News Release

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FOR IMMEDIATE RELEASE

New technique breaks nanometer barrier in X-ray microscopy

ARGONNE, Ill. (Nov. 9, 2006) — A new X-ray microscopy technique that observes molecular-scale features less than a nanometer in height has been developed by scientists at the U.S. Department of Energy's Argonne National Laboratory in collaboration with Xradia, Inc. By combining X-ray reflection with high-resolution X-ray microscopy, scientists can now study interactions at the nanometer-scale, where materials often exhibit new properties. A better understanding of interactions at the nanoscale promises to help cure the sick, protect the environment and make the nation more secure.

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This novel technique will lead to a better understanding of interfacial reactions at surfaces, such as ion adsorption, corrosion, and catalytic reactions. In particular, this method extends the capability of X-ray microscopy to observe sub-nanometer-sized interfacial features directly and in real time. This non-invasive approach complements the more widely used scanning probe microscopies and can image the topography of a solid surface without using probe-tips near the surface.

Argonne researchers together with Xradia, a firm specializing in X-ray optics and X-ray microscope systems, have achieved sensitivity to sub-nanometer-sized features by using a phenomenon known as phase contrast. This breakthrough makes it possible to look directly at individual steps on a solid surface, borrowing a technique used previously in electron microscopy,

“The ability to see individual nanometer-scale features is an important benchmark for X-ray microscopy” said Argonne physicist Paul Fenter. “Understanding interfacial reactivity is vital to many areas of science and technology, from the corrosion of metals to the transport of contaminants in the environment.”

“This technique opens up the possibility of watching these processes directly and will provide fundamentally new opportunities for understanding them,” added Steve Wang of Xradia.

This technique is a significant advance towards understanding the reactivity of solid-surfaces. Future studies will extend these measurements to the observation of real-time processes of mineral surfaces in contact with water. Employing a novel X-ray microscope setup developed by Xradia, and measurements performed at Argonne’s Advanced Photon Source, the most brilliant X-ray source in the Western Hemisphere, was central to the teams’ success.

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The research, funded by the U.S. Department of Energy's Office of Basic Energy Sciences, was carried out by a team at Argonne's Chemistry Division, including scientists Paul Fenter, Changyong Park, Zhan Zhang, in collaboration with Steve Wang from Xradia. The results were recently published in *Nature Physics* (VOL 2, pages 700-704, 2006).

Xradia, Inc. is a privately held company established in 2000 to commercialize high-resolution X-ray microscopy systems for nondestructive inspection and nano-scale imaging. Initially targeted at failure analysis in the semiconductor IC industry, subsequent developments have led to a suite of commercial X-ray imaging products that have permitted expansion into markets that include metrology in semiconductor IC production, scientific equipment, biomedical research and nanotechnology development.

The nation's first national laboratory, Argonne National Laboratory conducts basic and applied scientific research across a wide spectrum of disciplines, ranging from high-energy physics to climatology and biotechnology. Since 1990, Argonne has worked with more than 600 companies and numerous federal agencies and other organizations to help advance America's scientific leadership and prepare the nation for the future. Argonne is managed by the UChicago Argonne, LLC for the U.S. Department of Energy's Office of Science.

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