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Entrepreneurial Edge

# Nanotechnology Companies Planning to Sell Shares

By JAMES FLANIGAN

NANOTECHNOLOGY companies, nurtured on billions of dollars in government grants and venture investments through most of this decade, are getting ready to go public.

Being near taking such a step is another stage in the evolution of nanotechnology, the science of materials measured at billionths of a meter or one-500th of a human hair.

Experts note that nanotechnology-enabled products are already used in industry.

“There are 200 commercial products in cosmetics, apparel and sporting goods in which nanotechnology plays a role,” said Lynn E. Foster, emerging technologies director for the law firm Greenberg Traurig and author of the 2006 book “Nanotechnology: Science, Innovation and Opportunity.” He cites clothing with a coating of nanoparticles — from the Nano-Tex Corporation of Oakland, Calif. — that repels stains.

And increasing numbers of nanotech products are in the offing. Mihail Roco, senior adviser for nanotechnology at the [National Science Foundation](#) and an architect of the government’s research effort, predicted in an interview on the Web site of the National Nanotechnology Initiative that by 2015 nanotechnology will play a crucial role in \$1 trillion worth of products, “which would require two million workers.”

Companies in nanotechnology speak of adapting their research to medical innovations, in which nanoparticles would deliver medicine directly to individual cells, and to [solar energy](#), in which nano-enabled photovoltaic coatings would capture and store the sun’s energy at a lower cost than today’s solar panels.

The NanoGram Corporation in Milpitas, Calif., is aiming some of its research efforts toward such solar ambitions. “We have 58 of our 69 employees working in R.& D. in the clean technology area, including solar power,” said Kieran Drain,

chief executive of NanoGram, which earns revenues by licensing innovations to manufacturers of optical and electronic products.

NanoGram has a venture with Nagase & Company of Japan, a manufacturer of light-emitting diode, or L.E.D., screens for digital devices. “Our nanomaterials enable the screens to emit more light,” Mr. Drain said. In its 11-year history, NanoGram has spun off or sold operations to other companies in communications and medical electronics. In the last two years, the company has raised almost \$27 million in venture capital backing and looks to go public in 2009 “when we’ll have become larger in annual revenues,” Mr. Drain said.

Another company hoping to go public in the near future is Unidym Inc., which works with clusters of carbon nanoparticles that possess extraordinary properties in tensile strength and conduction of electrical current. Sean Olson, vice president for operations and strategy, said Unidym is working with companies that produce the touch screens for cellphone devices, A.T.M.’s and airport check-in terminals.

“Our carbon nanotube technology makes the light-emitting chipsets less brittle and able to emit more light,” he said. “Our screens can take a pounding.”

Unidym, based in Menlo Park, Calif., is a subsidiary of the [Arrowhead Research Corporation](#), a public investment company that was founded in 2003 to back small companies engaged in nanotechnology research. Arrowhead, based in Pasadena, Calif., is advised by half a dozen professors at the [California Institute of Technology](#). In March, Arrowhead helped Unidym merge with Carbon Nanotechnologies, a Houston-based firm that was founded by the late nanotechnology pioneer Richard Smalley of [Rice University](#), who won the [Nobel Prize](#) for his work.

“Unidym and Carbon Nanotechnologies make a powerful combination for the future of the semiconductor industry,” said John Miller, vice president business development at Arrowhead. He explained that nanoparticles, working at atomic scales, can produce semiconductors at more infinitesimal levels than current electronic technology and at lower cost than today’s manufacturing plants, which typically cost \$5 billion to build.

Arrowhead Research is backed by Fidelity Investments, the mutual fund company, and York Capital Management, a hedge fund company, and other public shareholders.

“As a public company, we can take a somewhat longer-term perspective on earning a return on investment,” Mr. Miller said. He gave that as a reason Arrowhead was able to combine Unidym with Carbon Technologies. Venture fund investors in Carbon Technologies, which was founded in 2000, “needed to get their money out,” Mr. Miller explained. Arrowhead can now reap its own

return when it assists Unidym in going public, possibly next year if general market conditions are favorable.

The Arrowhead example points up two factors in the recent evolution of nanotechnology. One is the role of universities. In disbursing \$8 billion in research grants since 2001, the National Nanotechnology Initiative has worked through 60 or so universities all over the United States. And it is still working through the universities that have been designated as Centers and Networks of Excellence, including the Center for Nanobiotechnology at [Cornell University](#); the Center for Scalable and Integrated Nano-Manufacturing at the University of California, Los Angeles; the Institute for Nanoelectronics and Computing at [Purdue University](#) and others.

The other factor is the fickleness of financial market opinion. At the beginning of this decade, nanotechnology was greeted with predictions of instant wonders and investment success. But when technological developments seemed to take longer than anticipated, investor enthusiasm cooled and nanotechnology was looked on as an overhyped promise. Now attitudes are becoming positive again, Mr. Foster, the nanotechnology author, said, and “we’ll see many firms coming to the public markets.”

Indeed, NanoDynamics Inc., a company based in Buffalo, that has developed a nano-enabled fuel cell that generates hydrogen energy at military bases and factories, filed a registration statement with the Securities and Exchange Commission in May intending to raise \$100 million with a public stock offering. It withdrew the registration statement in November because of financial market uncertainties, but is a candidate to go public when markets settle down.

NanoDynamics had \$4.4 million in revenue in 2006 but spent \$8.8 million on research that year. Currently the company has a Defense Department grant for fuel-cell research and other financing from the [National Institutes of Health](#) for research on infection-resistant medical devices and implants.

The company needs to raise public money to build manufacturing plants for the products it is planning for the emerging solar power industry, according to its registration with the S.E.C.

NanoDynamics, Unidym and Nanogram all presented their stories at a forum on public finance for nanotechnology at Caltech on Dec. 8.

Clearly, federal and state government support for nanotech research has spawned a lively field of innovation. And giant companies, including [General Electric](#) and [Hewlett-Packard](#), are also involved in pursuing the new science.

To be sure, questions are also being raised about the risks of unleashing materials of infinitesimal size and unknown properties. The Economist magazine

reported recently that some scientists in Britain and America were concerned about possible toxic qualities of nano particles of materials that are harmless at their full size.

Asked about potential dangers, Mr. Roco of the National Science Foundation responded that issues of possible adverse effects for air, water and soil are being studied at several of the Nanotech Initiative Centers. Mr. Miller of Arrowhead Research said he believed that “questions of toxicity will be explored but balanced by the potential benefits for medicine, energy and so many other fields.”

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