NANOMETRICS INC
Form 10-K
March 15, 2007
Table of Contents

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

(Mark One)

x **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
For the fiscal year ended December 30, 2006

OR

¨ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**
For the transition period from ____________ to ____________

Commission file number: 0-13470

NANOMETRICS INCORPORATED

(Exact name of registrant as specified in its charter)

Delaware	**94-2276314**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification Number)**

1550 Buckeye Drive

Milpitas, California	**95035**
(Address of principal executive offices)	**(Zip Code)**

Registrant s telephone number, including area code: (408) 435-9600

Securities registered pursuant to Section 12(b) of the Act:

Common Stock, $0.001 par value per share

Securities registered pursuant to Section 12(g) of the Act:

None

Indicate by check mark if the Registrant is a well-known seasoned issuer as defined in Rule 405 of the Securities Act. Yes ¨ No x.

Indicate by check mark if the Registrant is not required to file reports pursuant to Section 13 or Section 15(d) of the Act. Yes ¨ No x.

Indicate by check mark whether the Registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the Registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes x No ¨.

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of Registrant s knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. ¨

Indicate by check mark whether the Registrant is a large accelerated filer, an accelerated filer, or a non-accelerated filer. See definition of accelerated filer and large accelerated filer in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer ¨ Accelerated filer x Non-accelerated filer ¨

Indicate by check mark whether the Registrant is a shell company (as defined by Rule 12b-2 of the Securities Exchange Act of 1934) Yes ¨ No x.

As of July 1, 2006, the last business day of the Registrant s most recently completed second fiscal quarter, the aggregate market value of the common stock of Registrant held by non-affiliates, based upon the closing sales price for the Registrant s common stock, as quoted on the NASDAQ Global Market, was $56,767,546. Shares of common stock held by each officer and director and by each person who owned 5% or more of the outstanding common stock have been excluded because such persons may be deemed to be affiliates as that term is defined under the rules and regulations of the Exchange Act. This determination of affiliate status is not necessarily a conclusive determination for any other purpose.

The number of shares of the Registrant s common stock outstanding as of February 28, 2007 was 18,141,795.

DOCUMENTS INCORPORATED BY REFERENCE

The Registrant has incorporated by reference into Part III of this Annual Report on Form 10-K portions of its Proxy Statement for its 2007 Annual Meeting of Stockholders to be filed pursuant to Regulation 14A.

Table of Contents

NANOMETRICS INCORPORATED

FORM 10-K

FOR THE FISCAL YEAR ENDED DECEMBER 30, 2006

TABLE OF CONTENTS

PART I

ITEM 1.	BUSINESS	4
ITEM 1A.	RISK FACTORS	20
ITEM 1B.	UNRESOLVED STAFF COMMENTS	29
ITEM 2.	PROPERTIES	29
ITEM 3.	LEGAL PROCEEDINGS	30
ITEM 4.	SUBMISSION OF MATTERS TO A VOTE OF SECURITY HOLDERS	30

PART II

ITEM 5.	MARKET FOR REGISTRANT S COMMON EQUITY, RELATED STOCKHOLDER MATTERS AND ISSUER PURCHASES OF EQUITY SECURITIES	31
ITEM 6.	SELECTED FINANCIAL DATA	33
ITEM 7.	MANAGEMENT S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS	34
ITEM 7A.	QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK	45
ITEM 8.	FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA	45
ITEM 9.	CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE	80
ITEM 9A.	CONTROLS AND PROCEDURES	80
ITEM 9B.	OTHER INFORMATION	84

PART III

ITEM 10.	DIRECTORS AND EXECUTIVE OFFICERS OF THE REGISTRANT	85
ITEM 11.	EXECUTIVE COMPENSATION	85
ITEM 12.	SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS	85
ITEM 13.	CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS	85
ITEM 14.	PRINCIPAL ACCOUNTANT FEES AND SERVICES	85

PART IV

ITEM 15.	EXHIBITS AND FINANCIAL STATEMENT SCHEDULES	86
SIGNATURES		89

Table of Contents

Forward-Looking Statements

This Annual Report on Form 10-K contains forward-looking statements that involve risks and uncertainties. These forward-looking statements include, but are not limited to, statements regarding trends in demand in our industry, the increased use of metrology in manufacturing, the drive toward integrated metrology and the broadening of our technology portfolio. Words such as believe , expect , anticipate or similar expressions, are indicative of forward-looking statements.

Our actual results may differ materially from the results discussed in the forward-looking statements. Factors that might cause such a difference include, but are not limited to, those outlined in Item 1A Risks Factors and Management s Discussion and Analysis of Financial Condition and Results of Operations, below. The forward-looking statements contained herein are made as of the date hereof, and we assume no obligation to update such forward-looking statements or to update reasons actual results could differ materially from those anticipated in such forward-looking statements.

Table of Contents

PART I

ITEM 1. BUSINESS

Overview

We are a leader in the design, manufacture, and marketing of high-performance process control metrology systems used in the manufacture of silicon and compound semiconductor substrates, devices and integrated circuits. Our metrology systems measure various optical and physical thin film properties, critical circuit dimensions and layer-to-layer circuit alignment (overlay). The accurate alignment, or overlay, of successive film layers, relative to each other, across the wafer is critical for device performance and favorable production yields. Customers use our process control and metrology systems during various steps of the manufacturing process, enabling semiconductor and integrated circuit manufacturers to improve yields, increase productivity and lower their manufacturing costs.

