Turning over a new leaf

NANOTECHNOLOGY

An artist's impression of the new nanocenter, adjacent to Brookhaven's synchrotron facility. (Courtesy of Brookhaven National Laboratory.)

Brookhaven National Laboratory (BNL) is moving ahead with its planned nanocenter. With sponsorship from the US Department of Energy, conceptual design of the new center is beginning, with full design beginning in the spring. Construction should begin in 2005, if the project goes according to plan.

Ron Pindak, Interim Associate Director of the Brookhaven Nanocenter, explains that it will offer large-scale facilities that universities may not have, with around 70 trained staff on hand to help. Facilities vital to future developments in nanotechnology include BNL's laser electron accelerator facility (LEAF), which enables the flow of charge in nanostructures to be studied, as well as synchrotron radiation light sources and neutron scattering facilities for characterization. The 7250 m^2 new building will allow for synthesis, processing, and fabrication of nanoscale materials. Particular research interests range from organic films to nanocatalysts, including magnetic nano-assemblies and the electronic conduction in molecular wires and dots.

Since the new center will build on existing facilities and capabilities, BNL is keen to start working with users in the meantime. According to Pindak, BNL intends to work cooperatively with the other nano research centers that are springing up across the US. Eventually, BNL expects around 400 researchers per year to use the nanocenter.

Sandia's 'sweet spots'

BIOTECHNOLOGY

Sandia National Laboratories is bringing a 'bio' focus to its efforts in organic sciences developing new materials and antiterrorism technologies.

"The same way computers dominated the past 20 years, biology is going to dominate this new century like nothing else will," says Bill Camp, director of Sandia's Computers, Computation, Information and Math Center. "How can Sandia not go into biology?" Al Romig, VP for science and technology, and Mim John, VP of the California Lab, began pushing for this new focus over three years ago. "It became apparent that if Sandia didn't go into biotech, we were going to be left behind," says John. Even before 9/11, countering bioterrorism and biowarfare were important areas for Sandia – and ones where biotech could offer obvious benefits.

"We have a lot of intrinsic strengths that make us a competitive biotech player – sensors, electronics, mathematical algorithms, and computational ability," explains Romig.

In 2000, Sandia established a Biotech Science and Technology Council to turn the labs into a biotech center and three new departments were formed. A year later, a biotech portfolio, Laboratory Directed Research and Development (LDRD), was formed to provide 'seed' funding for the new area. This included three 'Grand Challenges' focusing on interfacial bioscience (to develop new bioanalytical instruments); molecular integrated microsystems (to develop tailored nanomaterials and addressable microdevice architectures); and bio-micro fuel cells (to develop power sources that use fuels from biological sources). This year, about $21 million of Sandia's $1.7 billion budget will be devoted to biotech, including $9.8 million on the three Grand Challenges and nine other LDRD projects. "We will be working in the 'sweet spots' in physical and bio areas where we have expertise and where there is greatest need," explains Romig, namely bioterrorism and health care. But there is also another reason for going bio. "I am very excited about how bio will be a key enabler of nano and lead to new materials and devices," he says. "To stay at the cutting edge of nanoscience, materials science, and micro/nano devices we must invest in bio. I would bet that someday bio-inspired materials and devices will appear in Sandia national security systems and nuclear weapons."

Black ball of sunshine

NEW FACILITIES

US homeowners spend an estimated $65-75 billion per year on maintenance, repair, and replacement, according to the National Association of Home Builders, often because of premature material failure. But predicting how materials respond to outdoor weathering can be a tricky business. A new facility at the National Institute of Standards and Technology's (NIST) Building and Fire Research Laboratory could make all the difference.

The NIST SPHERE (short for 'Simulated Photodegradation by High Energy Radiant Exposure') is a revolutionary device that allows the effect of ultraviolet (UV) radiation, temperature, and humidity on polymer coatings, materials, and structures to be determined quickly and reliably. Nicknamed the 'black ball of sunshine', the NIST SPHERE will "revolutionize how products are developed, tested, and marketed," according to NIST's director Arden Bement.

The device can accommodate over 500 samples at any one time, which can be housed in any of 32 specimen chambers. UV radiation can be uniformly distributed to the chambers, with independent control of temperature and humidity. A wide variety of weathering conditions can be mimicked simultaneously – from a California sunset to a North Dakota winter night. The device allows weathering studies to be performed around 50 times faster than in outdoor weathering for rapid testing. "The SPHERE will make it possible for manufacturers to rapidly develop innovative products tailored for specific environments and will enable consumers to choose a product based not only on cost, but also on its expected service life performance," says Bement.