

IPG PHOTONICS CORP
Form 10-K
February 27, 2012
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UNITED STATES SECURITIES AND EXCHANGE COMMISSION

Washington, DC 20549

Form 10-K

(Mark One)

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

For the fiscal year ended December 31, 2011

OR

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

Commission File Number: 001-33155

IPG PHOTONICS CORPORATION

(Exact name of registrant as specified in its charter)

Delaware

(State or other jurisdiction of

incorporation or organization)

50 Old Webster Road, Oxford, Massachusetts

(Address of principal executive offices)

04-3444218

(IRS Employer

Identification No.)

01540

(Zip Code)

Registrant's telephone number, including area code:

(508) 373-1100

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

Title of Class

Name of Exchange on Which Registered

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Common Stock, Par Value \$0.0001 per share

The NASDAQ Stock Market LLC

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

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

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 No

Indicate by check mark whether the registrant has submitted electronically and posted on its corporate Web site, if any, every Interactive Data File required to be submitted and posted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit and post such files). Yes 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, a non-accelerated filer or a smaller reporting company. See definitions of large accelerated filer, accelerated filer and smaller reporting company in Rule 12b-2 of the Exchange Act. (Check one):

Large accelerated filer Accelerated filer Non-accelerated filer Smaller reporting company

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Act). Yes No

The aggregate market value of the registrant's common stock held by non-affiliates of the registrant was approximately \$2.0 billion, calculated based upon the closing price as reported by the Nasdaq Global Market on June 30, 2011. For purposes of this disclosure, shares of common stock held by persons who own 5% or more of the outstanding common stock and shares of common stock held by each officer and director have been excluded in that 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 conclusive.

As of February 23, 2012, 47,680,519 shares of the registrant's common stock were outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Portions of the registrant's Proxy Statement for its 2012 Annual Meeting of Stockholders to be filed pursuant to Regulation 14A within 120 days of the end of the registrant's fiscal year ended December 31, 2011 are incorporated by reference into Part III of this Annual Report on Form 10-K to the extent stated herein.

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This Annual Report on Form 10-K contains certain forward-looking statements within the meaning of Section 27A of the Securities Act of 1933 and Section 21E of the Securities Exchange Act of 1934, and we intend that such forward-looking statements be subject to the safe harbors created thereby. For this purpose, any statements contained in this Annual Report on Form 10-K except for historical information are forward-looking statements. Without limiting the generality of the foregoing, words such as may, will, expect, believe, anticipate, intend, estimate, or continue or the negative or other variations thereof or comparable terminology are intended to identify forward-looking statements. In addition, any statements that refer to projections of our future financial performance, trends in our businesses, or other characterizations of future events or circumstances are forward-looking statements.

The forward-looking statements included herein are based on current expectations of our management based on available information and involve a number of risks and uncertainties, all of which are difficult or impossible to accurately predict and many of which are beyond our control. As such, our actual results may differ significantly from those expressed in any forward-looking statements. Factors that may cause or contribute to such differences include, but are not limited to, those discussed in more detail in Item 1 (Business) and Item 1A (Risk Factors) of Part I and Item 7 (Management's Discussion and Analysis of Financial Condition and Results of Operations) of Part II of this Annual Report on Form 10-K. Readers should carefully review these risks, as well as the additional risks described in other documents we file from time to time with the Securities and Exchange Commission (the SEC). In light of the significant risks and uncertainties inherent in the forward-looking information included herein, the inclusion of such information should not be regarded as a representation by us or any other person that such results will be achieved, and readers are cautioned not to rely on such forward-looking information. We undertake no obligation to revise the forward-looking statements contained herein to reflect events or circumstances after the date hereof or to reflect the occurrence of unanticipated events.

PART I

ITEM 1. BUSINESS

Our Company

IPG Photonics Corporation (IPG, the Company, the Registrant, we, us or our) is the leading developer and manufacturer of a broad line of high-performance fiber lasers, fiber amplifiers and diode lasers that are used in numerous applications in diverse end markets. Fiber lasers are a type of laser that combines the advantages of semiconductor diodes, such as long life and high efficiency, with the high amplification and precise beam qualities of specialty optical fibers to deliver superior performance, reliability and usability at a generally lower cost compared to competing lasers.