We were incorporated in California in 1975 and reincorporated in Delaware in 2006. We have been a pioneer and innovator in the field of optical metrology. We have been selling these systems since 1977 and have an extensive installed base with industry leading customers worldwide, including Applied Materials, Inc., Samsung Electronics Co. Ltd., Hynix Semiconductor, Inc., Ebara Technologies, Inc., Intel Corporation, Renesas Technology Corp., Micron Technology, Inc., ProMOS Technologies, Mimasu Semiconductor Industry Co., Ltd., International Business Machines Corporation and Toshiba America, Inc.

Additional information about Nanometrics is available on our website at http://www.nanometrics.com. Our investor relations website is located at http://www.nanometrics.com/investor.html We make available free of charge through our investor relations website our Annual Reports on Form 10-K, Quarterly Reports on Form 10-Q, Current Reports on Form 8-K and any amendments to those reports as soon as reasonably practicable after we electronically file or furnish such materials to the U.S. Securities and Exchange Commission (SEC). Further, a copy of this annual report on Form 10-K is located at the SEC s Public Reference Room at 100 F Street, N.E., Washington, D.C. 20549. Information on the operation of the Public Reference Room can be obtained by calling the SEC at 1-800-SEC-0330. The SEC maintains an Internet site that contains reports, proxy and information statements and other information regarding our filings at http://www.sec.gov.

Our Business

We offer a complete line of systems to address the metrology requirements of our customers. Our metrology systems can be categorized as follows:

- Standalone, fully automated systems for high-volume manufacturing process control;
- Integrated systems built into semiconductor processing equipment that provide real-time measurements and feedback to improve process control and increase throughput; and
- Standalone, manual and semi-automatic systems for manufacturing process characterization and for engineering and low-volume production environments.

We believe that process control metrology is growing faster than other segments of the semiconductor equipment market. As films become thinner, film materials more exotic, and circuit dimension control and overlay requirements more demanding, metrology and process control continue to grow in importance, especially as wafers become larger and more expensive to manufacture. We expect these factors will continue to drive the demand for our high-end, standalone and integrated metrology products.

Additional demands on process tool manufacturers for better film uniformity, tighter dimensional and overlay control, tool-to-tool matching and within-tool chamber uniformity is driving the need for integrated process control metrology. These new tool requirements will drive the need to place metrology inside the process tool for real-time, integrated, process control metrology, using both feed forward and feedback of the collected metrology data to control the process equipment.

4

Table of Contents

We have made several strategic changes in our business to enable us to further address these metrology trends. These changes include:

- The acquisition of Soluris, Inc., or Soluris, a supplier of advanced overlay metrology equipment in March 2006;
- The acquisition of Accent Optical Technologies, Inc., or Accent, a leading supplier of compound semiconductor and advanced 200 and 300mm overlay metrology equipment in July 2006;
- The continued outsourcing of certain system components, such as wafer handling robotics, enabling us to leverage our technical resources; and
- The development of new measurement technologies for advanced chemical mechanical planarization, or CMP, and photolithographic processes.

Demand for our products continues to be driven by the increasing use of multiple thin film technology by semiconductor manufacturers and, more recently, by the increased adoption of both integrated metrology and real-time process control. With feature sizes shrinking below 45 nanometers, or nm, well below the wavelength of light, the need for very tight process tolerances as well as productivity improvements in semiconductor fabrication, or fabs, are driving the need for metrology systems and process control. As a result, semiconductor device and wafer manufacturers are investing in process control and metrology systems that improve their manufacturing efficiency by detecting process variations sooner and facilitating rapid diagnosis and corrective action. Our process control and metrology systems measure and characterize the physical dimensions, material composition, optical and electrical characteristics and other critical parameters of semiconductor devices during their fabrication. For the photolithography process, overlay and critical dimension systems provide enhanced control of layer alignment and device dimensions. For lattice engineering applications, metrology systems monitor the physical, optical, electrical and material characteristics of compound semiconductor, strained silicon and silicon on insulator devices, including composition, crystal structure, layer thickness, dopant concentration, contamination and electron mobility.

Our innovative 9010T, deep ultra-violet (DUV) wavelength, Optical Critical Dimension, or OCD®, measurement system is being increasingly viewed not only as an enabling technology for process control, but also as a solution for critical dimension measurement for wafers as well as reticles and photomasks used for photolithography. The compact size and speed of this technology enables the measurement system to be fully integrated into the customer s process tool, thus providing a complete, feed forward and feedback process control solution for wafer-to-wafer closed loop control. By measuring the critical dimensions of developed photoresist and then adjusting the final etched dimensions of a silicon gate-etch process by feeding this information back into the process and trimming the resist, the device manufacturer is able to achieve the shortest gate-length and the maximum possible microprocessor speed. In addition, new semiconductor process technologies, such as copper interconnects, require that new measurement technologies be developed in order to keep pace with the latest metrology demands. This integrated metrology module also provides a solution to the problem of measuring the remaining oxide film thickness as well as the loss of material over arrays of copper lines during the CMP process with the added capability of detecting residual films remaining after the polishing process.

Our OCD technology has also proven to be applicable to the emerging requirements for advanced photolithography measurements such as the characterization of critical dimensions and film thicknesses on masks and reticles which are comprised of square glass substrates. The Nanometrics Atlas-M is the first fully automated, standalone metrology system to use OCD technology for these square glass substrates at several key customer locations. This system is crucial to the suppliers and users of masks and reticles by providing the means for accurately determining line widths and analyzing complex profiles for a variety of structures found in today s mask fabrication process.

The Caliper élan and Q240[AT], are advanced overlay metrology and analysis systems for monitoring microlithography stepper performance. These newly acquired products provide exceptional throughput and measurement performance required by today s demanding 65nm overlay control applications. Elan builds on the

Table of Contents

solid foundation established by the original Caliper overlay tool to provide the most cost effective solution for today s most advanced process technologies. Rounding out the overlay product line is the newly acquired IVS advanced overlay metrology system for critical dimension and overlay measurements for both semiconductor and MEMS manufacturing. The IVS delivers unsurpassed measurement performance and reliability with the lowest possible cost-of-ownership.

