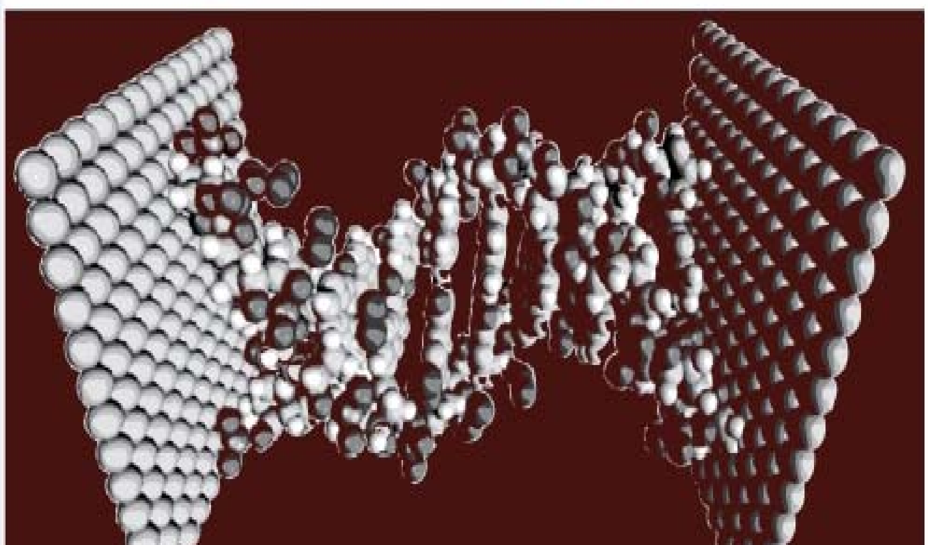
INVESTREND

INVESTREND RESEARCH

NANOTECHNOLOGY SECTOR REPORT
4TH QUARTER 2006

COMMISSIONED BY

CRONUS CAPITAL MARKETS



MOHAMMAD SHARIFZADEH, CFA, PhD

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Introduction

Nanotechnology is about application of findings of nanoscience for real life purposes. The impact of nanotechnology is so widespread that a too precise definition might picture an unrealistic view of its true scope. That is why some, like the UK Department of Trade and Industry (DTI), simply define it as "nanotechnology is about new ways of making things. It promises more for less: smaller, cheaper, lighter and faster devices with greater functionality, using less raw material and consuming less energy" (DTI, 2002). As such, nanotechnology is a collection of technologies, techniques and processes rather than a specific area of science or engineering.

The most referenced definition of nanotechnology, which incorporates the paradigm of nanosize, is provided by the U.S. National Nanotechnology Initiative (NNI). The NNI defines nanotechnology as:

> Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications. Encompassing nanoscale science, engineering and technology, nanotechnology involves imaging, measuring, modeling, and manipulating matter at this length scale. At the nanoscale, the physical, chemical, and biological properties of materials differ in fundamental and valuable ways from the properties of individual atoms and molecules or bulk matter. Nanotechnology R&D is directed toward understanding and creating improved materials, devices, and systems that exploit these new properties. (NNI, 2004)

Some of the important characteristics of nanotechnology are:

1. Nanotechnology is an *enabling* technology. It opens up the possibility of developing new classes of products not previously feasible and enables us to develop new products and processes in all industries. Implementation of nanotechnology results in emergence of new industries, new companies, and new markets. And like other enabling technologies such as the combustion engine, electricity, and the internet, it has widespread and unanticipated impacts on the society.

2. Nanotechnology is *disruptive*. Being based on new production processes and bringing about new products with better and higher qualities, nanotechnology displaces existing technologies and gradually makes them obsolete. With nanotechnology, radically new generation of existing products and processes emerge and existing firms have to adjust accordingly in order to survive.

3. Nanotechnology is *multidisciplinary*. Nanotechnology is a general capability that affects many scientific disciplines and in this process brings together people from previously separate disciplines blurring the boundaries between different sciences (Holister, 2002).

4. Nanotechnology is *global*. As will be described later in this report, governments in all developed countries are allocating funds to promote research in nanotechnology and entrepreneurs as well as some large corporations are investing in nanotechnology worldwide.

Nanomanufacturing entails two distinct approaches, the *top-down* approach and the *bottom-up* approach. These two approaches are fundamentally different. They have different approaches in making structures and they utilize the findings of different areas of science.

In the top-down approach the size of a large structure is reduced towards the nanosize, that is, towards the 1-100 nanometer dimensions using mechanical, chemical or other form of energy. The nanosize objects are then used as the *building blocks* for making larger structures with novel physical and chemical properties. The term *nanostructure*, therefore, refers to structures composed of or manufactured out of the nanosized building blocks. Main techniques employed in the top-down approach are *nanolithography* and *precision engineering*. Nanolithography is contemplated to replace or modify the *photolithography* process currently employed in manufacturing of computer chips and microelectronic devices. Currently, the alternatives developed that allow for smaller sizes than photolithography are the *E-beam* lithography and the *dip pen* lithography. The top-down nanotechnology has its scientific base in nanoelectronics and nanoengineering. Precision engineering involves using advanced tools for cutting, etching, and grinding surfaces to build nanostructures and devices.