Our diverse lines of low, mid and high-power lasers and amplifiers are used in materials processing, advanced, communications and medical applications. We sell our products globally to original equipment manufacturers, or OEMs, system integrators and end users. We market our products internationally primarily through our direct sales force. We have sales offices in the United States, Germany, Italy, the United Kingdom, France, Spain, Japan, China, South Korea, Singapore, India and Russia.

We design and manufacture most of our key components used in our finished products, from semiconductor diodes to optical fibers and other components, finished fiber lasers and amplifiers. We also manufacture certain complementary products used with our lasers, including optical delivery cables, fiber couplers, beam switches, optical heads and chillers. Our vertically integrated operations allow us to reduce manufacturing costs, ensure access to critical components, rapidly develop and integrate advanced products and protect our proprietary technology.

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We are listed on the Nasdaq Global Market (ticker: IPGP). We began our operations in Russia in 1990 and we were incorporated in Delaware in 1998. Our principal executive offices are located at 50 Old Webster Road, Oxford, Massachusetts 01540, and our telephone number is (508) 373-1100.

Industry Background

Conventional Laser Technologies

Since the laser was invented over 50 years ago, laser technology has revolutionized a broad range of applications and products in various industries, including general manufacturing, automotive, heavy industry, consumer products, electronics, semiconductors, research, medical and communications. Lasers provide flexible, non-contact and high-speed ways to process and treat various materials. They are incorporated into manufacturing and other systems by OEMs, system integrators and end users. For a wide variety of applications, lasers provide superior performance and a more cost-effective solution than non-laser technologies. Also, they are widely used to transmit large volumes of data in optical communications systems, in various medical applications and in test and measurement systems.

Lasers emit an intense light beam that can be focused on a small area, causing metals and other materials to melt, vaporize or change their character. These properties are utilized in applications requiring very high-power densities, such as cutting, welding, marking, engraving, drilling, cladding, annealing and other materials processing procedures. Lasers are well-suited for imaging and inspection applications, and the ability to confine laser light to narrow wavelengths makes them particularly effective in medical and sensing applications. A laser works by converting electrical energy to optical energy. In a laser, an energy source excites or pumps a lasing medium, which converts the energy from the source into an emission consisting of particles of light, called photons, at a particular wavelength.

Historically, CO₂ gas lasers and crystal lasers have been the two principal laser types used in materials processing and many other applications. They are named for the materials used to create the lasing action. A CO₂ laser produces light by electrically stimulating a gas-filled tube. A CO₂ laser delivers the beam through free space using mirrors to provide direction. A crystal laser uses an arc lamp, pulsed flash lamp, or diode stack or array to optically pump a special crystal. The most common crystal lasers use yttrium aluminum garnet, or YAG, crystals infused with neodymium or ytterbium. Some crystal lasers also use mirrors in free space to deliver the beam or direct the beam through fiber optics.

Introduction of Fiber Lasers

Fiber lasers use semiconductor diodes as the light source to pump specialty optical fibers, which are infused with rare earth ions. These fibers are called active fibers and are comparable in diameter to a human hair. The laser emission is created within optical fibers and delivered through a flexible optical fiber cable. As a result of their different design and components, fiber lasers are more electrically efficient, productive, reliable, robust and portable, and easier to operate than conventional lasers. In addition, fiber lasers free the end users from fine mechanical adjustments and the high maintenance costs that are typical for conventional lasers.

Although low-power fiber lasers have existed for approximately four decades, their increased recent adoption has been driven primarily by the significant scaling of output powers and the reductions in cost that we achieved over the last two decades, as well as their superior performance compared with conventional lasers. We have successfully increased output power levels by developing improved optical components such as active fibers that have increased their power capacities and improved their performance. Fiber lasers now offer output powers that exceed those of conventional lasers in many categories. Also, semiconductor diodes historically have represented the majority of the cost of fiber lasers. The high cost of diodes meant that fiber lasers could not compete with conventional lasers on price and limited their use to high value-added applications. Over the last several years, however, our semiconductor diodes have become more affordable and reliable due, in part, to

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substantial advancements in semiconductor diode technology and increased production volumes. Also, component prices for fiber lasers have decreased as production volumes have risen, making fiber lasers cost-competitive and generally priced lower than competing lasers. As a result, the average cost per watt of output power has decreased dramatically over the last decade.