Our broad offering of lattice engineering metrology solutions address specific yield challenges that arise when device and wafer manufacturers use advanced materials such as compound semiconductors or modify the basic structure of silicon in order to achieve higher device performance characteristics. We recently introduced the VerteX photoluminescence mapping system for high-volume compound semiconductor metrology. VerteX has the unique capability to forecast diode performance before the wafer is fully processed, providing the critical data needed to actively adjust process controls for optimal epitaxial layer growth the yield-limiting step in LED diode production.

Many types of thin films are used in the manufacture of products such as semiconductor integrated circuits. These products require the precise electronic, optical and surface properties enabled by thin film metrology. The need for tighter process control and improved productivity has created increased demand for our advanced standalone and integrated metrology systems.

Industry Characteristics

Growth

The semiconductor industry continues to be driven by the need for increasingly higher performance chips as well as the need to produce these chips with increased production efficiencies at reduced costs. The semiconductor equipment industry has recently settled into less cyclical growth with a compounded annual growth rate of approximately 7-9% over the past 10 years. During 2006, the semiconductor industry experienced a growth in semiconductor equipment revenues of approximately 10.6% over 2005. We believe that the continued expansions and new construction of 300-millimeter wafer fabs, the increasing use of copper interconnects and more efficient 45 nm architecture will continue to drive the demand for new metrology solutions, such as those that we offer, and that the process control market segment will continue to outpace overall equipment growth.

Semiconductor devices are enabling a wide variety of advanced computing, communications and consumer electronics products such as high-performance computing clusters, engineering workstations, routers, switches, cell phones, digital cameras, portable MP3 players, game consoles, DVD players, high-definition televisions, global positioning systems and flat panel displays. In the past, demand for Internet access, personal computers, telecommunications, and new consumer electronic products and services has fueled growth of the semiconductor industry. New display technologies, consumer electronics, automotive electronics and personal electronics will likely continue as the primary drivers in the near-term for the semiconductor industry. We believe that consumer desire for high performance electronics drives technology advancement in semiconductor design and manufacturing and, in turn, promotes the purchasing of capital equipment featuring the latest advances in technology.

The two significant factors affecting demand for our measurement systems are new construction or refurbishment of semiconductor manufacturing facilities and the increasing complexity of the manufacturing process as a result of the demand for higher performance semiconductor devices and integrated circuits.

Semiconductor Manufacturing Process

Semiconductors are fabricated by a series of process steps on a wafer substrate made of silicon or other material. Our thin film, critical dimension, overlay metrology and defect inspection systems can be used at many points during the fabrication process to monitor and measure circuit dimensions, layer-to-layer registration and

film uniformity as well as material properties in order to maximize the yield of acceptable semiconductors. Each wafer typically goes through a series of 100 to 500 process and metrology steps in generally repetitive cycles.

The four primary wafer film processing steps are:

- Deposition;
- Chemical Mechanical Planarization;
- Photolithography imaging and overlay; and
- Etching of circuit elements.

Deposition. Deposition refers to placing layers of insulating or conducting materials on a wafer surface in thin films that make up the circuit elements of semiconductor devices. Common methods of deposition include chemical vapor deposition, or CVD, plasma-enhanced chemical vapor deposition, or PECVD, and physical vapor deposition, or PVD. Diffusion and oxidation are also used to create or define thin films. The control of uniformity and thickness during the formation of these films is critical to the performance of the semiconductor circuit.

Chemical Mechanical Planarization. CMP flattens, or planarizes, the topography of the film surface to permit the multiple patterns of small features on the resulting smoothed surface by the photolithography process. The CMP process is a combination of chemical etching and mechanical polishing and commonly uses an abrasive liquid and polishing pad. Semiconductor manufacturers need metrology systems to control the CMP process by measuring the thin film layer to determine precisely when the appropriate thickness has been achieved.

Photolithography. Photolithography is the process step that projects the patterns of the circuits on the chip. A wafer is pre-coated with photoresist, a light sensitive film that must have an accurate thickness and uniformity for exposure. Photolithography involves the optical projection of integrated circuit patterns onto the photoresist after which, the photoresist is developed, leaving unexposed areas available for etching. In order to precisely control the photolithography process, it is necessary to verify reflectivity, film thickness, critical dimensions and overlay registration.

Etch. Etch is a dry or wet process for selectively removing unwanted areas that have been deposited on the surface of a wafer. A film of developed photoresist protects material that needs to be left untouched by the etch to make up the circuits. Thin film metrology systems are required to verify precision of material removal and critical dimension achievement.

Before and after deposition, CMP, photolithography and etch, the wafer surface is measured to determine the quality of the film or pattern and to find defects. Measurements taken to ensure process uniformity include thickness, width, height, roughness and other characteristics. Process control helps avoid scrapping wafers, reduce costly rework and results in higher yields for semiconductor manufacturers.

These processing steps are typically repeated multiple times during the fabrication process, with alternating layers of insulating and conducting films. Depending on the specific design of a given integrated circuit, a variety of film types and thicknesses and a number of layers can be used to achieve desired electronic performance characteristics. The semiconductors are then tested, separated into individual circuits, assembled and packaged into an integrated circuit.

