Argonne NATIONAL LABORATORY

News Release

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For immediate release

Argonne materials scientist wins young investigator award for work that could shape frontier of information technology

ARGONNE, Ill. (June 12, 2008) – Seungbum Hong, a materials scientist at the U.S. Department of Energy's (DOE) Argonne National Laboratory, received the Young Investigator Outstanding Achievement Award from the International Symposium on Integrated Ferroelectrics, a prize that recognizes his contributions to the study of a class of materials that could shape the frontier of information technology.

Before coming to Argonne in October 2007, Hong worked at Samsung, where his research focused primarily on finding ways to use ferroelectrics to more efficiently store electronic information. During his time at Samsung, Hong found that his true passion lay in basic science and published dozens of academic papers detailing his discoveries.

To store electric information, scientists use certain physical properties – for example, magnetism or electrical polarization – that enable tiny cells to switch between two states of equivalent energy. In his applied research, Hong attempted to find a way to reduce the energy necessary to trigger a switch in a cell. The less energy required to switch the cell's energy state, the smaller the cells that can be fabricated, Hong said.

However, repeated switching between different energy states can cause the cells to wear out – a process known as fatigue. As cells fatigue, small regions within the cells can take on energy states opposite to that of the cell itself. This problem, known as "frozen domains," formed the basis for some of Hong's most significant results.

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Hong used atomic force microscopy (AFM) to probe these regions of the cell, which often measure no more than 100 atomic layers thick. While other scientists had examined the fatigue using macroscopic techniques, Hong was the first to investigate the phenomenon using AFM.

As others followed Hong's lead in using AFM to investigate the surfaces and domains of the tiny cells, they began to notice inconsistent results in the electronic behavior of the domains. While other researchers dismissed the inconsistency as largely immaterial to the AFM analysis of ferroelectrics, Hong sought out an explanation for the aberration. "Before, many people just ignored the effect, because they thought that any influence that AFM could have on the collected data would be too small to notice," he said.

In the course of that project, Hong discovered that the voltage to the cantilever tip of the atomic force microscope causes a coupling between the cantilever and one of the electrodes on the cell, which can significantly contaminate the collected data. As a result of this discovery, scientists who study ferroelectrics have adopted Hong's technique of using a stiffer cantilever and high aspect-ratio tip.

Although Hong said that the time he spent at Samsung helped him to develop as a scientist, he found an additional set of rewards as he made the move to basic research. "I transitioned from industry to Argonne feeling that if I only focused on applications, I might get trapped in a short-term mindset of development. Then, as more fundamental issues arise, I might get stuck. I felt that I needed to do more basic science research, and that's where I found Argonne leading the field."

Physicist Amanda Petford-Long, who leads the Interfacial Materials Group of Argonne's Materials Science Division, in which Hong works, claimed that Hong's unique background makes him a valuable resource for any institution. "The fact that Seungbum worked in industry but made a host of important scientific contributions is very rare, and we are lucky to have him at Argonne," she said.

Hong accepted his award at the annual conference of the International Symposium on Integrated Ferroelectrics, held June 9-12 in Singapore.

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