The bottom-up approach involves building of nanostructures atom by atom or molecule by molecule. Major techniques used in the bottom-up approach are *chemical synthesis*, *self-assembly*, and *positional assembly*. In the chemical synthesis method the precursor material is transformed into molecules or nanoparticles via some chemical reactions. The resulting molecules or nanoparticles are then used either directly in other bulk materials or used as building blocks to make larger materials. Metal oxides, such as, titanium dioxide, zinc oxide, silicon dioxide, aluminum oxide, and iron oxide with commercial applications in cosmetic and fuel additives industries are examples of nanoparticles manufactured through chemical synthesis. With the self-assembly technique individual atoms or molecules are directed to self-assemble and self-organize into nanostructures and nanodevices through physical or chemical interactions. The inspirations for self-assembly technique mostly comes from biology where it is learned that cells and their pieces are made from self-assembling biopolymers such as proteins and protein complexes. Self-assembly techniques are still in their infancies, but they offer huge economies of scale, less manufacturing waste, and cleaner environment. Examples of nanostructures formed by self-assembly include quantum dot arrays, nanoporous adsorbents, and nanocrystals. The positional assembly technique involves using specific tools like the atomic force microscope (AFM) to position atoms or molecules one-by-one to build desired structures or devices. The positional assembly technique is still at laboratory and R&D stage as a challenge for future development.

Nano building blocks serve as the objects to build nanostructures and devices, analogous to the way bricks and mortar are used to construct a high-rise building. Some of main building blocks of nanotechnology are *Fullerenes, Carbon Nanotubes, Quantum Dots, and Dendrimers,*

Recent Developments in the U.S. National Nanotechnology Initiative

Since its inception in the Fiscal Year 2001, the U.S. National Nanotechnology Initiative (the NNI) which essentially consists of collaborating Federal agencies and departments has grown very rapidly and has become more articulate in its vision, goals, and investment strategy. In fact, in his 2006 *State of the Union* address, President Bush explicitly mentioned the importance of nanotechnology for the U.S. economy by pointing out that:

> And to keep America competitive…….First, I propose to double the federal commitment to the most critical basic research programs in the physical sciences over the next 10 years. This funding will support the work of America's most creative minds as they explore promising areas such as nanotechnology, supercomputing, and alternative energy sources. (President Bush State of the Union Address, Feb 2006)

Thus, The President's 2007 Budget proposes over $1.2 billion for the government's nanotechnology R&D investment through the NNI, almost tripling the NNI's budget from $464 million in FY 2001 to proposed $1,277 million for FY 2007.

In September 2006 the NNI issued the 'Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials" in which it identified and addressed the research and information needed for sound risk assessment and risk management of nanoscale materials. In this publication the NNI agencies identify five general research areas in which research is needed to evaluate the environmental, health, and safety issues of nanoscale materials. These general research areas addressed in the publications are (a) instrumentation, metrology, and analytical methods; (b) nanomaterials and human health; (c) nanomaterials and the environment; (d) health and environmental surveillance; and (e) risk management methods.

The ISE-CCM Nanotechnology Index

The ISE-CCM Nanotechnology Index (Index) was constructed jointly by the International Securities Exchange (ISE) and the Coronus Capital Markets, Inc. (CCM) in August 2005 and was launched on January 10, 2006. The options on the Index started trading on January 10^{th}. under the symbol TNY on the ISE. The Index value is calculated on a price and total return basis. The price Index is calculated in real-time and disseminated via the Options Price Reporting Authority (OPRA) and market data vendors every day the U.S. equity markets are open. The total return Index is calculated on an end-of-day basis. Both sets of values are freely available on ISE's website, www.iseoptions.com.

The ISE-CCM Nanotechnology Index has been constructed specifically to isolate "Nanotechnology Companies" in order to present an accurate and pure representation of the nanotechnology sector and to provide investors with the ability to track the nanotechnology sector. The Index always contains 17 different component stocks at all times. New companies are added to the Index only when there is a vacancy.