Increased Use of Metrology in Manufacturing

We believe that continually rising wafer costs are forcing semiconductor manufacturers to re-evaluate their manufacturing strategies at all levels, from individual process steps to fab-wide process optimization. Many major semiconductor manufacturers are adopting feed-forward and feedback of film thickness and critical

7

Table of Contents

dimensions, or CDs, based on real-time data from metrology systems. Major benefits of these new metrology strategies are higher manufacturing efficiencies from reduced rework, reduced headcount to perform at the same quality level and increased device performance. Additional benefits include process tool matching and more precise control of the overall manufacturing process.

Drive Toward Integrated Metrology

For many years, semiconductor manufacturers have sought to improve fab efficiency by choosing systems that integrate more than one process step into a single tool. Integrated metrology solutions increase productivity with higher throughput, smaller overall product footprints, reduced wafer handling and faster process development. This trend began in the mid-1980s, as leading manufacturers introduced a cluster process tool architecture that combined multiple processes in separate chambers around a central wafer-handling platform.

Today, there is continued focus on increased productivity driving the adoption of integrated metrology, as well as an additional requirement for tighter process tolerances with advanced, sub-45nm technologies. This new requirement is driving integrated process control metrology as a necessity for many processes, such as mechanical planarization, deposition, lithography and etch. As a result, we continue to see the emergence of integrated metrology using both feed-forward and feedback process tool control in real time. Integrated metrology has already shown its ability to control key process parameters during the manufacturing process. Additional benefits include extended tool availability and improved utilization. Tighter control of the process means lower material and processing costs. Integrated metrology also provides rapid fault detection, improved excursion control and loss prevention, which can be elusive with only open-loop standalone metrology.

Before we introduced integrated metrology, semiconductor manufacturers were required to physically transport wafers from a process tool to a separate metrology system in order to make critical measurements such as film thickness and uniformity. Manufacturers of process equipment are increasingly seeking to offer their customers integrated metrology in their tools to lower costs and improve overall tool efficiency. Integrated metrology provides semiconductor manufacturers with several additional benefits, including a reduction in the number of test wafers, increased overall process throughput, faster detection of process excursions and faults, reduced wafer handling, faster process development and ultimately an improvement in overall equipment effectiveness.

Nanometrics Offerings

We offer a complete line of systems to address the broad range of metrology requirements of our customers.

Our metrology systems can be categorized as follows:

Standalone, fully automated systems used for high-volume manufacturing process control. We offer a broad line of fully automated thin film thickness, critical dimension, defect inspection and overlay measurement systems. These systems remove the dependence on human operators by incorporating reliable wafer handling robots and are designed to meet the speed, measurement, performance and reliability requirements that are essential for today s semiconductor manufacturing facilities. Each of these measurement systems uses non-destructive, optical techniques to analyze and measure films. Our fully automated metrology product line also includes systems that are used to measure the critical dimensions and overlay registration accuracy of successive layers of semiconductor patterns on wafers in the photolithography process.

Standalone, manual and semi-automated systems used for manufacturing process characterization. We also offer a broad line of manual and semi-automated thin film thickness, critical dimension, defect inspection and overlay measurement systems. Each of these measurement systems uses non-destructive, optical techniques to analyze and measure films. These products also include systems that are used to monitor the physical, optical, electrical and material characteristics of

Table of Contents

compound semiconductor, strained silicon and silicon-on-insulator (SOI) devices, including composition, crystal structure, layer thickness, dopant concentration, contamination and electron mobility. Tabletop systems are used to manually or semi-automatically measure thin films in engineering and low-volume production environments. We have been a pioneer and leading supplier of tabletop thin film thickness measurement systems, which are used primarily in low-volume production environments such as failure analysis and engineering labs. Our tabletop models have multiple capabilities and several available configurations, depending on wafer handling, range of films to be measured, uniformity mapping and other customer needs.

Integrated systems used to measure in-process wafers automatically and quickly without having to leave the enclosed wafer processing system. Our integrated metrology systems are compact and monitor a multitude of small test points on the wafer using sophisticated pattern recognition. Our integrated systems can be attached to film deposition, planarization, lithography, etch and other process tools to provide rapid monitoring of films on each wafer immediately before or after processing. Integrated systems can offer customers significantly increased operating efficiency and equipment utilization, lower manufacturing costs and higher throughput. We anticipate continuing to ship integrated systems to many original equipment manufacturers for installation on their planarization, deposition, photolithography and etch tools.

Strategy

Our strategy is to offer and support, on a worldwide basis, technologically advanced metrology solutions that meet the changing manufacturing requirements of the semiconductor industry. Key elements of our strategy include:

Maintaining Organically Developed Technology Leadership. We are committed to developing advanced metrology systems that meet the requirements of advanced semiconductor manufacturing technology. We have an extensive array of proprietary technology and expertise in optics, software and systems integration. These technologies include polarized reflectometry, precision motion control, extreme dark field imaging, low distortion imaging and advanced algorithms.

Continuing to Offer Advanced Integrated Metrology Systems. We were one of the first suppliers to offer products that integrate process control metrology systems into wafer processing equipment. We supply integrated metrology systems for Applied Materials Mirra Mesa and 300mm Reflexion CMP systems and the Producer QA and SE CVD systems. Our OCD metrology system is incorporated in the Applied Materials Transforma 300mm etch system for controlling critical dimensions. The introduction of the first combined film thickness and critical dimension measurement integrated metrology product has allowed us to penetrate additional original equipment manufacturers, or OEMs, of etch processing and CMP equipment, including Hitachi High Tech, or HHT, Dainippon Screen, or DNS, and Ebara. The introduction of the Nano 9010T enhanced integrated metrology product has led to additional design wins at TEL/Timbre. Our integrated metrology sales group continues to focus on sales of integrated metrology products to both OEMs and end-users.

