NANOMETRICS INC
Form 10-K/A
February 23, 2006
Table of Contents

UNITED STATES

SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K/A

(Amendment No. 2)

(Mark One)

x **ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the fiscal year ended January 1, 2005

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)

California	**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:

None

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

Common Stock, no par value

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 the 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 shell company (as defined in Rule 12b-2 of the Exchange Act.): Yes ¨ No x

Indicate by check mark whether the registrant is an accelerated filer (as defined in Rule 12b-2 of the Act). Yes ¨ No x

As of July 2, 2004, the last business day of our most recently completed second fiscal quarter, the aggregate market value of the Common Stock of the registrant held by non-affiliates was approximately $73,351,027. Shares of voting stock held by each officer and director and by each person who owns 5% or more of the outstanding voting 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 Securities Exchange Act of 1934, as amended. This determination of affiliate status is not necessarily a conclusive determination for other purposes.

As of February 24, 2005, 12,576,644 shares of the registrant s Common Stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Certain portions of the registrant s definitive proxy statement, to be filed with the Securities and Exchange Commission in connection with the registrant s upcoming annual meeting of shareholders for the fiscal year ended January 1, 2005, are incorporated by reference in Part III of this Form 10-K.

Table of Contents

NANOMETRICS INCORPORATED

FORM 10-K/A

YEAR ENDED JANUARY 1, 2005

TABLE OF CONTENTS

PART I

ITEM 1.	BUSINESS	1
ITEM 2.	PROPERTIES	17
ITEM 3.	LEGAL PROCEEDINGS	18
ITEM 4.	SUBMISSION OF MATTERS TO A VOTE OF SECURITY HOLDERS	18

PART II

ITEM 5.	MARKET FOR REGISTRANT S COMMON EQUITY AND RELATED SHAREHOLDER MATTERS	19
ITEM 6.	SELECTED CONSOLIDATED FINANCIAL DATA	20
ITEM 7.	MANAGEMENT S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS	21
ITEM 7A.	QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK	41
ITEM 8.	CONSOLIDATED FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA	42
ITEM 9.	CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE	65
ITEM 9A.	CONTROLS AND PROCEDURES	65
ITEM 9B.	OTHER INFORMATION	66

PART III

ITEM 10.	DIRECTORS AND EXECUTIVE OFFICERS OF THE REGISTRANT	67
ITEM 11.	EXECUTIVE COMPENSATION	67
ITEM 12.	SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED SHAREHOLDER MATTERS	67
ITEM 13.	CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS	67
ITEM 14.	PRINCIPAL ACCOUNTANT FEES AND SERVICES	67

PART IV

ITEM 15.	EXHIBITS AND FINANCIAL STATEMENT SCHEDULES	68

Table of Contents

EXPLANATORY NOTE

On October 26, 2005, the Company s Audit Committee, acting on a recommendation from the Company s management, determined that the Company s audited financial statements for the fiscal year ended January 1, 2005, and its unaudited quarterly financial statements for the periods ended April 2, 2005 and July 2, 2005, respectively, should be restated to revise the accounting for certain post-sale warranty services and other items. The restatement impacts the year ended January 1, 2005 presented herein and is further discussed in Note 2 to the condensed consolidated financial statements included herein.

This amendment to the Company s Annual Report on Form 10-K/A is being filed solely for the purpose of amending and restating Items 1, 6, 7 and 8 of the Form 10-K originally filed solely to the extent necessary (i) to reflect the restatement of the Company s condensed consolidated financial statements as of and for the year ended January 1, 2005 as described in Note 2 to the condensed consolidated financial statements and (ii) to make revisions to Management s Discussion and Analysis of Financial Condition and Results of Operations as warranted by the restatement, (iii) to make revisions to Item 9A of Part II to reflect our evaluation of controls and procedures as of the date of filing this amended Annual Report on Form 10-K/A, (iv) to include the certifications required by the Sarbanes-Oxley Act of 2002 and (v) to update the exhibits. The Company has made no further changes to the originally filed Form 10-K. All other information in this amended Annual Report on Form 10-K/A is as of the date the Annual Report on Form 10-K was originally filed and does not reflect any subsequent information or events other than those described above.