The component companies of the Index, their share prices, number of assigned shares, and their weights in the Index as of January 9, 2007, are listed in Table 1:

Table 1

ISE-CCM Nanotechnology Index Components as of January 9, 2007

Symbol	Name	Price	Assigned Shares	Weighting
ACCL	Accelrys Inc	6.17	350262697	6.42%
ALTI	Altair Nanotechnologies Inc	2.5	751879699	5.58%
ARWR	Arrowhead Resh Corp Com	4.32	444444444	5.70%
CBT	Cabot Corp.	44.05	47607712	6.23%
FEIC	FEI Company	26.74	78926598	6.27%
FLML	Flamel Technologies	32.58	62500000	6.05%
HW	Headwaters Inc.	23.78	83056478	5.87%
KOPN	Kopin Corp	3.64	571428571	6.18%
MTSC	MTS Systems Corp.	39.53	52287582	6.14%
NANO	Nanometrics Inc	8	246305419	5.85%
NANX	Nanophase Technologies Corp	5.71	309597523	5.25%
NGEN	Nanogen Inc	1.85	990099010	5.44%
PANL	Universal Display Corp	14.71	155763240	6.80%
SMMX	Symyx Technologies Inc	20.41	92464170	5.60%
TINY	Harris & Harris Group Inc	11.34	149700599	5.04%
UTEK	Ultratech Inc.	12.59	147928994	5.53%
VECO	Veeco Instruments	19.06	107123728	6.06%

Source: ISE-CCM Nanotechnology Index, January 2007 Report.

Performance of the Index during the Year 2006

The daily closing price behavior of the Index from January 3 to December 28, 2006 is shown in Figure 1.

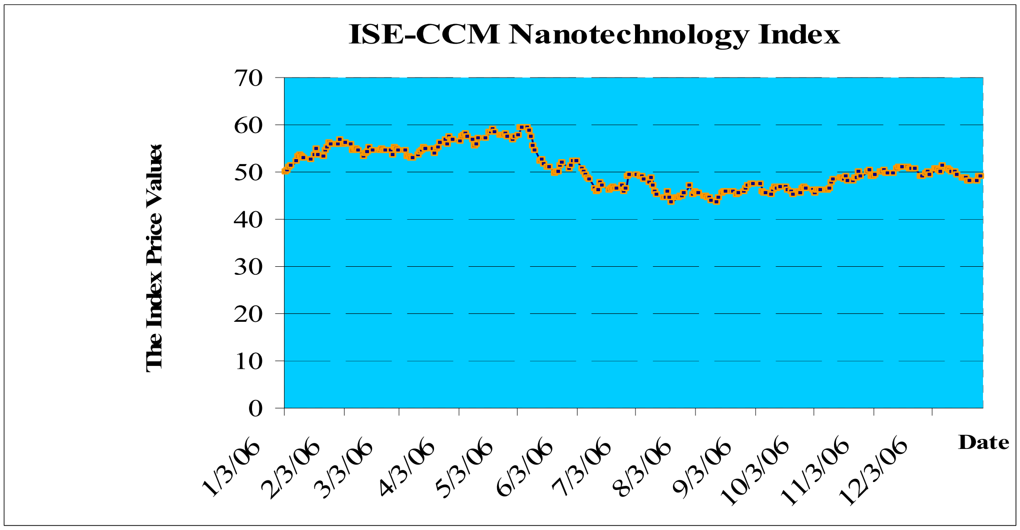


Figure 1. Price performance of ISE-CCM Nanotechnology Index during the year 2006.

The 2006 daily percentage price change of the Index versus those of S&P500, NASDAQ Composite, and Russell 3000 stock indices is plotted in Figure 2. The average daily percentage price changes, total year-to-date percentage price changes, and volatilities of daily percentage price changes for each index are calculated and reported in Table 2.

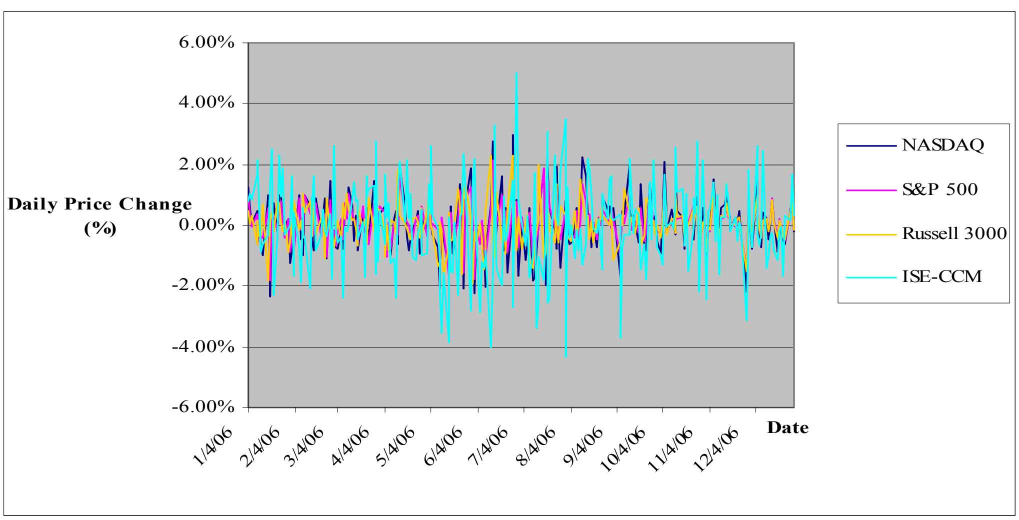


Figure 2. Daily price change (%) of ISE-CCM Nanotechnology Index versus major indices during the year 2006.

