

# Nanotechnology: A risky frontier?

November 5 2009, By Thomas Lee

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Inside a cramped back room at Rushford Hypersonic, a start-up headquartered in southeastern Minnesota, sits a cube-like machine that throws a mean atomic fastball. At the push of a button, the reactor hurls atoms toward a substrate material at eight times faster than the speed of sound.

The result is a coating that significantly strengthens industrial tools such as knives and drill bits. Rushford's technology, licensed from the University of Minnesota, is just one example of how local companies, from corporate giants such as Medtronic Inc. and Seagate Technology to start-ups like Rushford, Vixar Inc., and BioCee Inc., are embracing nanotechnology.

"It's the next generation," said Rushford CEO Daniel Fox, who bills his start-up as the first nanotechnology company in rural Minnesota. "It's what's coming. Nanotech does not need to be done by just big corporations like IBM and Ford. If we don't do it, we're going to be left behind because the rest of the world is really pushing it."

Broadly defined, nanotechnology is the science of coaxing special properties out of matter less than 100 [nanometers](#). At that small size -- one nanometer equals 1/10,000 the width of a human hair -- some matter displays unique characteristics, such as greater surface size, electrical conductivity and resistance to liquids like water. The result is batteries that pack more juice, light bulbs that use less energy, and, further down the road, medical devices that can deliver drugs and [stem cells](#) to diseased tissue anywhere in the body. In Rushford's case, the coating's

nanoparticles bind closer together, increasing hardness, resisting fracture and better tolerating heat.

But if size is nanotechnology's greatest asset, it's also the science's greatest worry. Matter may be helpful at such a small size. But could it also be harmful? Some studies suggest carbon nanotubes could damage the lungs in the same manner as asbestos fibers. Nano-size carbon and silver also can quickly reach the brain if inhaled. Scientists have yet to determine how humans and the environment react to nano materials over time and at different exposure levels.

Despite decades of research, federal regulators, including the Environmental Protection Agency and the Food and Drug Administration, are still struggling to define and identify nanotechnologies, let alone determine if they cause cancer or genetic mutation. Without clear scientific and legal guidance, some companies are hesitant to embrace nanotechnology, mindful of the billions of dollars in jury awards and cleanup costs associated with asbestos and pesticides. Insurance companies like Travelers Cos. Inc. in St. Paul, Minn., also wonder whether they should underwrite companies using nanotechnologies.

"The lack of clear regulations really keeps companies from finding markets," said Mark Bunger, a research director for Lux Research in San Francisco. "They're also not looking for product improvements they could get out of nanotechnology. If consumers aren't sure about it and the regulators aren't sure about it, then sellers of nano materials can't find buyers."

Companies are especially sensitive to how the public reacts to a new technology. In general, the public doesn't know much about nanoscience, which means any health or safety scare, even an unfounded one, could doom the technology, no matter how promising, experts say. For

example, worldwide fears of genetically modified crops, introduced in the 1990s, cost U.S. farmers \$100 million in export losses a year, according to the Environmental Defense Fund in Washington, despite the lack of evidence biotech foods are unsafe.

"We're aware of that," said Darrel Untereker, Medtronic's vice president of research and technology. "We would be foolish not to realize that perception becomes reality. Unfounded worries will always be troublesome to some industries. But we have to use our heads and listen to the science. We should worry about things that are real."

Medtronic has used nanotech coatings on millions of its implantable devices for years without any problems, he said.

The fact that nanotech has evolved from the stuff of science fiction to a broad-based technology used or explored by so many different industries should give regulators a sense of urgency, analysts say. Nanotech will touch an estimated \$3 trillion worth of products by 2015 compared with \$240 billion last year, according to Lux Research.

But where to start? No one, not even the federal government, knows how many nanotech products are out there. The Project on Emerging Nanotechnologies in Washington maintains an online database of more than 1,000 consumer products with nanotech, including tennis rackets, ketchup, socks and flash drives. The number is probably higher since the project has limited resources to track such information, said Andrew Maynard, the project's chief science adviser.

In September, the EPA held a workshop in Raleigh, N.C., on regulating titanium dioxide, a common nano material often used in sunscreen products. The agency asked a group of 50 scientists, researchers and academics in the United States and Canada to help the EPA identify research priorities. After two days of intensive discussions, the group

could not even agree on standard definitions, terminology and testing protocols, frustrating some scientists eager to focus on toxicity.

Despite years of such consultations, the EPA has yet to act, critics say.

"It's not that EPA is going slow, they're just not doing anything," said Bunger, who attended the workshop.

EPA officials defend their approach, arguing they want to get the science right before they regulate the technology. Federal regulators were widely blamed for failing to anticipate the danger of asbestos.

But Fred Miller, a toxicology expert and another workshop participant, said it's time for the EPA to move forward on nanotech.

"There's enough (information) for them to quit analyzing," said Miller, a consultant and former Public Health Service Officer assigned to the EPA. "What should the agency be studying? They don't have a firm grasp yet."

At the same time, the EPA is hobbled by funding woes and bureaucratic infighting, Miller said. The EPA also needs a new law to replace the outdated Toxic Substances Control Act, he said. The law, passed in 1976, is not strong enough for the EPA to regulate such a rapidly evolving technology, environmental advocates say.

For instance, the EPA can't disclose data to state and local governments if the company deems it confidential business information. Such a designation does not expire. The EPA also can't require companies to test their nano material unless it "presents or will present an unreasonable risk."

The regulatory haze has prompted mixed responses from corporate

America. In Minnesota, a coalition of top business, academic and political leaders is working to convert a \$100 million Seagate factory in Edina into a Minnesota Center of Excellence in Nanotechnology. And many Minnesota companies are developing expertise in the field.

But Procter & Gamble, one of the world's largest consumer products manufacturers, so far sees no "blockbuster" nanotech application that's worth the risk.

Meanwhile, chemical maker DuPont has partnered with the Environmental Defense Fund to develop a voluntary framework to help companies identify potential health, safety and environmental risks of nanotechnology.

In any case, companies don't face an imminent risk of lawsuits because it's hard to connect a health condition to a nanoproduct made by a specific company, said Albert Lin, a law professor at the University of California, Davis.

"We don't know exactly what the risks are," Lin said. "If there is a risk, can we trace it back to the parties that are liable? We are at the beginning stages."

Still, he said, "companies are beginning to think about it. They are worried about their reputation and legal liability. One bad incident could set back the field."

Insurance companies, who could be on the financial hook for such risks, are taking notice.

Travelers' risk management committee "deals a lot with product liability, and one of the things that is high on the list right now is nanotechnology," CEO Jay Fishman told an investment conference last

year. "The question becomes as that industry emerges, is that a risk class that we are comfortable writing?"

So is nanotech safe? Several experts fear airborne nanoparticles could pose a threat to people who inhale them.

But Miller, the toxicologist, says it's important to keep things in perspective. Just because products contain nanomaterials doesn't automatically pose a threat because people wouldn't necessarily inhale particles or large amounts.

"Most products that are used, it would be an exception to find a major health issue," Miller said.

What's missing is data on how exposure levels to certain nano materials will affect human and animal health over the short and long term, he said. "The public needs to understand there are benefits" to [nanotechnology](#), Miller said. "But there's no such thing as zero risk."

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