Broadening Our Product Portfolio. We intend to continue to add a wide range of new measurement technologies to our expanding base of intellectual property. Our highly successful integrated platform offers a single integrated module that combines OCD and DUV technologies, and enables us to perform critical erosion and film thickness/array measurements for the oxide and copper/metal CMP processes. These metrologies are key requirements for the copper damascene process, which replaces the current subtractive aluminum process on newer semiconductor devices.

Our newly acquired SiPHER photoluminescence mapping system detects and quantifies near surface and bulk metallic contamination in silicon and epitaxial layers.

Our OCD technology has also been applied to advanced photolithography processes with the Nanometrics Atlas-M, a fully automated metrology system for mask and reticule measurement and

Table of Contents

characterization. This product has already successfully correlated the interrelationships between film thickness and critical dimension parameters.

Leveraging Existing Customer and Industry Relationships. Our strong industry relationships have allowed close customer collaboration which, in return, facilitates our ability to introduce new products and applications in response to customer needs. We believe that our large customer base will continue to be an important source of new product development ideas. Our large customer base also provides us with the opportunity for increased sales of additional metrology systems to our current customers. Our new acquisitions are expected to strengthen our customer relationships and foster working partnerships with semiconductor equipment manufacturers by providing technologically superior systems and high levels of customer support.

Providing Worldwide Sales and Customer Support. We believe that a direct sales and support capability is beneficial for developing and maintaining close customer relationships and for rapidly responding to changing customer requirements. Because a majority of our revenues come from sources outside of the United States, we have direct sales teams in Europe, Japan, South Korea, Taiwan and China, and will expand into additional territories as customer requirements dictate. We use selected sales representatives selectively in isolated regions. We intend to monitor our network by evaluating our existing and new offices, as well as developing additional relationships as needed. We believe that enhancing our sales and customer support network will improve our competitive position.

Addressing Multiple Markets. There are broad applications of our technology beyond the semiconductor industry. We currently offer a comprehensive family of metrology systems that accurately measure thin films, critical dimensions and overlay registration used in manufacturing process. Newer products inspect for particles and defects and monitor critical metal loss during the copper removal process. We believe that diversification of our technology through applications across multiple industries increases the total available market for our products and reduces, to an extent, our exposure to the cyclicality of any particular market.

Acquisitions. We expect to continue to evaluate the attractiveness of strategic transactions, including mergers and asset acquisitions, in order to address business challenges and opportunities. On March 15, 2006, we announced our acquisition of Soluris, a privately held corporation focused on overlay and CD measurement technology and headquartered in Concord, Massachusetts. On July 21, 2006, we announced the completion of the merger of our business with Accent Optical, a leading supplier of process control and metrology systems to the global semiconductor manufacturing industry headquartered in Bend, Oregon. The strategic business combination of Nanometrics and Accent creates one of the largest metrology and process control companies in the semiconductor capital equipment industry.

Technology

We believe that our engineering expertise, technology acquisitions, supplier alliances and short-cycle production strategies enable us to develop and offer advanced solutions that address industry trends. By offering common metrology platforms that can be configured with a variety of measurement technologies, our customers can (i) specify high performance systems not easily offered by other suppliers and (ii) narrowly configure a system for a specific application as a cost saving measure.

Spectroscopic Reflectometry. We pioneered the use of micro-spot spectroscopic reflectometry for semiconductor film metrology in the late 1970s. Spectroscopic reflectometry uses multiple wavelengths (colors) of light to obtain an array of data for analysis of film thickness and other film parameters. Today s semiconductor manufacturers still depend on spectroscopic reflectometry for most film metrology applications. Reflectometry is the measurement of reflected light. For film metrology, a wavelength spectrum in the visible region is commonly used. Light reflected from the surfaces of the film and the substrate is analyzed using computers and measurement algorithms. The analysis yields thickness information and other parameters without contacting or destroying the film.

Table of Contents

In the mid-1980s, we introduced a DUV reflectometer for material analysis. In 1991, we were awarded a patent for the determination of absolute reflectance in the ultraviolet region. This technology provides enhanced measurement performance for thinner films and for films stacked on top of one another.

Spectroscopic Ellipsometry. Like reflectometry, ellipsometry is a non-contact and non-destructive technique used to analyze and measure films. An ellipsometer analyzes the change in a polarized beam of light after reflection from a film s surface and interface. Our systems are spectroscopic, providing ellipsometric data at many different wavelengths. Spectroscopic ellipsometry provides a wealth of information about a film, yielding very accurate and reliable measurements. In general, ellipsometers are used for thin films and complex film stacks, whereas reflectometers are used for thicker films and stacks.

Optical Critical Dimension Technology. Our OCD technology is a critical dimension measurement technology that is used to precisely determine the dimensions on the semiconductor wafer that directly control the resulting performance of the integrated circuit devices. Our non-destructive, OCD measurement technology is compatible with the current 90nm manufacturing technology and can be extended below 90nm for future requirements in both photo-lithography and etch applications. OCD combines non-contact optical technology with extremely powerful data analysis software to provide highly accurate measurement results for line width, height and sidewall angles. This technology is available in both standalone and integrated platforms.

Overlay Registration. Overlay registration refers to the relative alignment of two layers in the thin film photolithographic process. Our microscope-based, imaging measurement technology utilizes a high magnification, low distortion optical system combined with proprietary software algorithms to numerically quantify the alignment. Customers use our overlay systems to measure vertical alignment of the layers on silicon wafers and MEMS structures.

Optical Profilometry. We developed the optical profiler for the measurement of copper metal loss during the chemical mechanical planarization process. This technology uses the combination of an optical interferometer and our reflectometer technology to accurately determine metal loss, even over multiple layers during the final steps of metallization. Our technology is a unique method for precisely and accurately controlling this semiconductor manufacturing process step.