Subsequent to the filing of this Form 10-K/A, the Company will file an Amendment No. 1 to its Quarterly Report on Form 10-Q/A for the periods ended April 2, 2005 and July 2, 2005, respectively, to reflect restatements of the Company s consolidated balance sheet as of each respective quarter end and the Company s consolidated statements of operations and cash flows for the three-month periods ended April 2, 2005 and April 3, 2004 and the six-month periods ended July 2, 2005 and July 3, 2004.

As stated above, the Company is filing this Amendment No. 2 to its Annual Report on Form 10-K/A for the year ended January 1, 2005 and as such, the unaudited quarterly financial statements in the Quarterly Reports on Form 10-Q for the periods ended April 3, 2004, July 3, 2004 and October 2, 2004, should no longer be relied upon. The Company has not amended and does not intend to amend its previously filed Quarterly Reports on Form 10-Q for the periods affected by the restatement prior to January 1, 2005 as the 2004 restatement information will be reflected in the Quarterly Reports on Form 10-Q/A for the three-month periods ended April 2, 2005 and July 2, 2005 and in the Quarterly Report on Form 10-Q for the three-month period ended October 1, 2005 with the statement of operations information also included in this Form 10-K/A.

Forward-Looking Statements

This Annual Report on Form 10-K/A 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 7, Management s Discussion and Analysis of Financial Condition and Results of Operations Risks Related to Our Business and Management s Discussion and Analysis of Financial Condition and Results of Operations Risks Relating to

the Merger with August Technology Corporation, 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 semiconductors/integrated circuits and flat panel displays. Our metrology systems (i) measure various thin film properties, critical circuit dimensions and layer-to-layer circuit alignment (overlay) and (ii) inspect for surface defects during various steps of the manufacturing process, enabling semiconductor and integrated circuit manufacturers to improve yields, increase productivity and lower their manufacturing costs. The relative alignment of sequentially patterned thin film layers is critical to device production.

We have been a pioneer and innovator in the field of metrology for nearly three decades. We have been selling metrology systems since 1977 and have an extensive installed base with industry leading customers worldwide, including Applied Materials Inc., Samsung, Hynix Semiconductor Inc., IBM, Intel Corporation, Micron Technology, Inc., TSMC Ltd., Renesas, Powerchip, UMC, Ebara, Chi Mei, AU Optronics and Hannstar.

On January 21, 2005, we announced a definitive agreement to merge our business with August Technology Corporation, a leading provider of defect inspection technology headquartered in Bloomington, Minnesota. Upon consummation of the merger, Nanometrics will be renamed August Nanometrics Inc. and reincorporated into Delaware. Additionally, August Technology will become a wholly owned subsidiary of August Nanometrics. Each share of August Technology common stock will be converted into the right to receive 0.6401 of a share of August Nanometrics common stock upon consummation of the merger. The merger is expected to close during the second quarter of 2005, and is subject to customary closing conditions, including receipt of shareholder approval from the shareholders of Nanometrics and August Technology. See Management s Discussion and Analysis of Financial Condition and Results of Operations Risks Relating to the Merger with August Technology Corporation for more information concerning this announcement.

We intend to file a joint proxy statement/prospectus in connection with the proposed merger as well as other documents related to the merger. Investors and security holders are urged to read these filings when they become available because they will contain important information about the proposed merger. Investors and security holders may obtain free copies of these documents (when they are available) and other documents filed with the Securities and Exchange Commission at the Securities and Exchange Commission s web site at *www.sec.gov*. Investors and security holders may obtain free copies of the documents filed by Nanometrics with the Securities and Exchange Commission by contacting Investor Relations at 1550 Buckeye Drive, Milpitas, California 95035, 408.435.9600. In addition, investors and security holders may read and copy any reports, statements and other information filed by Nanometrics at the SEC public reference room at 450 Fifth Street, N.W., Washington, D.C. 20549. Please call the SEC at 800.SEC.0330 for further information on the public reference room. Nanometrics and August Technology and their respective directors and executive officers may be deemed to be participants in the solicitation of proxies from the shareholders of Nanometrics and August Technology in connection with the proposed merger. Certain officers and directors of Nanometrics have interests in the proposed merger, including their ownership of Nanometrics common stock, and their interests will be described in the joint proxy statement/prospectus when it becomes available.

