Pacific Northwest National Laboratory
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Sharing the Excitement of Science

Breakthrough Science and Technology for the Northwest

Richland, Washington

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PNNL's science a key contributor to Motorola's semiconductor advances

Motorola Labs announced a breakthrough discovery in semiconductors in early September that serves as a perfect example of how the fundamental science at Pacific Northwest National Laboratory and state-of-the-art tools at a national user facility are making a significant impact on commercial products and the nation's economy.

As one of the first industrial users of the U.S. Department of Energy's William R. Wiley Environmental Molecular Sciences Laboratory at PNNL, Motorola scientists have had access to scientific instruments and equipment that were well ahead of industry standards. Hands-on experience with Laboratory tools and interactions with EMSL researchers gave Motorola scientists a strong appreciation of the science underlying their challenge to create the next generation of semiconductor wafers.

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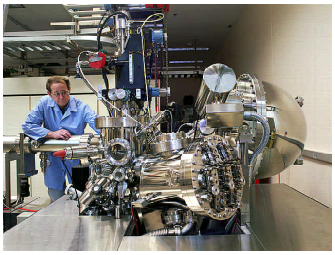

"PNNL has greatly assisted us in understanding the interface between our epitaxial oxide materials and the silicon substrate," said William Ooms, director of materials, device and energy research at Motorola Labs, in a letter to PNNL. "This unique equipment and new understanding of the science has greatly accelerated our progress."

PNNL and Motorola scientists used a unique growth and characterization system to obtain detailed information about the formation, stability and electronic structure of single crystal oxide layers on silicon. Along with other research, the Molecular Beam Epitaxy system designed by PNNL scientist Scott Chambers provided Motorola with the information needed to successfully combine workhorse properties of silicon with the speed and optical high-performance capabilities of compound semiconductors known as the III-IV materials. This scientific advancement will result in smarter electronic products that cost less and perform better. Motorola will manufacture silicon wafers using this new technology in 2002 and produce communication devices containing circuits manufactured on these substrates in 2003.

Oregon universities partner with Laboratory

The Oregon University System, Oregon Health & Science University and Pacific Northwest National Laboratory have formed a collaborative relationship to further research that will benefit human health, create sustainable industrial practices and create high-tech businesses in the Northwest.

Initial activities include two collaborations in the life and physical sciences and one in economic development. A new program in functional genomics will link OHSU's advanced technologies for monitoring gene expression with PNNL's state-of-the-art protein analysis methods to create a unique database that could hold clues to disease prevention. In another collaboration, PNNL and several Oregon research universities will share microtechnology research efforts that could revolutionize the production of heat exchangers, heat pumps, combustors, fuel processors and other devices.

In the economic development arena, PNNL will partner with the Oregon Technology Transfer Council, a group comprised of technology officers from Oregon's research universities, to create The Northwest Virtual Entrepreneurial Support Network. The network will share technology, management, money and marketing resources in Oregon and Washington to create successful high-tech businesses. See **http://www.pnl.gov/news/2001/oregon.htm** for more.

Water and energy—managing powerful partners

In the Northwest, water and energy go hand in hand—and researchers at Pacific Northwest National Laboratory are using that relationship to develop an integrated management process that links hydropower generation and natural resources. As part of the Laboratory's internally funded Integrated Natural Resource Management Initiative, researchers are developing a plan that combines physical, ecological and economic process models.

"Some of the same conditions that affect the timing and abundance of water availability for the hydro system also affect the demand for water for other uses, including power generation," said Rick Skaggs in the Laboratory's Natural Resources Group.

California's power crisis in early 2001 brought national attention to the critical relationship among power, water and environmental quality when precious water from reservoirs in Washington and Oregon was sent through Northwest dams to produce energy for southern neighbors. At the same time, a low snow pack meant increased management of rivers' in-stream flow to support salmon protection and recovery measures required by the Endangered Species Act. Then farmers, who rely on the same water for irrigation, faced water shortages and potential crop loss.

Researchers are hoping their work will help federal, state and local agencies better understand and balance the potential outcomes—and trade-offs—of river operation alternatives and ultimately enable decision-makers to make robust, reliable decisions in the face of uncertainty. For more about PNNL's natural resource management and other energy projects, see **http://www.pnl.gov/breakthroughs/fall01/special2.html**.

Habitat mapping helps preserve environment

With help from Pacific Northwest National Laboratory, Washington's King County knows where it could locate the outfall from its new wastewater treatment plant for the least environmental impact on the Puget Sound shoreline.

Using a combination of side-scan sonar and underwater videography, researchers at PNNL successfully characterized nearly 14 miles of shoreline, creating baseline maps and identifying potentially sensitive areas. In addition to helping identify a site location for the plant outfall, these assessments will be used in determining future restoration scenarios.

Researchers found the combined technologies of sonar and video provide much greater accuracy and detail in characterizing shallow water than more traditional methods. They continue working on system refinements that will save time, such as neural-network-based pattern recognition capabilities to automatically characterize and extract features from the sonar imagery in the near-shore environment. See **http://www.pnl.gov/breakthroughs/fall01/update.html#mapping**.

Reinhold Mann named deputy laboratory director at PNNL

Dr. Reinhold Mann joined Pacific Northwest National Laboratory as the new deputy laboratory director for science and technology, taking his post Oct. 1.

Known for his ability to integrate large programs and lead large research teams, Mann's role at the lab will include assuring that key scientific initiatives at PNNL—including systems biology, computational science and engineering and nanoscience and nanotechnology—are integrated with PNNL's other research activities.

Mann has more than 20 years of experience as a researcher and leader in life, physical, computational and engineering sciences. He comes to PNNL from the Department of Energy's Oak Ridge National Laboratory in Tennessee where he was director of life sciences.

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