Extreme Dark Field (EDF) Imaging Technology. Our new, extreme dark field inspection technology is used to detect and accurately locate particles and defects on the front and back sides of wafer surfaces, which could potentially lead to device failures and critical yield loss during the semiconductor manufacturing process. The technology combines a high efficiency, broadband light source with a high-resolution detection system and proprietary digital image processing for defect and contamination detection on a wide variety of films and surfaces. We believe that this technology can be readily extended to other manufacturing processes.

Photoluminescence Imaging Technology. Our room-temperature photoluminescence imaging and mapping technology is used to detect metallic contamination such as Cu, Fe and heavy metals which create point defects (e.g. interstitial atoms, substitutional atoms, precipitates), and line defects such as threading dislocations, misfit dislocations, pile ups, slip, stacking faults. Contamination at this level is common in Si wafer processing and may result from multiple causes including cross contamination of metals during wafer handling, contamination from deposition tools contamination after maintenance and incomplete cleaning of reclaimed wafers.

Fourier-Transform Infra-Red (FTIR) Spectroscopy Technology. Silicon producers around the world use our FTIR tools for the certification of silicon epitaxial, or epi, thickness in blanket epi layers, buried layer epi films and silicon-on-insulator (SOI) epi films. The tools are also used for the precise measurement of interstitial oxygen and substitutional carbon in silicon substrates. Semiconductor device manufacturers use these FTIR systems for thin film metrology. BPSG films can be analyzed for the concentrations of boron and phosphorus; atomic hydrogen content in silicon nitride and silicon oxynitride can be estimated; low-K films can be characterized (fluorine in FSG films; carbon in SiOC, and SiCN films. The FTIR tools

Table of Contents

provide a rapid, non-contact method for the thin film metrology. The automated FTIR tools also provide full support for the factory automation needs of the device manufacturing community

Lattice Metrology Technologies. We supply a wide array of lattice engineering metrology systems to semiconductor device and silicon wafer manufacturers. These products address specific yield challenges that arise when device and wafer manufacturers use advanced materials such as compound semiconductors or modify the lattice, or basic crystal structure of pure silicon, in order to achieve higher device performance characteristics.

Products

We operate in one reportable segment, which is the sale, design, manufacture, marketing and support of thin film, optical critical dimension and overlay dimension metrology systems. Our measurement systems use microscope-based, non-contact spectroscopic reflectometry, or SR. Some of our systems provide complementary spectroscopic ellipsometry, or SE, and FTIR to measure the thickness and optical characteristics of films on a variety of substrates. In addition, we offer both integrated and standalone optical critical metrology systems to measure critical dimensions of patterns on semiconductor wafers. We also manufacture a line of optical overlay registration systems that are used to determine the alignment accuracy of successive layers of semiconductor patterns on wafers in the photolithography process. Our products can be divided into two principle groups: standalone systems and integrated systems. See Note 19 of the Notes to Consolidated Financial Statements for an analysis of our net revenues by principal product group.

Platform	Market	Substrate Size	Applications	Technology
Standalone Systems				
9100	Semiconductor	75-200mm	CVD, CMP, Etch, Litho, Film Thickness	SR, SE
FLX	Semiconductor	200mm 300mm	CVD, CMP, Etch, Litho, Film Thickness, CD	SR, OCD/SR
Atlas/Atlas-M	Semiconductor	200mm 300mm 6-inch masks/reticles	CVD, CMP, Etch, Litho, Film Thickness, Film Stress, CD	SR, SE, OCD/SE
Caliper élan	Semiconductor	300mm	Overlay	Imaging
Q240[AT]	Semiconductor	200mm	Overlay	Imaging
Orion	Semiconductor	200mm 300mm	Overlay	Imaging
IVS	Semiconductor, MEMS	200mm	Overlay	Imaging
SiPHER	Substrate Semiconductor	200mm 300mm	Substrate defects, metallic contamination	Photoluminescence
VerteX	Compound Semiconductor	75mm 125mm 150mm	Epitaxial layer properties	Photoluminescence
QS2200/3300	Substrate Semiconductor	200mm 300mm	Epitaxial layer thickness	FTIR
3000	Semiconductor	75mm 150mm	Film Thickness	SR
6100	Semiconductor	75mm 150mm 200mm	Film Thickness	SR
QS1200	Substrate Semiconductor	100mm 125mm 150mm 200mm 300mm	Epitaxial layer thickness	FTIR
RPM2000	Compound Semiconductor	75mm 125mm 150mm	Substrate defects, composition	Phololuminescence

Table of Contents

Platform	Market	Substrate Size	Applications	Technology
Integrated Systems				
9000	Semiconductor	200mm	CVD, CMP, Film Thickness	SR
9000i	Semiconductor	300mm	CVD, CMP, Etch, Film Thickness, CD	SR, OCD
9000b	Semiconductor	300mm	CVD, CMP, Etch, Film Thickness	SR
9010/9010b	Semiconductor	300mm	CMP, CVD, Etch, Litho, Film Thickness, CD	OCD/SR, CLP, UDI
9010T/9010T/b	Semiconductor	200mm 300mm	CMP, Etch, Litho CD	OCD/SR

Standalone Systems

Our standalone systems are made up of manual, semi-automated and fully automated metrology systems which are employed in high-volume and low-volume production environments. The automated systems incorporate automated material handling interface options for a variety of fab automation environments and implement multiple measurement technologies for a broad range of substrate sizes. The manual and semi-automated systems are used primarily in engineering labs for which automated handling and high throughput are not required. Our automated systems range in price from approximately $200,000 to over $1,000,000, depending on substrate sizes, measurement technologies, material handling interfaces and other options. The manual and semi-automated systems range in price from $50,000 up to $1,000,000 depending upon configurations and options.