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 operations;

- Integrated systems for integration into semiconductor processing equipment that provide real-time measurements and feedback to improve process control and increase throughput; and

1

Table of Contents

- Tabletop systems used to provide manual or semi-automatic measurements for engineering and low-volume production environments.

We also provide systems that are used to measure the overlay accuracy of successive layers of semiconductor patterns on wafers in the photolithography process. 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.

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

Additional demands on process tool manufacturers for better film uniformity, tighter dimensional 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.

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

- The separation of our business in Japan into two facilities to better serve the semiconductor and flat panel display (FPD) metrology markets.
- The building of our position as a leading supplier of integrated metrology systems;
- The introduction of several new 300 millimeter wafer platforms for both advanced standalone and integrated metrology;
- The continued outsourcing of certain system components, such as robotics, enabling us to leverage our technical resources;
- The maximum utilization of an in-house manufacturing strategy for our products; and
- The development of new measurement technologies for advanced lithography and ultra-thin film deposition.

Demand for our products is driven by the increasing use of multiple thin film technology by manufacturers of electronic products and, more recently, by the increased adoption of both integrated metrology and advanced process control (APC) by semiconductor manufacturers. With feature sizes shrinking below 90 nanometers, 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 integrated metrology and APC. Our innovative Optical Critical Dimension (OCD®) measurement system is being increasingly viewed not only as an enabling technology for APC, but also as a solution for critical dimension measurement.

We combined our deep ultraviolet (DUV) reflectometry technology with the OCD technology in a single, integrated metrology module, the NanoOCD/DUV 9010. The compact size and speed of this OCD/DUV technology enables the measurement system to be fully integrated into the customer s process tool, thus providing a complete, feed forward and feedback APC 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 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. Our new, combined integrated metrology module represents a unique 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 chemical mechanical planarization (CMP) process.

Our OCD technology has also proven to be applicable to the emerging requirements for advanced lithography measurements such as the characterization of critical dimensions and film thicknesses on masks and reticles which are comprised of square glass substrates. We introduced the Nanometrics Atlas-M, the first fully automated, standalone metrology system to use OCD technology for these square glass substrates. This system is crucial to the suppliers 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.

We successfully beta tested the Nanometrics Orion Overlay Control System at a leading semiconductor memory device manufacturer. The Orion is an advanced overlay metrology and analysis system for monitoring microlithography stepper performance. Orion provides exceptional throughput and measurement performance required by today s demanding 200mm and 300mm overlay control applications.

We have continued the development the Universal Defect Inspection (UDI) system following the successful beta site testing at a leading integrated device manufacturer (IDM). The NanoUDI technology can be configured as either a standalone, fully automated 300-millimeter system or an integrated module for defect and contamination detection on a wide variety of films and surfaces. The system combines high efficiency illumination and high-resolution optics with sophisticated image processing to detect and classify particles and defects in the sub-micron range.

Many types of thin films are used in the manufacture of products, such as semiconductor integrated circuits and flat panel displays. 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

Moore s Law which, simply stated, predicts a doubling of integrated circuit performance with a 50% reduction in manufacturing costs every 18 months, is an important factor in determining factory investment in the semiconductor industry. Two important industry drivers are: (i) the increasing complexity of chip designs as users of semiconductor chips demand increasingly higher performance and require more complicated manufacturing processes and (ii) the market pressure for lower cost chips. The semiconductor equipment industry has experienced cyclical growth with a compounded annual growth rate of approximately 15-17% over the past 20 years. The semiconductor industry recently emerged from an exceptionally long, cyclical downturn, and 2004 saw a growth in semiconductor equipment revenues of approximately 60% over 2003. We believe that the convergence of 300-millimeter wafer size, copper interconnects and fast, sub-100 nanometer 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.