Table 2

Price Performance of ISE-CCM Nanotechnology Index versus Major Indices during the Year 2006.

	NASDAQ	S&P 500	Russell 3000	ISE-CCM
Total Price Change (%)	6.53%	11.88%	10.83%	-1.72%
Average Daily Price Change (%)	0.03%	0.05%	0.04%	0.004%
Volatility of Daily Price Change (%)	0.89%	0.63%	0.67%	1.47%

As can be seen from the numbers in Table 2, on a four quarter basis the ISE-CCM nanotechnology index underperformed major indices, by showing more volatility and less returns as compared to major indices. The reason for this is mainly due to the recovery of stock market in the second and third quarters of 2006 which resulted in investors rotating out of emerging sectors and into established segments of the market.

In Tables 3, 4, 5, and 6 performance of ISE-CCM nanotechnology index versus major indices during the year 2006 is broken down on a quarterly basis.

Table 3

Price Performance of ISE-CCM Nanotechnology Index versus Major Indices during the First Quarter of 2006.

	NASDAQ	S&P 500	Russell 3000	ISE-CCM
Total Price Change (%)	1.89%	1.63%	4.54%	7.96%
Average Daily Price Change (%)	0.05%	0.04%	0.05%	0.22%
Volatility of Daily Price Change (%)	0.76%	0.57%	0.57%	1.25%

Table 4

Price Performance of ISE-CCM Nanotechnology Index versus Major Indices during the Second Quarter of 2006.

	NASDAQ	S&P 500	Russell 3000	ISE-CCM
Total Price Change (%)	-8.75%	-3.10%	-3.13%	-12.85%
Average Daily Price Change (%)	-0.13%	-0.04%	-0.05%	-0.21%
Volatility of Daily Price Change (%)	1.07%	0.81%	0.86%	1.76%

Table 5

Price Performance of ISE-CCM Nanotechnology Index versus Major Indices during the Third Quarter of 2006.

	NASDAQ	S&P 500	Russell 3000	ISE-CCM
Total Price Change (%)	4.80%	4.85%	4.81%	-5.81%
Average Daily Price Change (%)	0.08%	0.08%	0.07%	-0.08%
Volatility of Daily Price Change (%)	0.96%	0.62%	0.68%	1.58%

Table 6

Price Performance of ISE-CCM Nanotechnology Index versus Major Indices during the Fourth Quarter of 2006.

	NASDAQ	S&P 500	Russell 3000	ISE-CCM
Total Price Change (%)	8.40%	7.02%	7.57%	6.81%
Average Daily Price Change (%)	0.12%	0.11%	0.11%	0.10%
Volatility of Daily Price Change (%)	0.73%	0.46%	0.50%	1.21%

As shown in Table 3, during the first quarter of 2006 the performance of ISE-CCM nanotechnology index far exceeded those of all general indices. In the second quarter the major indices as well as the ISE-CCM nanotechnology index had negative performances. In the third quarter although the ISE-CCM nanotechnology index underperformed the general indices but its relative performance improved compared to its relative performance in the second quarter. This positive trend continued in the fourth quarter. As a result in the fourth quarter of 2006, the performance of ISE-CCM nanotechnology index almost matched those of the major indices.

Valuations

As can be seen in Table 7 below, all the component companies of the ISE-CCM nanotechnology index are generating revenues. However, because nanotechnology is still an emerging sector and most of the companies in this sector are at the developmental stage, they mostly have negative EPS. Therefore, it is not possible at this stage to use P/E based valuation metrics. As for other valuation metrics, there is a great deal of variations. Revenue per share for the Index's component companies ranges from a multiple of 0.019x to a multiple of 42.38x. Similarly, price-to-sales multiples ranges from 0.90x to 229x. These numbers suggest that the market values nanotechnology companies on a case-by-case basis, by assessing factors such as the value of patents, potential growth, industry affiliation, and the type of products for each company separately.

