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Nano-made in Massachusetts?

Highly touted technology goes into production mode, raising manufacturing hurdles

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After Eikos Inc. Chief Executive Joe Piche spoke at Nikkei-sponsored symposium on nanotechnology in March, the 19-employee company fielded a flurry of orders for its conductive carbon nanotube coatings used in display screens.

“The result has been a tsunami of companies that want to get this into production,” Piche said. “We have been completely inundated.”

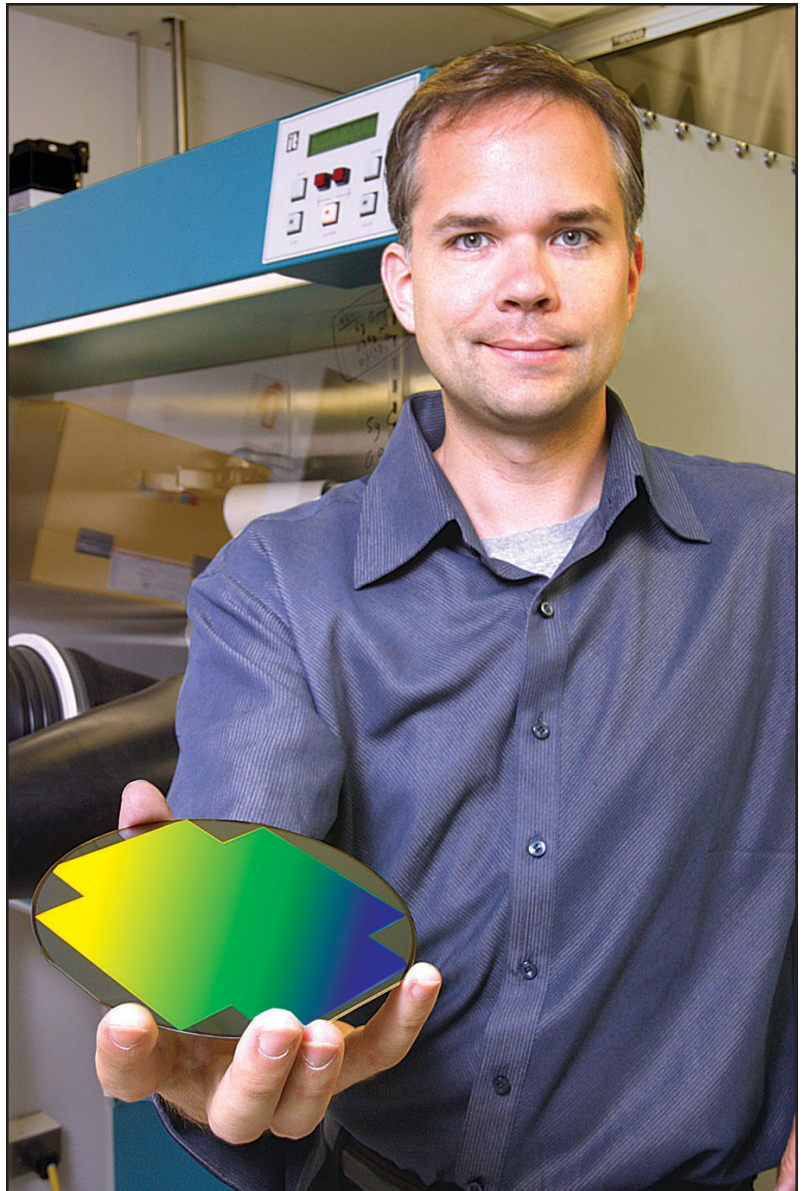
Eight-year-old Eikos began manufacturing products on a regular basis just six months ago and making regular shipments about three months ago. Now the Franklin-based company is scrambling for venture funding to expand its production capabilities exponentially, Piche said.

After Silicon Valley, Massachusetts has the greatest concentration of nano-technology expertise, locals say. But some officials question whether the state will be able to convert that expertise into a manufacturing cluster — and whether that is even important in a region that values its research base as highly as manufacturing jobs.

The practical realities of full-scale nano-technology production — components measured in billionths of a meter — are now being contemplated by more than a dozen Boston-area startups.