In the past, demand for Internet access, personal computers, telecommunications, and new consumer electronic products and services has fueled growth of the semiconductor, data storage and flat panel display industries. New display technologies, consumer electronics, automotive electronics and personal computers 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.

3

The two significant factors affecting demand for our measurement systems are: (i) new construction or refurbishment of manufacturing facilities, which, in turn, depends on the current and anticipated market demand for semiconductors, disk drives, flat panel displays, and products that use such components, and (ii) the increasing complexity of the manufacturing process as a result of the demand for higher performance semiconductors and flat panel displays.

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 (CVD), plasma-enhanced chemical vapor deposition (PECVD) and physical vapor deposition (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 costly rework or misprocessing and results in higher yields for semiconductor manufacturers.

Table of Contents

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.

Flat Panel Display Manufacturing Processes

Flat panel displays are manufactured in clean rooms using thin film measurement systems that are similar to those used in semiconductor manufacturing. Most flat panel displays are constructed on large glass substrates that currently range in size up to 1,870 x 2,200 millimeters and should increase to up to 2,160 x 2,400 millimeters by the end of 2005.

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 fabwide process optimization. Many major semiconductor manufacturers are adopting feed-forward and feedback of film thickness and critical 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, although there is continued focus on increased productivity driving the adoption of integrated metrology, there is an additional requirement for tighter process tolerances with advanced, sub-90nm technologies. This new requirement is driving integrated process control metrology as necessary for many processes, such as 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 fab 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.

5

Table of Contents

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 the characterization and measurement of thin films in high-volume manufacturing operations. 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 and flat panel display 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.

Integrated systems used to measure in-process wafers automatically and quickly without having to leave the enclosed wafer processing system. In 1998, we introduced our high-speed integrated metrology 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, litho and etch tools.

Tabletop systems 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 mainly used 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.

Each of our measurement systems provides for the measurement, visualization and control of film uniformity and thickness, critical dimensions and profiles, and layer-to-layer registration/overlay. In addition, we have developed new automated systems and tabletop products for emerging technologies using larger substrates such as 300-millimeter silicon wafers and larger flat panel displays. We were one of the first companies to ship fully automated thin film thickness measurement systems for 300-millimeter wafers. We have also introduced new technology for the precise thin film measurements that are dictated by sub-100nm design rules and have developed products with mini-environments that meet the latest standards for clean, particle-free manufacturing.

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 and flat panel display industries, as well as other industries that use metrology systems. Our proposed merger with August Technology may enable us to expand our strategy into the macro defect inspection space. 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 and flat panel display manufacturing technology. We have an extensive array of proprietary technology and expertise in optics, software and systems integration. We have chosen to reduce our dependence on outside suppliers by taking control of the technology and development of the critical components of our metrology systems. These technologies include polarized reflectometry, precision motion control, extreme dark field imaging, low distortion imaging and advanced algorithms.

Table of Contents

Continuing to Offer Advanced Integrated Metrology Systems. We were one of the first suppliers to offer products that integrate process 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 SECVD systems. Our optical critical dimension (OCD) metrology system is incorporated in the Applied Materials Transforma 300mm etch system for controlling critical dimensions. The introduction of the first combined OCD/DUV integrated metrology product has allowed us to penetrate additional OEM suppliers of etch processing and CMP equipment, including Hitachi High Tech (HHT), Dainippon Screen (DNS) and Ebara. The introduction of the NanoOCD/DUV 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 original equipment manufacturers (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. In addition, our copper/metal profiler for CMP process control combines optical profile measurement or profilometry with our highly successful reflectometry technology to monitor metal removal during the CMP process. These metrologies are key requirements for the copper damascene process, which replaces the current subtractive aluminum process on newer semiconductor devices.

We also participate in the particle and defect inspection market with our Universal Defect Inspection (UDI) technology. This technology has applications not only for inspection of semiconductor wafers but also for flat panel displays for the purpose of detecting defects early in the process before they cause catastrophic yield loss.