Nanometrics Atlas and Atlas-M

The Nanometrics Atlas high-performance metrology system combines up to four metrology technologies on a single platform, providing increased measurement capabilities in a small footprint design for reduced cost of ownership. The Atlas-M further extends the versatility of this 300mm platform to provide fully automated mask and reticle measurements. The system is capable of housing up to four metrology technologies including polarized, normal incidence spectroscopic ellipsometry for linewidth profile and critical dimensions, spectroscopic reflectometry for films and film stacks, ultra-violet, or UV, and deep UV spectroscopic ellipsometry for ultra-thin films and film characterization, and film stress/wafer bow measurements. The Atlas offers high accuracy, high precision metrology for wafer characterization and can be configured for 200mm and 300mm wafer sizes or 6-inch masks and reticles. The system is also compatible with NanoNet, an optional software package that enables users to synchronize standalone and integrated metrology systems for remote process setup and monitoring.

Nanometrics FLX

The Nanometrics FLX flexible metrology system is based on the Atlas automation platform, and is designed to support up to four integrated metrology modules simultaneously the tool can mix-and-match any combination of modules to form a complete metrology solution for lithography, planarization, etch and deposition processes. This capability accelerates process development through parallel development of integrated metrology solutions. The Nanometrics FLX is a flexible, cost-efficient, high-throughput 300-mm standalone metrology system based on Nanometrics proven integrated metrology solutions. The system offers industry-leading throughput of 250-500 wafers per hour fueled by dual multi-axis wafer-handling robots.

NanoSpec 9100

The NanoSpec 9100 standalone, automated thin film measurement system is capable of handling wafers ranging in size from 75 to 200 millimeters in diameter. The 9100 can be configured with a deep

Table of Contents

ultraviolet, or DUV, to near infrared spectroscopic ellipsometer for ultra-thin, multiple film stack and DUV lithography measurement applications. Other 9100 options include a standard mechanical interface with mini-environment enclosures for use in ultra-clean manufacturing facilities. The 9100 uses technologies from the integrated film thickness systems to allow easy transfer of measurement recipes between the integrated and standalone film metrology systems.

Nanometrics Orion

The Nanometrics Orion, Advanced Overlay Control System provides enhanced measurement performance and higher wafer throughput and replaces the original Metra line of products. The system is based on the highly successful Atlas platform and offers high throughput in excess of 180 wafers per hour. Orion utilizes a proprietary optical system to provide low total measurement uncertainty (TMU), enabling 1 nanometer, 3-sigma precision and matching in overlay control applications. Orion s aerial image metrology with proprietary digital image folding tolerates wide process variations and reduces the possibility of erroneous data. Both attributes are crucial elements in attaining high yields in 200mm and 300mm volume production.

Caliper élan and Q240^{AT}

The Caliper élan and Q240^{AT} are our latest and most advanced overlay metrology solutions. Elan builds on the solid foundation established by the original Caliper overlay tool to provide the most cost effective solution for today s most advanced 300mm process technologies. Elan extends the production-proven Caliper platform with a refined optical metrology head coupled with advanced focusing and algorithms to provide a 50% improvement in both measurement (MAM) time and total measurement uncertainty (TMU). The Q240^{AT} incorporates the same measurement technology as the Caliper, and delivers the same advanced measurement capabilities for 200mm wafer sizes.

SiPHER

The SiPHER is a fully automated photoluminescence metrology system for the detection and mapping of 300mm substrate defects and metallic contamination. SiPHER detects and quantifies near surface and bulk metallic contamination in both bulk silicon and silicon epitaxial layers.

VerteX

The VerteX is a recently introduced rapid photoluminescence mapping system designed for high-volume compound semiconductor metrology applications such as volume LED manufacturing. The new VerteX with power density control provides improved matching to electrical test data, improved tool matching and improved reproducibility and repeatability. It also provides predictive metrics for the manufacturing process. In the case of high-brightness LED processing, VerteX enables accurate predictive processing metrics of green, blue and UV LED emission wavelengths at the wafer level, a capability that we believe is unmatched in the industry.

QS2200/3300

The QS2200 and QS3300 are Fourier-Transform Infra-Red spectrometers designed for non-destructive wafer analysis. These systems are used for the characterization and measurement of semiconductor substrates as well as in device manufacturing. The QS2200 model is available in two configurations; an automated 200mm system with two open cassettes and an automated system with one SMIF indexer and one open cassette for high-volume wafer manufacturing. The QS2200 series incorporates a universal stage, which adjusts automatically to different wafer sizes 100, 125, 150 and 200mm. The QS3300 is a production version which supports high-volume 300mm manufacturing for various applications: boron and phosphorus concentration in BPSG films, atomic hydrogen concentrations in silicon nitride passivation layers, fluorine in FSG films, epitaxial thickness, concentrations of interstitial oxygen and substitutional carbon in silicon.

Table of Contents

NanoSpec 3000 and 6100

The NanoSpec tabletop systems provide a broad range of thin film measurement solutions at a lower entry price point. The NanoSpec 3000 is a basic, manual system while the 6100 models feature semiautomatic wafer handling or staging.

QS1200 FTIR System

The QS1200 incorporates all of the measurement capability found in the semi-automated and fully-automated FTIR metrology systems in a table-top configuration. The QS1200 FTIR metrology tool is used primarily for dopant monitoring, epi thickness measurement, and other epitaxial substrate applications. The QS1200 is specifically designed for advanced semiconductor fabs performing material characterization in silicon growing and device manufacturing areas. It provides a new level of integration of the FTIR technique utilizing proven optical technology for SEMI standard wafers of 100, 125, 150, 200, and 300mm diameter as well as custom substrates up to 2mm in thickness.