Table 7

Valuation Metrics of the ISE-CCM Nanotechnology Index Component Companies

Symbol	Name	Price	Revenue (ttm):	Quarterly Revenue Growth (yoy)	Revenue /Share (ttm)	Price/Sales (ttm)	Price/Book (mrq)	EPS (ttm)
ACCL	Accelrys Inc	6.18	80.24M	6.90%	3.06	2.03	2.39	-0.24
ALTI	Altair Nanotechnologies Inc	2.62	3.04	28.10%	0.051	50.58	8.35	-0.27
ARWR	ARROWHEAD RESH CORP COM	4	595.46K	-81.30%	0.019	229.63	4.45	-0.60
CBT	Cabot Corp.	46.74	2.54B	18.80%	42.383	1.15	2.45	1.29
FEIC	FEI Company	27.3	445.48M	20.40%	13.189	2.03	2.83	-0.73
FLML	Flamel Technologies	34.65	21.50M	75.00%	0.931	36.66	10.98	-1.55
HW	Headwaters Inc.	24.3	1.12B	-12.70%	26.784	0.90	1.25	2.19
KOPN	Kopin Corp	3.69	87.97	-10.00%	1.28	2.77	1.70	0.15
MTSC	MTS Systems Corp.	39.7	369.79	17.40%	21.163	1.79	4.19	2.05
NANO	Nanometrics Inc	8.08	85.68M	104.40%	6.158	1.73	0.81	-0.87
NANX	Nanophase Technologies Corp	6.02	8.25M	44.90%	0.456	13.84	6.71	-0.27
NGEN	Nanogen Inc	1.83	21.23M	136.70%	0.389	5.72	1.85	-1.97
PANL	Universal Display Corp	14.56	11.67M	-8.20%	0.385	38.59	7.94	-0.51
SMMX	Symyx Technologies Inc	19.6	115.89M	-6.90%	3.484	5.51	2.94	0.22
TINY	Harris & Harris Group Inc	11.86	3.11M	128.20%	0.15	75.85	2.05	-0.53
UTEK	Ultratech Inc.	12.5	130.16M	11.80%	5.472	2.23	1.61	-0.03
VECO	Veeco Instruments	20.58	430.77M	12.30%	14.227	1.45	2.26	0.32

Source: http://finance.yahoo.com/

New Developments during the Fourth Quarter of 2006.

New ideas, new discoveries, new R&D investments, and new innovations and product developments are something of continual nature in the nanotechnology sector.

Below are some of the major developments that took place in the fourth quarter of 2006 within the ISE-CCM nanotechnology index component companies.

Nanomaterials and Alternative Energy

Altair Nanotechnologies Inc.
Altair Nanotechnologies Inc. (NASDAQ, ALTI) engages in developing and commercializing nanomaterial and titanium dioxide pigment technologies. The company operates in two segments, Performance Materials and Life Sciences. The Performance Materials segment produces materials for paints, coatings, thermal spray powders, photocatalytic materials for air and water cleansing, sensors, power systems, materials for improving process technologies, and alternative energy devices, such as high performance batteries, fuel cells, and photovoltaics. The Life Sciences segment produces pharmaceutical products, including lanthanum-based active pharmaceutical ingredients; drug delivery products for the delivery of chemicals, drugs, and biocides; and biocompatible nanomaterials for use in dental implants, dental fillings, and dental products, as well as in biocompatible coatings on implants.

During October 2006, Altair announced that, in ongoing testing, it has completed 15,000 deep charge/discharge cycles of its innovative NanoSafe battery cells. According to the company, even after 15,000 cycles, the cells still retained over 85% of their original charge capacity. This represents a significant improvement over conventional, commercially available rechargeable battery technologies such as lithium ion, nickel metal hydride and nickel cadmium. These other commercially available rechargeable batteries typically retain their level of charge capacity only through approximately 1,000 deep charge/discharge cycles. The commercial implications of such an extended life battery are significant and could provide substantial competitive advantage in the electric vehicle and plug-in hybrid electric vehicle markets for Altair.

In November 2006, Altair announced that it has completed the first phase of a research project on workplace nanomaterial exposure characterization in conjunction with the National Institute of Occupational Safety and Health (NIOSH), the federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness. Altair is complementing the partnership with NIOSH by conducting further studies of the environment and human interaction with nanomaterials in conjunction with other recognized experts. This includes a recently announced DOE funded project to investigate the interaction of Altair's nanomaterials with various non-aqueous environments.

Tools and Equipments

FEI Company

FEI Company (NASDAQ, FEIC) supplies products and systems that enable research, development, and manufacturing of nanoscale features. The company offers focused ion beam (FIB) equipment, scanning electron microscopes (SEMs), transmission electron microscopes, and DualBeam systems, which combine a FIB and SEM on a single platform, as well as computer aided design navigation and yield management software.

On November 30, 2006, FEI announced it will expand its Helios NanoLab(TM) family of DualBeams(TM) when it introduces the Helios NanoLab 400 and 400S systems the following week at SEMICON Japan. Combining advanced focused ion beam (FIB) and scanning electron microscope (SEM) technologies in a highly-integrated and easy-to-use platform, the Helios NanoLab family of tools will provide semiconductor manufacturers with a complete range of advanced high-resolution solutions for their analytical labs. According to FEI, the new Helios NanoLab systems are designed to help semiconductor companies move through their design and process ramps quickly and with more efficiency, enabling them to move new products to market faster.

The Helios NanoLab 400 offers an advanced high resolution stage and load lock and the 400S is equipped with a flip stage for highly precise sample localization to bridge the SEM-TEM gap. The 600 system, introduced earlier this year, offers a larger stage for versatile sample handling.

