

# NANOBIOTECH NEWS

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## Nanomix in new deals to commercialize nanotube-based detection devices

By Russell A. Jackson

Private carbon nanotube player Nanomix, Inc., of Emeryville, CA, has inked research and development agreements with the Naval Research Laboratories, the Center of Integrated Nanomechanical Systems (COINS) at the University of California at Berkeley, which is a National Science Foundation nanotechnology center, and the University of Pittsburgh. The goal: develop and commercialize medical applications for Nanomix's Sensation technology.

That technology, the company says, "is contained in an array of devices that would fit on the head of a pin." The firm has selected three market segments for deployment of its detection platform. One is the industrial gas segment, in which it took "a unique hydrogen sensor" to market early this year. In the nanobiotech space, Nanomix's second market segment is medical breath testing. That arm of the company plans to bring to market "a high-volume, disposable application -- a quantitative emergency respiratory monitoring device" in late 2006.

The third segment includes products that employ fundamentally new, simplified and disruptive methods for nanoelectronic biomolecule detection.

"Nanomix is actively seeking collaborative partners for joint development and distribution within those market segments," the firm says. And, explains Christian Valcke PhD, vice president of research and development, the three just-announced affiliation partners represent a mix of government and academic institutions -- right in line with that goal.

"We have identified the entities because of their research efforts that are complementary with Nanomix technology," he tells *NanoBiotech News*. "NRL has published frequently on carbon nanotube network devices and their detection applications. The team there has demonstrated unique

detection signatures for a variety of analytes through electronic characterization of nanoelectronic devices. The agreement extends that work to biodetection in liquid media."

The research group at UC Berkeley's COINS, he continues, "is focused on enhanced detection utilizing nanomaterials for both gases and bioanalytes. The multidisciplinary team there consists of a tremendous knowledge base related to nanomaterials and nanofabrication. Research activities are focused on novel synthesis, fabrication and characterization of materials at the molecular level."

And, he adds, "the work at UP is focused on synthetic chemistry for enhanced molecular recognition. The medical literature has documented a strong relationship between analytes found in exhaled breath and a variety of treatable medical conditions. Respiratory detection of some analytes has not been pursued because of limitations in current measurement technology. The advantages of the Sensation detection platform make practical measurement of those analytes achievable, enabling innovative diagnostic and monitoring applications. One such example is the development work at Nanomix toward a disposable emergency respiratory monitor for CO<sub>2</sub>."

All three partnerships work on basic research activities that can feed directly into the product development activities at Nanomix, he adds. "The focus here on product development and commercialization represents a logical outlet for the results of research flowing from those academic and government institutions." But that's all the information he's willing to give up at this time. "Nanomix is a private company," he says, "and detailed terms of the agreements are confidential."

Eric Snow, head of the NRL's nanotechnology section, notes that "the combination of our research activities on nanotube sensors with the Nanomix technology development significantly increases the possibilities of additional commer-

cial applications." And Jeff Grossman, executive director at COINS, says "the addition of Nanomix as an industrial collaborator will accelerate our development of real-world applications of nanosensors."

Indeed, Nanomix is "launching a portfolio of devices based on Sensation detection technology," the company reports. "The scaleable, nanoelectronic devices use ultra-sensitive carbon nanotube sensing elements combined with proprietary chemistries that can be deployed across a broad range of industrial and medical applications where the attributes of nanodetection technology -- low power consumption, small form factor and high sensitivity -- offer significant performance advantages and enable unprecedented access to critical information."

Valcke adds that "the unique material and electronic properties of carbon nanotubes are utilized to fabricate detection devices. The platform can be used for detection of gas analytes and also in liquids. To enhance the selectivity and sensitivity of the platform, the nanotube network can be chemically modified with functionalized layers. The composition and processing of those functionalization layers constitute our 'proprietary chemistries'."

Specifically, he says, "carbon nanotubes are combined with silicon microstructures using proprietary materials and methods. Electrical properties can be measured by applying a voltage, thus providing a characteristic signal." The nanotube network is coated with a functional layer that interacts with the chemical or biological analyte of interest. The 1 nm diameter of the nanotubes allows for ultra-sensitive detection, as very slight changes in electronic characteristics can be measured," Valcke adds.

The principal competitive advantages of Sensation technology, the company says, include:

- a wide variety of disruptive industrial and medical applications, providing access to information;
- sensitivity, specificity and reproducibility, with the ability to select a desired dynamic range;
- electronic detection, which eliminates the need for expensive labeling chemistries and optical equipment;
- room temperature operation, low power consumption, wireless integration and simple deployment;
- sensor arrays, which enable multi-analyte detection and maximum flexibility in test design; and
- proprietary know-how enabling manufacturing scalability.

There is a growing demand for such detection

devices, Valcke comments, based on:

- a need for immediate access to critical information to improve public health and safety;
- provision of access to critical information where and when it's needed for decision-making -- such as portable detection of dangerous gases or viruses in breath or emergency respiratory measurements;
- a growing demand for medical point-of-care information;
- the promise of genetics and proteomics to diagnose and treat disease;
- an aging patient population that demands greater access to information in a more cost-effective manner;
- new military and homeland security demands for the detection of explosive, chemical and biological warfare agents -- as well as environmental and health and safety regulations; and
- a need to simplify complex testing protocols to make them practical for routine use, such as clinical and point-of-care diagnostics, drug discovery, human identification, personalized therapy, continuous monitoring and biomedical research.

With its twin focuses on "saving lives and improving patient health," the company says, it "plans on making testing and monitoring information accessible at the point of care." Nanomix breath analysis products, for example, provide diagnostic and monitoring information for providers and individuals who need access to information for real-time patient assessment. "Current technology provides limited information at the point of care," the company says, "resulting in potential loss of life or undesired patient outcomes."

The Nanomix Sensation detection platform "will also simplify and expand the use of biomolecule analysis," the firm continues. "Nanomix biomolecule detection solutions simplify conventional processes for scientists, medical professionals and other individuals who need routine access to diagnostic information. Current technology is complex, time-consuming and expensive, which limits access to critical diagnostic information."

Indeed, Valcke tells *NanoBiotech News*, "a review of the literature will reveal hundreds of applications for nano-electronic-enabled detection. Through our opportunity evaluation process, we have narrowed that down to a prioritized list of about 20 applications with significant revenue and growth potential. Some of them are already in development at Nanomix and others are being explored through collaborations."

*Editor's Note: Contact Christian Valcke at (510) 428-5300. ©*