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Press Release

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## **The World's First Diamond Nanoprobe Tips Demonstrate Success in Nanomanufacturing**

Romeoville, IL—June 16, 2010—Advanced Diamond Technologies (ADT), the University of Illinois at Urbana-Champaign, the Naval Research Laboratory, and the University of Pennsylvania have published groundbreaking work in the May 2010 issue of the journal *ACS Nano* demonstrating that nanometer-scale diamond tips exhibit unparalleled stability and anti-fouling capabilities under extremely harsh conditions.

“Wear-resistant Diamond Nanoprobe Tips with Integrated Silicon Heater for Tip-Based Nanomanufacturing,” demonstrates the ability of UNCD<sup>®</sup> tips integrated with doped silicon atomic force microscope (AFM) cantilevers for use in nanomanufacturing. The initial UNCD tip radius can be as small as 15 nm, and retains its shape when scanned for more than a meter at high temperatures and under high loading forces. Silicon tips, frequently used in prototype nanomanufacturing demonstrations, are quickly destroyed under similar conditions. Additionally, silicon tips easily foul, or pick up undesirable material from the scanned surface, while the low stiction properties of diamond avoid fouling.

“The UNCD probe tip, integrated onto a silicon heater-thermometer, has extraordinary longevity and demonstrates success under the harsh conditions required for tip-based nanofabrication,” said team leader Dr. William P. King, associate professor and Willett Faculty Scholar at the University of Illinois. “There are countless applications where we would like to have a nanoprobe scan over a hard surface at high temperature and high loading force.”

Tip-based nanofabrication is the ability to use a nanometer-scale tip to imprint or write patterns onto a material; which is comparable to using a pencil to write on paper. In the nanoworld, writing tiny patterns is extremely difficult. Tip-based nanomanufacturing is currently used to fabricate or repair nanoelectronics or lithographic masks; a demanding job requiring the tip to scan long distances over hard substances.

“Diamond has long been considered the ideal tip material. This paper demonstrates how UNCD technology meets the challenge of demanding specifications of imaging and nanomanufacturing placed on the tip radius of dimensional stability; thus paving the way for probe-based technologies for a number of applications,” said Dr. John Carlisle, chief technology officer, ADT.

These wear resistant diamond nanoprobe tips integrated with silicon heaters are perfectly suited for nanomaterials characterization, nanoscale transport measurements, and applications such as dip-pen nanolithography, probe-based non-volatile memories, and patterning nanowires on surfaces.

Next, the researchers will be building and using arrays of these probe tips. “The longevity of these probes allow them to be implemented in massively parallel arrays that could scan over long distances and at high speed,” said Dr. King. “We can now think about using nanoprobe tip arrays to address many square centimeters of surface area. Eventually we’ll go to nanoprobe scans on a meter scale.”

ADT and its university partners gratefully acknowledge DARPA’s Tip-Based Nanofabrication Program for sponsoring this work.

#### **About Advanced Diamond Technologies**

ADT is the world leader in the development of diamond for industrial, electronics, energy, and medical applications. ADT is a World Economic Forum 2007 Technology Pioneer, a recipient of a 2008 EuroAsia IC Award in the Materials Enabling category from *EuroAsia Semiconductor* magazine, and a 2008 R&D 100 Award winner for UNCD Seals (mechanical seals for pumps), and a 2009 R&D 100 Award winner for NaDiaProbes<sup>®</sup> (the world’s first all-diamond AFM probes). For more information about ADT, visit <http://www.thindiamond.com>.

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