MTS Systems Corporation
MTS Systems Corporation (NASDAQ, MTSC) supplies test systems and industrial position sensors. The company operates in two business segments, Test and Industrial. The Test segment offers rolling road simulators, multiaxial test systems, and earthquake simulation systems. Its products, systems, software, and services are used for research, product development, and quality control to determine the mechanical properties and performance of materials, products, and structures in ground vehicles, aerospace, and infrastructure market. The Industrial segment offers measurement and control instrumentation products to measure process variables and to automate production processes. It serves manufacturers of mobile equipment, steel-making equipment, plastic molding machines, pulp and paper processing equipment, transfer lines and various types of semiconductor equipment, and surgical room equipment.

On November 21, 2006 MTS Systems Corporation and announced that it has received an R&D 100 Award from R&D Magazine for a new generation of Nano testing systems. The InSEM(TM) T250 nano tensile testing system enables characterization of materials and components at the micro/nano length scale within a scanning electron microscope. The InSEM system enables micro- and nano-scale materials testing simultaneously with imaging.

On October 27, 2006 MTS Systems Corporation announced that it has been named the recipient of a 2006 Tekne Award in the Established Technology Services category for the development of the MTS Bionix® Spine Wear Simulator. The MTS Bionix Spine Wear Simulator enables orthopedic device manufacturers to perform highly accurate, long-term wear, fatigue and durability simulations on both lumbar and cervical spine disc implants.

Nanometrics Inc.
Nanometrics Incorporated (NASDAQ, NANO) engages in the design, manufacture, and marketing of process control metrology systems used in the manufacture of semiconductors and integrated circuits. It offers metrology systems that measure various thin film properties, critical circuit dimensions, and layer-to-layer circuit alignment; and inspects for surface defects during various steps of the manufacturing process. The company also provides systems that are used to measure the overlay accuracy of successive layers of semiconductor patterns on wafers in the photolithography process. It sells its metrology systems to the semiconductor manufacturers and equipment suppliers, as well as to producers of silicon wafers and photomasks in Asia and the United States.

On October 18, 2006 Nanometrics Inc. introduced its VerteX rapid photoluminescence (PL) mapping system used for compound semiconductor production control during volume manufacturing of optoelectronic devices, such as light emitting diodes (LEDs). The tool marks the first automated PL mapping system that accurately predicts emission wavelengths for green LEDs at the wafer level. Green LEDs are vital for RGB-based LED displays and solid-state lighting applications. According to the company VerteX's superior control of laser excitation conditions allows for accurate matching of PL data to electroluminescence (EL) test information, resulting in faster run-to-run epitaxial layer growth feedback. This enables the predictive metrics required for volume production of LEDs, particularly green LEDs.

Veeco Instruments In.
Veeco Instruments, Inc. (NASDAQ, VECO) engages in the design, manufacture, marketing, and servicing of equipment used by manufacturers in the data storage, semiconductor, high brightness light emitting diode, and wireless telecommunications industries worldwide. Its process equipment products deposit or remove various materials in the manufacturing of thin film magnetic heads. The company operates through three segments: Ion Beam and Mechanical Process Equipment, Epitaxial Process Equipment, and Metrology. The Ion Beam and Mechanical Process Equipment segment deposits or etches thin film products, primarily used in the manufacture of data storage components, such as thin film magnetic heads and compound semiconductor/wireless devices. The Epitaxial Process Equipment segment provides molecular beam epitaxy and metal organic chemical vapor deposition products to high brightness light emitting diode and wireless telecommunications customers. The Metrology segment offers equipment that is used to provide critical surface measurements on products, such as semiconductor devices and thin film magnetic heads. It also includes atomic force microscopes, optical interferometers, and stylus profilers sold to semiconductor customers, data storage customers, and research facilities and scientific centers. The company's solutions are also used as a key research instruments in universities and scientific laboratories, as well as in industrial applications.

On November 27, 2006 Veeco Instruments Inc. announced the launch of the new Dektak® 150 Surface Profiler for high-performance research and industrial metrology applications. According to Veeco the Dektak 150 delivers the highest repeatability and lowest noise over the largest scanning range available for a stylus profiler, enabling Veeco's customers to benefit from greater scan range and ease-of-use.

Also on November 27, 2006 the company announced the release of the Wyko® NT9300(TM) and NT9800(TM) Optical Profilers. The new NT optical profilers are ideal for non-contact surface metrology in a wide range of demanding industrial, research, and production applications including automotive, aerospace, semiconductor, MEMS, and biomedical devices.