“There are a lot of intermediary steps these companies need to take,” said Thomas Hubbard, vice president of Massachusetts Technology Collaborative Inc. “They need to formulate the materials they want to use, scale them up, produce them and embed them in some kind of product. They are looking at a really intense process of iterating back and forth with partners to get something to market.”

A few local companies are already nanomanufacturing veterans. The 21-year-old Hyperion Catalysis International Inc. makes nanotubes to improve the conductivity, strength and cleanliness of plastic. It has been selling plastic in “hefty commercial quantities” since 1990 to the automotive and electronics industries, said sales and marketing manager Patrick Collins.



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Greg Schmergel, president and CEO of Nantero in Woburn, holds the company's prototype for a new form of computer memory on a silicon wafer containing nanotubes.

“Everyone runs around (saying) they’re going to build the next generation of computer chip,” Collins said. “That’s a new material chasing a new application. It’s many years in the future. We chose to make mundane products people are ready to buy

NONTECH: Bay State companies face unique production challenges

right now with a high-tech material.”

Kopin Corp. has been making chips with components smaller than 100 nanometers since 1995, and shipped 50 million units last year, said CEO John C.C. Fan. That got the Taunton company listed on a new nanotechnology financial index by Merrill Lynch & Co. Inc., along with Boston’s Cabot Corp.

“Nanomanufacturing is very difficult, and you have to go through many cycles of learning,” Fan said. “You really almost have to use nature to structure the products. Think of ice crystals that naturally grow — nature automatically lines those things up, and that is what you need to do. It takes very tight control parameters to make sure it grows that way every time.”

Nantero Inc., a nanoscale chip designer in Woburn, recently licensed technology to LSI Logic Inc., a specialty electronics maker in California. Nantero figured out how to bend tiny strands of carbon together to create computer circuits.

“This is a big step forward for us — it gets us out of the lab and into the fab,” or fabrication plant, said Nantero CEO Greg Schmergel. “There were several firms we considered, but LSI Logic had a U.S.-based state-of-the-art production lab and it is getting harder to find that these days since so much production has moved to Asia.”

Konarka Technologies Inc. of Lowell is poised to become another local nano-

technology producer after raising \$18 million last month to build a factory for flexible solar panels.

Modifying production from the beaker to the factory in a cost-effective fashion is a common land mine for nanotechnology companies, said Mike Masterson, CEO of ALD NanoSolutions Inc., which operates in Wellesley and Longmont, Colo.

“We have customers that want us to make larger quantities,” Masterson said. “But we have to see, if we build bigger a reactor, will we be able to deliver the same quality attributes. That’s a big jump. You usually have to bring in a big investment to prove to customers that you can scale up.”

ALD has reaped investments of “a couple of million” dollars each from the government and industry and is still in the development stage, but it plans to produce products locally for the life sciences sector, Masterson said.

As of February, 29 percent of Massachusetts companies that were using or developing nanoscale technologies were in the biopharma sector, the technology collaborative reported. Half were in electronics, instrumentation or materials, and manufacturing made up 6 percent.

“A lot ... depends on the size of market you are going for,” said Julie Chen, a professor at the University of Massachusetts at Lowell. “If you are going for a narrow focus on biomedical products, you don’t

need volume. If you are going for electronics, you are talking about millions of these things, and you would be looking for someone else to make it.”

One company taking the first step on the journey toward large-scale production is Konarka, which was spun out of UMass Lowell. The two organizations still work together as the school builds a \$23 million nanomanufacturing research facility.

Konarka’s equipment will take up about the same amount of space as a trailer, and within a year, that unit should have the capacity to produce enough solar-cell fabric to pave Interstate 95 — in both directions — between Lowell and Magwah, N.J., where Konarka’s closest rival Sharp has its base.

“With any first-of-kind chemical production, you see a progression — you initially need a pretty sophisticated engineering operation to get a plant running and understand what is going on,” said Konarka marketing chief Dan McGahn. “In nanotechnology, a lot of (the challenge) is trying to find the defect — you want to focus on things that are defect-free.”

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