Our OCD technology has also been applied to advanced photolithography processes with the introduction of the Nanometrics Atlas-M fully automated metrology system for mask and reticle measurement and characterization. This new product has already successfully correlated the interrelationships between film thickness and critical dimension parameters. The OCD technology has also been successfully extended to perform overlay/registration measurements. Our new diffraction-based overlay (DBO) technology can provide lithographers with wafer overlay control well beyond the requirements of the 65-nanometer node of the International Technology Roadmap for Semiconductors (ITRS) through the year 2010.

Leveraging Existing Customer and Industry Relationships. We expect to continue to strengthen our existing customer relationships and foster working partnerships with semiconductor equipment manufacturers by providing technologically superior systems and high levels of customer support. 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.

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 expanded our direct sales force in Japan, South Korea, Taiwan and China, and will continue to expand into additional territories as customer requirements dictate. We use selected sales representatives in non-key territories. 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

intend to continue developing and marketing products to address metrology requirements in the manufacture of flat panel displays and any other industries that might apply our technology in the future. 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.

Table of Contents

Broadening of our OEM Customer Base. We believe that our OEM customer base will become an increasingly important aspect of our business. In 2004, we began shipping to Ebara, Hitachi, Dainippon Screen and Tokyo Electron Limited (TEL). These OEM design wins, together with our strong OEM position with Applied Materials, is expected to allow us to capitalize on this rapidly growing market segment. Our new, OEM integrated metrology sales group provides additional focus on this market opportunity, which is expected to result in continued increasing acceptance of our products in this sector.

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.

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, measurement technology utilizes a high magnification, low distortion imaging system combined with proprietary software algorithms to numerically quantify the alignment.

8

Table of Contents

Diffraction-Based Overlay Registration. We developed diffraction-based overlay as an alternative solution for overlay technology nodes below 90 nanometers. This novel technique extracts overlay alignment error from our broadband OCD technology using specially designed diffraction targets in real-time. The technique is based on spectroscopy rather than imaging, is much more robust than aerial imaging methods, and the total measurement uncertainty is about six times smaller than traditional techniques. This new technology is capable of meeting the advanced design requirements of the 45nm process. A major advantage of the diffraction technique is that the measurement targets can be produced that match the dimensions of the circuits being manufactured, thus providing the immediate benefit of looking at the overlay performance of features that closely resemble the circuit features.

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, 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.

Table of Contents

Products

Our thin film thickness measurement systems use microscope-based, non-contact spectroscopic reflectometry (SR). Some of our systems provide complementary spectroscopic ellipsometry (SE) 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 three groups: automated standalone systems, integrated systems and tabletop systems.

Platform	Market	Substrate Size	Applications	Technology
Automated/				
Standalone Systems				
9100	Semiconductor	75-200mm	CVD, CMP, Etch, Litho, Film Thickness	SR, SE
9200	Semiconductor	150mm 200mm	CVD, CMP, Etch, Litho, Film Thickness	SR
FLX	Semiconductor	200mm 300mm	CVD, CMP, Etch, Litho, Film Thickness, CD	SR, OCD/SR, UDI
Atlas/Atlas-M	Semiconductor	200mm 300mm 6-inch masks/reticles	CVD, CMP, Etch, Litho, Film Thickness, Film Stress, CD	SR, SE, OCD/SE, DBO
6500 Series	Flat Panel Display	Generations 5, 6 and 7	Film Thickness	SR, SE
Orion	Semiconductor	200mm 300mm	Overlay	Imaging
Integrated Systems				
9000	Semiconductor	200mm	CVD, CMP, Film Thickness	SR
9000i	Semiconductor	200mm 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	OCD/SR
Table Top Systems				
3000	Semiconductor	75mm 150mm	Film Thickness	SR
6100	Semiconductor	75mm 150mm 200mm	Film Thickness	SR

Automated/Standalone Systems

Our standalone, fully automated metrology systems are employed in high-volume production environments. These 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. 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.

