwest National Laboratory

A researcher racing for results



Yuntian Zhu

Yuntian Zhu of DOE's Los Alamos National Laboratory's may have started late in the race to develop ultra-long carbon nanotubes, but he is now on the fast track to success.

Scientists have been chasing the fabrication of long carbon nanotubes for more than a decade —far longer than the two years Zhu has devoted to the project. Although their diameter is roughly one-ten-thousandth that of a human hair, carbon nanotubes are 100 times stronger than steel. Undeterred by the complexity of the challenge and his colleagues' extensive knowledge and wealth of experience in the field, Zhu entered the field confident that he and his teammates could catch up quickly.

Last year, Zhu demonstrated his expertise in the topic when he announced the creation of a world record-length, four-centimeter-long carbon nanotube developed in collaboration with chemists from Duke University.

Zhu got to the head of the pack not by following the lead of others, but by going in his own direction. "I tend to think 'Can I solve this issue with a new approach instead of approaches others have tried, but failed?' I don't want to follow anyone," Zhu said.

Beginning with nothing but his desire to understand the challenge of growing long nanotubes, he read all he could find on the topic to make sure his wasn't just a crazy idea. He also held brainstorming sessions with his fellow researchers and secured funding to pay for his work.

In May 2005, the invention was recognized as one of the top 50 technologies moving nanotechnology into mainstream markets as a winner in Nanotech Briefs magazine's first-ever Nano 50 competition. Currently, funding is being arranged to commercialize the invention, but the race is far from over. Zhu's team's next task is to develop ways to entwine the nanotubes into longer strands.

Submitted by DOE's Los Alamos National Laboratory