Biotechnology

Nanogen, Inc.
Nanogen, Inc. (NASDAQ, NGEN) provides human molecular diagnostic products to research, clinical laboratory, and point of care markets in North America, Europe, and Asia. The company's diagnostic technologies focus on the identification of the nucleic acid sequences, gene variations, and gene expressions associated with genetic conditions and infectious diseases. It offers its products in four categories: instrumentation, reagents,

test kits, and custom assays. Instrumentation product line includes Molecular Biology Workstation, a semi-automated solution for developing molecular assays in basic and clinical research labs; NanoChip 400 System, a laboratory automated platform for molecular testing; LifeSign DXpress Reader, a tabletop camera-based instrument for reading results of in vitro immunodiagnostic assays; and iLynx Reader for recording information related to the conduct of the tests. Nanogen's reagent products include NGEN reagents for use in detecting nucleic acid sequences for specific organisms or genetic mutations; MGB Alert reagents, a clinical reagent used for detecting nucleic acid sequences for specific organisms or genetic mutations associated with diseases in a polymerase chain reaction format; and MGB Eclipse Probe Systems used in the development of diagnostics. The company offers Cardiac STATus and Decision Point tests, as well as develops Nexus Dx, an immunassay product line; Nexus DX ELISA Test Kits; and StatusFirst CHF NT-proBNP for use with the LifeSign DXpress Reader. The company's custom assays services include Assay Blueprint for laboratory customers and MGB Eclipse Online Design for designing and ordering of MGB Eclipse Probes

On October 30, 2006 Nanogen, Inc. announced that it received four patents covering the use of biological markers to diagnose diabetes and Alzheimer's disease. Biological markers, known as biomarkers, are specific biochemical characteristics within certain patient populations. Three of the patents cover biological markers found in Type 2, or adult onset, diabetes. The fourth patent covers the marker human glutamine synthetase, which is associated with Alzheimer's disease. Along with a test to detect Alzheimer's, a test could also be developed using the marker to distinguish whether a person's dementia is being caused by the disease

On December 4, 2006 Nanogen Inc. announced it has been awarded a $4.5 million contract from the U.S. Centers for Disease Control and Prevention (CDC) to develop a unique multi-analyte Point-Of-Care (POC) diagnostic assay for Influenza in support of the US Government's efforts to strengthen its readiness for a potential influenza pandemic. The goal of the development is to employ proprietary Nanogen technology in a low cost, high sensitivity POC immunoassay that simultaneously detects Influenza Type A, Type B, seasonal flu (H1N1 and H3N2) and avian flu (H5N1) in a simple to use assay format. This development program is partnered with HX Diagnostics, Inc., which will commercialize the product upon approval.

On December 6, 2006 Nanogen, Inc. announced that it has released reagents designed for research use only studies analyzing CYP2C9 and VKORC1, two genes with potential applications in drug metabolism and response. The company plans to submit similar reagents, along with others, for FDA clearance in 2007.

OLEDs

Universal Display Corporation

Universal Display Corporation (NASDAQ, PANL) engages in the research, development, and commercialization of organic light emitting diode (OLED) technologies for use in various flat panel display and other applications. OLEDs are thin and lightweight solid-state devices, suitable for use in portable, full-color display applications. The company's proprietary technology, Phosphorescent OLEDs, utilize various materials and device structures that allow OLEDs to emit light through a process known as phosphorescence. It develops and licenses its OLED technologies to display manufacturers for use in applications, such as mobile phones, digital cameras, laptop computers, televisions, and other consumer electronic devices. The company's Transparent OLED (TOLEDs) technology utilizes transparent cathodes and transparent anodes, which are used in novel flat panel display applications requiring semitransparency or transparency, such as graphical displays in automotive windshields. In addition, Universal Display is developing Flexible OLEDs, which are OLEDs built on nonrigid substrates, such as plastic or metal foil; and Organic Vapor Phase Deposition technology.

On December 21, 2006 Universal Display Corporation and Nippon Steel Chemical Co., Ltd. (NSCC) announced significant enhancement in the performance of green phosphorescent OLEDs resulting from their ongoing technical collaboration. By combining Universal Display's green phosphorescent emitter, UDC-GD48, with NSCC's new green host material, the two companies have achieved record operational lifetime for a green phosphorescent OLED device. According to the announcement this green OLED offers 60,000 hours of operational lifetime at an initial luminance of 1,000 candelas per square meter (cd/m(2)). The device also exhibits a high luminous efficiency of 65 candela per ampere (cd/A) and an external quantum efficiency of 18%, at 1,000 cd/m(2), both characteristic features and benefits of phosphorescent OLED technology.

On August. 14, 2006 Universal Display Corporation announced their significant advances in the development of WOLED(TM) white OLED technology for solid-state lighting and flat panel display applications. The company reported the achievement of a white light source with twice the power efficiency of a standard incandescent bulb, and an external quantum efficiency that is among the highest demonstrated for a single (non-stacked) white OLED. Specifically, the white light source demonstrated 31 lumens per Watt which corresponds to an external quantum efficiency of 29% at a luminance of 850 candelas per square meter. The white lighting panel, 25 cm squared in size, emits a pleasing, warm white tone with CIE coordinates of (0.37, 0.36). This achievement was made possible through the use of the company's high-efficiency PHOLED technology and materials, as well as through the use of output coupling enhancements under development at Universal Display.

Conclusions

Nanotechnology is about utilization of the findings of nanoscience for useful purposes. Nanoscience deals with properties of matter at the nanoscale. At the nanoscale, the physical, chemical, and biological properties of materials are fundamentally different from the properties of individual atoms and molecules or bulk matter. Because of its multidisciplinary, disruptive, and enabling characteristics, it is argued that nanotechnology will affect all industries across the whole economy and eventually will change all aspects of our lives.

