

## Focus on Ohio Industry

## Nanotechnology

### New Technologies

**Third Frontier Project:** More than \$29 Million dollars is supporting nanotechnology projects around the State of Ohio, thanks to the Third Frontier Project. Examples of this investment:

#### • **NanoScale Science and Engineering**

**Center** at The Ohio State University formed in 2004 following a \$13 M award to the National Science Foundation

#### • **University of Dayton Research Institute (UDRI)**

in 2004, licensed its carbon nanofiber technology to NanoSpense, which is now applying the technology to develop lighter, stronger, and more durable polymers for applications in aerospace, electronics, equipment manufacturing and the automotive industry

#### **Ohio Ranked #10 (2004-2005)**

Ohio ranked in the top ten states most favorable to nanotechnology development, according to *Small Times* magazine. Ohio's consistently ranks in the top ten due to diversity in academic research as well as its longstanding ties to Ohio industry.

#### **Ohio is 2800 Polymer Companies**

##### **Strong!**

Ohio is the home to more than 2,800 polymer based companies. **PolymerOhio, Inc.** works with these companies, Ohio universities and other research facilities to promote the growth of nanotechnology through the communication of new developments of companies such as Applied Sciences, NanoSpense, NanoFilm and PolyOne. PolymerOhio works closely with CMPND to facilitate commercialization of new technologies.

### Center for Multifunctional Polymer Nanomaterials and Devices (CMPND)

CMPND, a Wright Center of Innovation, was formed as a research and commercialization partnership in polymer nanotechnology. Centered at The Ohio State University, CMPND works with the University of Akron and the University of Dayton, three additional Ohio universities, 50 large and small Ohio companies, the National Composite Center, polymer organizations and national labs, all situated in Ohio.

CMPND was awarded \$22.5M from the State of Ohio Third Frontier Project and in return will, by 2009, contribute more than a total of \$78M toward nanotechnology research and commercialization.

New equipment and facilities, funded from these awards, enable scale-up and prototyping and testing of materials, processes, and device assembly techniques. In addition, an interdisciplinary research and training program helps students and industrial researchers develop skills needed to pursue careers in this fast-growing field.

CMPND seeks to have a statewide economic impact by expanding existing business and creating and retaining more than 5,000 high-paying 'white collar' jobs and 20,000 to 25,000 skilled manufacturing jobs.

### Ohio Nanotechnology Summits

Ohio's premier nanotechnology event since 2005 has been **The Ohio Nanotechnology Summit**. The first summit, held in 2005 at Wright Patterson Air Force Base, proved to be a launching pad for the development of relationships between academia and industry. 500 representatives of businesses, universities, military, and federal and state government assembled at the event

The 2006 summit, held in Columbus, Ohio, focused on useful applications and the commercialization of nanotechnology.

The third annual summit, held at the John S. Knight Convention Center in Akron, Ohio featured four areas of focus:

- Nano Materials
- Nano Processing
- Nano Bio
- Nano Photonics and Electronics

#### Resources:

- [www.cmpnd.org](http://www.cmpnd.org)
- [www.odod.state.oh.us](http://www.odod.state.oh.us)
- [www.polymerohio.org](http://www.polymerohio.org)

## Ohio Universities and Nanotechnology

### The Ohio State University (Columbus)

- Demonstration of new generation of solar cells built from nanoengineered semiconductor materials
- Establishment of world-class nanoscale electron beam lithography capability
- Creation of the world's single highest resolution microscope, capable of imaging structures less than one hundredth of a nanometer in size

### University of Dayton (Dayton)

- Development of near-field scanning microscope, of special interest to microelectronics industry
- Research to tailor the growth, treatment, physical characteristics and performance of carbon nanotubes and other novel nanomaterials
- Focus on enhancing the structural, thermal, electrical and barrier performance of corresponding polymer nanocomposites and conventional composites made from nanostructured materials

### University of Akron

- Development of new classes of functional polymers in rapidly advancing fields such as dendrimers, polymer brushes, nanocomposites
- Established nanofibers as a platform technology which can then be successfully applied toward a wide range of new products

### Ohio University (Athens)

- Development of powerful crystal growth machine and microscope funded by US Department of Defense
- Invention and use of biological nanosensors to measure nitric oxide in the body
- Studies aimed at improving the construction of quantum dots, which may become the building blocks of tomorrow's quantum computer

### University of Cincinnati—Institute for Nanoscale Science and Technology (Cincinnati)

- Use of carbon nanofibers from Applied Sciences in Cedarville, OH to develop reinforced polymer composites
- Assisting Siloam Biosciences with commercialization of a smart disposable polymer biochip for a wristwatch-sized health monitor
- Use of carbon nanotube arrays in reinforcing laminated composites as part of the Ohio Center for Advanced Propulsion and Power in collaboration with the Air Force Institute of Technology

### Case Western Reserve University

- Leader in development of targeted nanoparticles for imaging and therapeutics
- Additional nanotechnology and MEMS research efforts in medical, materials, industrial and electronic areas
- Development of tools to help researchers design devices at nanometer scale, including nanopatterning and Raman spectroscopy

### Kent State University—Liquid Crystal Institute

- Inventors of liquid crystal display
- LCD research uses nanotechnology to develop flexible displays, advanced electro-optics and liquid crystal structures to make sensors and other devices

### University of Toledo

- Development of new and more efficient solar cells
- Research in nanomaterials

## Ohio Organizations and Nanotechnology

- PolymerOhio, Inc (Westerville)
- Ohio Supercomputer Center (Columbus)
- Air Force Research Lab (Dayton)
- NASA Glenn Research Center (Cleveland)
- Ohio's Edison Centers—including CAMP—Cleveland Manufacturing Technology Center (Kettering) and EMTEC—Edison Materials Technology Center (Kettering)
- Ohio NanoNetwork
- Maple Fund (Cleveland)
- ASM International (Materials Park)
- Ohio Polymer Strategy Council
- Battelle

## Key Ohio Companies Involved in Nanotechnology

Applied Sciences, Inc	Halden Enterprises LLC	First Solar	Zyvex Performance Mat'ls.
The Cleveland Clinic	Midwest Optoelectronics LLC	PolyOne	Maverick
Pilkington Glass	NanoFilm	Proctor & Gamble	NanoSpense
General Electric	Five Star Technologies	Lockheed Martin	Sherwin Williams
Owens Corning	GrafTech	MetaMateria Partners	Honda
Ecology Coatings	Keithley Instruments	Battelle	Ethicon-Endo
Lubrizol	ComSense	ER Semiconductor	Goodyear Tire & Rubber
A. Schulman	Ashland, Inc.		