

# Stanford to unveil newly renovated hub for nanotech research

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Stanford nanotechnology researchers and technology industry leaders will dedicate the latest nanotechnology research facility on campus—the newly renovated Stanford Nanocharacterization Laboratory (SNL)—on Oct. 5 from 3 to 6 p.m. In the facility, located in the Geballe Laboratory for Advanced Materials, researchers will be able to resolve and investigate structures as small as two tenths of a billionth of a meter. Such mastery of the incredibly small is essential to producing innovations in fuel cells, semiconductors and other important technological components.

"This is the first time at Stanford in which we have gathered all our equipment for characterization of materials into one coordinated facility," says Robert Sinclair, director of the SNL and chair of the Materials Science and Engineering Department. "The renovation has created an open laboratory space whereby students and researchers working on different types of instruments can interact, providing a synergy which could not have happened before."

The lab's formal unveiling at 4:45 p.m. will highlight an afternoon of events, beginning with an hour-long tour of the Allen Center for Integrated Systems at 3 p.m., followed by remarks by Arthur Bienenstock, vice provost and dean of research and graduate policy, in Stone Pine Plaza. Joining Sinclair and Bienenstock will be the industry leaders who helped make the renovation and the most recent equipment acquisitions possible. They are Craig Barrett, chairman of Intel Corp. and a former Stanford materials science professor, and his wife,

Barbara; Morris Chang, chief executive officer of Taiwan Semiconductor Manufacturing Corp.; and Vahé Sarkissian, president and chief executive officer of FEI Co., which makes nanocharacterization equipment. Barrett, Chang and Sarkissian will speak before Sinclair unveils the lab.

## **Figuring out fuel cells**

One recently acquired FEI tool, a focused ion beam (FIB), is now being used in a multidisciplinary collaboration among three School of Engineering professors to improve the design and prototyping of a fuel cell. Students of Professor Fritz Prinz, chair of the Mechanical Engineering Department, have been using the machine to study ultra-thin membranes that enable the power-producing chemical reaction to take place in solid oxide fuel cells.

"Current solid oxide fuel cells operate efficiently around 800 degrees Celsius, which is very high compared to typical temperatures inside an automobile," explains Paul McIntyre, associate professor of materials science and engineering, who is part of the collaboration along with chemical engineering Professor Stacey Bent. "In order to use such a power plant in a car, it would be necessary to have expensive and heavy cooling systems that are not desirable in a passenger vehicle."

By experimenting with new materials and structures for the membrane, the researchers hope to reduce the fuel cell's operating temperature. The FIB allows researchers to study and experiment with the membranes because it can dissect fuel cell structures, add materials or simply act as a high-resolution microscope, enabling measurements. Such tools and a well-designed environment in which to operate them effectively are essential to nanotechnology work, McIntyre says.

## Stanford's nanotechnology nexus

The upgraded SNL is one of several major research facilities at Stanford that together give scientists and students a full suite of tools for exploring and exploiting nanotechnology. Also hosted by the School of Engineering in the Center for Integrated Systems is the Stanford Nanofabrication Facility, which is a shared, 10,000-square-foot clean room for making computer chips and other devices with nanoscale structures. It is supported by the National Science Foundation through the National Nanotechnology Infrastructure Network. And last year Stanford researchers won a \$7.5 million grant to establish the Center for Probing the Nanoscale, a facility for developing new tools for nanotechnology research. It is co-directed by faculty members Kathryn Moler and David Goldhaber-Gordon and located in the Geballe Lab.

"Our advanced electron microscopes, and future surface science tools, provide a natural and extremely important complement to the fabrication, synthesis and computing laboratories at Stanford," Sinclair says. "The SNL opening is indeed an exciting development, expanding Stanford's influence in this critical research area of the future."

Source: Stanford Nanocharacterization Laboratory

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