The importance of nanoscience and nanotechnology for future economic growth and leadership, have prompted the U. S. government and governments in other industrial countries to consider R&D investments in nanotechnology as a top national priority. The U.S. leads the global race in nanotechnology R&D investment. The U.S. government spends more than any other government and more than all the EU countries on nanotechnology R&D. Also, the U.S. corporate investments in nanotechnology R&D by far exceed those of corporations in other countries.

Commercialization of nanotechnology products has already started. This is evident from the fact that all the component companies of the ISE-CCM nanotechnology index are now generating revenues. During the fourth quarter of 2006, many of the ISE-CCM nanotechnology index component companies introduced new innovations and new products.

References

Feynman, R. P. (1959). *There is plenty of room at the bottom: An invitation to enter a new field of physics*. Retrieved on 02/15/2006 from:http://www.zyvex.com/nanotech/feynman.html.

Holister, P. (2002). Nanotech: The tiny revolution, *CPM Cientifica*: http://www.cmp-cientifica.com.

International Securities Exchange and the Coronus Capital Markets Inc. (2006). *ISE-CCM Nanotechnology Index*: http://www.ccmsectorinvest.com.

Japan's Ministry of Education, Culture, Sports, Science, and Technology.(2005). *Mid- and long-term research and development strategies for nanotechnology/materials science field in Japan*: http://www.nanonet.go.jp/english/info/policy.html.

Lux Research Inc. (2004). *Revenue from nanotechnology-enabled products to equal IT and Telecom by 2014, exceeding biotech by 10 times*. Press release. http://www.luxresearchinc.com/press/RELEASE_SizingReport.pdf.

Lux Research Inc. (2005). *Nanotechnology: Where does the U. S. Stand*? Press release : http://www.luxresearchinc.com/testimony.pdf.

Miller, J. C., Serrato, R. M., Represas-Cardenas, J. M., & Kundahl, G., A. (2005). *The handbook of nanotechnology: Business, policy, and intellectual property law*. John Wiley & Sons Inc.: Hoboken, New Jersey

Nakanishi, H. (2003). Reformation of Government R&D for Promoting Innovation in Japan. NEDO Washington Office.

Nanoforum. (2005). *European nanotechnology infrastructure and networks*: http://www.nanoforum.org.

Niyogi, S. & Haddon, R. C. (2004). Nanotechnology: Why is this special length scale? *In nanoscience and nanotechnology: Opportunities and challenges in California: California Council on Science and Technology, Sacramento, California.*

Office of Science and Technology Policy Executive Office of the President. (2006). *National Nanotechnology Initiative research and development funding in the President's 2007 budget*: www.ostp.gov

Rejeski, D (2005). Environmental and safety impacts of nanotechnology: What research is needed? Testimony in United States House of Representatives Committee on Science on November 17, 2005.

Roco, M. C. (2005). Nanotechnology. *Presentation at Nanotechnology and Occupational Health, Conference, Minnesota, October 3, 2005*.

Saxl, O. (2005). Nanotechnology: A key technology for the future of Europe. http://www.cordis.lu/nanotechnology/src/pe_reports_studies.htm.

Semiconductor Equipment and Materials Institute. (2005). *November 15, 2005 press release on materials and equipments for nanoelectronics forecast:* http://wps2a.semi.org

Smalltimes. (2003). *Small tech 101: An introduction to micro and nanotechnology*: Smalltimes**.**

Tomalia, D. A. (2004). Birth of a new macromolecular architecture: Dendrimers as quantized building blocks for nanoscale synthetic organic chemistry. *Aldrichimica ACTA*, 37, 39-57

UK Department of Trade and Industry. (2002). *New dimensions for manufacturing: UK strategy for nanotechnology*: http://www.nano.org.uk.

U.S. Department of Energy, Office of Science. (2002*). Theory and modeling in nanoscience*. http://www.science.doe.gov/nano/Publications.htm.

U.S. Department of Energy, Office of Science. (2005).*The scale of things*: http://www.science.doe.gov/bes/scale_of_things.html.

U.S. National Nanotechnology Initiative. (2004). *The National Nanotechnology Initiative strategic plan*: http://www.nano.gov.

U.S. National Nanotechnology Initiative. (2006). *Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials*: http://www.nano.gov.

U. S. National Nanotechnology Advisory Panel. (2005). *The National Nanotechnology Initiative at five years: Assessments and recommendations of the National Nanotechnology Advisory Panel*: http://www.nano.gov.

U.S. National Science and Technology Council. (2000). *National Nanotechnology Initiative: Leading to the next industrial revolution. Report prepared by the Interagency Working Group on Nanoscience, Engineering and Technology*: http://www.nano.gov.

U. S. National Science Foundation.(2002). *NSF_EU workshop on nanomanufacturing and processing, summary report:* http://www.nsf.go