Integrated Systems

Our integrated metrology systems are installed inside wafer processing equipment to provide near real-time measurements for improving process control and increasing throughput. Our integrated systems are available for wafer sizes up to 300 millimeters and offer DUV spectroscopic reflectometry and/or critical dimension measurement technologies. Our integrated metrology systems range in price from approximately $80,000 to $400,000 depending on features and technology.

NanoSpec 9000

The NanoSpec 9000 is an ultra-compact measurement system designed for integration into semiconductor wafer processing equipment. The system can be used in several wafer film process steps, including metal deposition, planarization, chemical vapor photolithography and etch. In its basic configuration, the NanoSpec 9000 is equipped with visible wavelength spectroscopic reflectometry.

NanoSpec 9000i

The NanoSpec 9000i is a 300mm version of the NanoSpec 9000. This metrology platform can be integrated into multiple wafer film process steps including metal deposition, planarization, chemical vapor deposition, photolithography and etch. The NanoSpec 9000i is also equipped with visible wavelength spectroscopic reflectometry and can be extended into deep ultraviolet wavelengths.

NanoOCD 9010M

The NanoOCD 9010M utilizes our production-proven OCD metrology, and enables non-destructive, real-time measurement and profiling of critical features on photomasks and reticles without the limitations and drawbacks associated with critical dimension scanning electron microscope, or CD-SEM, metrology. Current CD-SEM technology appears to be reaching its theoretical limits for making critical dimension measurements on these substrates. Photoresist-on-chrome-on-glass features found on reticles and masks suffer severe charging during CD-SEM metrology making critical dimension measurements impossible. OCD is a non-destructive technology that provides information not available from CD-SEM measurements.

Nano 9010b Series Integrated Metrology Platform

The 9010b is the first integrated metrology tool to combine two measurement technologies on a single platform. The 9010b incorporates both ultra violet optical critical dimension (OCD) spectroscopic ellipsometry and deep ultra violet (DUV) spectroscopic reflectometry. The 9010b provides thin film and film stack thickness measurements on pads as well as oxide, nitride and trench profile measurements on arrays in a single tool. The combined technologies provide a complete measurement solution over the entire

range of measurement requirements for each process step. This complete metrology capability can be utilized across a number of lithography, deposition, copper planarization, dielectric planarization, poly-Si etch and dielectric etch applications.

The 9010b is also available as a SEMI BOLTS compatible, 300 millimeter based system that incorporates all the features of the integrated configuration of the 9010b. By conforming to the industry standard BOLTS mounting system, the Nano 9010b BOLTS configuration is interchangeable with industry conforming load ports for simplified mechanical integration .

Nano 9010T Integrated Metrology Platform

The 9010T is an advanced, integrated metrology platform for optical CD measurement and profiling. The 9010T system is designed to be incorporated into semiconductor equipment requiring leading-edge CD metrology for semiconductor applications. The 9010T offers an extended wavelength range down to 210nm, extending the CD measurement capabilities for line width structures down to 65nm. The system also incorporates the UV film thickness function, and its improved design offers a faster, more cost effective integrated CD measurement solution with increased throughput. The system is also offered as the 9010T-BOLTS, in the SEMI, BOLTS configuration for easy installation directly onto the OEM process equipment s standard 300mm loadport.

Customers

We sell our metrology systems worldwide to many of the major semiconductor manufacturers and equipment suppliers, as well as to producers of silicon wafers and photomasks. The majority of our systems are sold to customers located in Asia and the United States. Three customers, Applied Materials, Inc., Samsung Electronics Co. Ltd. and Hynix Semiconductor, Inc. represented 20.1%, 14.3% and 13.5% of our total net revenues in 2006, respectively. See Note 18 of the Notes to Consolidated Financial Statements for information regarding our major customers.

The following is a list of our top ten customers (categorized by type of customer), based on revenues, during 2006:

Original Equipment Manufacturers (OEMs)	Integrated Device Manufacturers (IDMs)
Applied Materials, Inc.	Samsung Electronics Co. Ltd.
Ebara Technologies, Incorporated (ETI)	Hynix Semiconductor, Inc.
	Intel Corporation
	Renesas Technology Corp.
	Micron Technology, Inc.
	ProMOS Technologies
	Mimasu Semiconductor Industry Co., Ltd.
	International Business Machines Corporation

Sales and Marketing

We believe that the capability for direct sales and support is beneficial for developing and maintaining close customer relationships and for rapidly responding to changing customer requirements. We provide direct sales, service and application support from our corporate office in California for U.S. customers. We also have a direct sales presence in South Korea, Japan, Europe, Taiwan, China and Singapore. We use selected sales representatives in the United States and other countries. We intend to continue monitoring our network, our existing and new offices as well as developing additional distribution relationships when needed. We believe that growing our international distribution network can enhance our competitive position. We maintain a direct sales force of highly trained, technically sophisticated sales engineers who are knowledgeable in the use of metrology systems generally and with the features and advantages of our specific products. Our sales engineers are

Table of Contents

supported by applications scientists. Together, these highly trained individuals work closely with our customers to offer cost-effective solutions to complex measurement and process problems which our customers face.

Direct exports of our metrology systems to our foreign customers and shipments to our subsidiaries require general export licenses. See Note 19 of the Notes to Consolidated Financial Statements for information regarding total net revenues and long-lived assets of our foreign operations. See Item 1A, Risk Factors for information regarding risks related to our foreign operations.

Net revenues from customers located in the United States and in foreign countries, as a percentage of total net revenues, were as follows:

	2006	2005	2004
United States	46.1%	33.3%	28.2%
Japan	17.4%	26.2%	29