Table of Contents

Nanometrics Atlas and Atlas-M

The Nanometrics Atlas high-performance metrology system combines up to five 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 five metrology technologies including polarized, normal incidence spectroscopic ellipsometry for linewidth profile and critical dimensions, spectroscopic reflectometry for films and film stacks, UV and deep UV spectroscopic ellipsometry for ultra-thin films and film characterization, diffraction-based overlay technology for layer-to-layer registration measurement, 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 ultraviolet (DUV) to near infrared (NIR) 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 system also features a Windows NT software platform that conforms to the newly establish SEMI user interface standard. The 9100 can also be configured to handle the substrates. We developed the 9100 using technologies from the integrated film thickness systems to allow easy transfer of measurement recipes between the integrated and standalone film metrology systems.

NanoSpec 9200

The NanoSpec 9200 standalone, automated thin film measurement system is capable of handling wafers of 150 and 200 millimeters in diameter. We developed this system, using technologies from the NanoSpec 9000 integrated film thickness system, to be compact and to provide high wafer throughput.

NanoSpec 6500

The NanoSpec 6500 measures optically transparent films that are used in the manufacture of flat panel displays. The NanoSpec 6500 is an advanced version of our flat panel measurement system with additional proprietary software and hardware enhancements and is capable of handling generation 5, 6 and 7 substrates. Product enhancements include the integration of ultra-violet (UV) spectroscopic reflectometry for the measurement of low temperature, deposited poly-silicon films and UV to near infra-red (NIR) spectroscopic ellipsometry (SE) for the measurement of multilayer film stacks and improved measurement precision.

Nanometrics Orion

The recently introduced 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 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.

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 $300,000 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. The NanoSpec 9000i will also support the newly developed optical critical dimension (OCD) technology for the measurement of critical dimensions on semiconductor wafers. The system is designed for integration into semiconductor wafer processing equipment and used in several critical processing steps including photolithography and etch.

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 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.

NanoOCD/DUV 9010

The NanoOCD/DUV 9010 is the first integrated metrology tool to combine two measurement technologies on a single platform. The NanoOCD/DUV 9010 incorporates both ultra violet optical critical dimension (OCD) spectroscopic ellipsometry and deep ultra violet (DUV) spectroscopic reflectometry. The NanoOCD/DUV 9010 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.

Table of Contents

NanoOCD/DUV 9010b

The NanoOCD/DUV 9010b is a SEMI BOLTS compatible, 300 millimeter based system that incorporates all the features of the NanoOCD/DUV 9010. By conforming to the industry standard BOLTS mounting system, the NanoOCD/DUV 9010b 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/b, in the SEMI BOLTS configuration for easy installation directly onto the OEM process equipment s standard 300mm loadport.

Tabletop Systems

Our tabletop systems are used primarily in low-volume production environments and in engineering labs for which automated handling and high throughput are not required. Our tabletop product line encompasses both manual and semi automated models for film thickness measurements. Our tabletop system prices range from approximately $50,000 to $200,000.

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.

Customers

We sell our metrology systems worldwide to many of the major semiconductor and flat panel display 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. Two customers, Applied Materials and Samsung, represented 21.4% and 14.7% of our total net revenues in 2004, respectively.

The following is a list of our top ten customers (categorized by type of customer), based on revenues, during 2004:

Original Equipment Manufacturers (OEMs)	**Integrated Device Manufacturers (IDMs) and Flat Panel Display (FPD)**
Applied Materials, Inc.	Samsung
Ebara Technologies, Incorporated (ETI)	Hynix Semiconductor Inc.
Tokyo Electron Limited (TEL)	Tricenti Technology Inc. (TTI)
	Semiconductor Manufacturing International Corporation (SMIC)
	Taiwan Semiconductor Manufacturing Corporation (TSMC)
	United Microelectronics Corporation (UMC)
	Innolux Display Corporation

Table of Contents

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 and support from our corporate office in California. We also have a direct sales presence in South Korea, Taiwan, China and Japan. 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 supported by applications scientists. Together, these highly trained individuals work closely with our customers to solve complex measurement and process problems.

Direct exports of our metrology systems to our foreign customers and shipments to our subsidiaries require general export licenses. See Note 13 of the Notes to Consolidated Financial Statements for information regarding total net revenues and long-lived assets of our foreign operations. See Item 7, Management s Discussion and Analysis of Financial Condition and Results of Operations-Risks Related to Our Business, for information regarding risks related to our foreign operations.

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

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