Because of these improvements, our fiber lasers can now effectively compete with conventional lasers over a wide range of output powers and applications, and we are developing new applications in which lasers have not been widely used before, for example in natural resource extraction. As a pioneer in the development and commercialization of fiber lasers, we have contributed to many advancements in fiber laser technology and products.

Advantages of Fiber Lasers over Conventional Lasers

We believe that fiber lasers provide a combination of benefits that include:

Superior Performance. Fiber lasers provide high beam quality over the entire power range. In most conventional laser solutions, the beam quality is sensitive to output power, while in fiber lasers, the output beam is virtually non-divergent over a wide power range. A non-divergent beam enables higher levels of precision, increased power densities and the ability to deliver the beam over greater distances to where processing can be completed. The superior beam quality and greater intensity of a fiber laser's beam allow tasks to be accomplished more rapidly, with lower-power units and with greater flexibility than comparable conventional lasers.

Lower Cost. Fiber lasers offer strong value to customers because of their generally lower required maintenance costs, high reliability and energy efficiency. Many high-power lasers have lower acquisition costs. Fiber lasers are cheaper to operate due to their lower energy usage, lower required maintenance costs and better processing speeds. Fiber lasers convert electrical energy to optical energy approximately 2 to 3 times more efficiently than diode-pumped YAG lasers, approximately 3 times more efficiently than conventional CO₂ lasers and approximately 15 to 30 times more efficiently than lamp-pumped YAG lasers. Because fiber lasers are much more energy-efficient and place lower levels of thermal stress on their internal components, they have substantially lower cooling requirements compared to those of conventional lasers, which also improves overall energy efficiency. Fiber lasers have lower to no maintenance costs due to the high performance and long life of our single-emitter diodes, fiber optics and other optical components, which can be used for up to 100,000 hours without replacement. The higher power density of the fiber laser beam also allows for higher processing speeds in many applications, which increases the operating efficiencies and reduces customer costs on a per-part basis.

Ease of Use. Many features of fiber lasers make them easier to operate, maintain and integrate into laser-based systems as compared to conventional lasers. There are no moving parts in the fiber laser so they do not require adjustments of internal components.

Compact Size and Portability. Fiber lasers are typically smaller and lighter in weight than conventional lasers, saving valuable floor space. While conventional lasers are delicate due to the precise alignment of mirrors, fiber lasers are more durable and able to perform reliably in variable environments both inside and outside a factory setting.

Choice of Wavelengths and Precise Control of Beam. The design of fiber lasers generally provides a broad range of wavelength choices, allowing users to select the precise wavelength that best matches their application and materials. Because the beam is delivered through fiber optics, it can be directed to the work area over longer distances without loss of beam quality.

Fiber amplifiers are similar in design to fiber lasers, use many of the same components, such as semiconductor diodes and specialty optical fibers, and provide many of the same advantages in the applications that require amplification.

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Notwithstanding the benefits offered by fiber lasers, there remain applications and processes where conventional laser technologies may provide superior performance with respect to particular features. For example, crystal lasers can provide higher peak power pulses and fiber lasers do not generate the deep ultraviolet light that is used for photolithography in many semiconductor applications. In addition, CO₂ lasers operate at wavelengths that are optimal for use on many non-metallic materials, including plastics.

Our Competitive Strengths

We believe that our key competitive strengths position us to take advantage of opportunities to displace traditional lasers and enable use of fiber lasers in new applications. Our key strengths and competitive advantages include:

World's Leading Producer of Fiber Laser Technology. We are the world's largest manufacturer of fiber lasers, which is a technologically advanced laser technology that provides superior electrical efficiency, superior beam quality, lower maintenance cost, longer life, more flexibility and higher productivity than other laser technologies. As a pioneer and technology leader in fiber lasers, we have built leading positions in our various end markets with a large and diverse customer base. Based on our leadership position, we are able to leverage our scale to lower costs for our customers and drive the proliferation of fiber lasers in existing and new applications. Our technology platform is modular, scalable and robust. Our fiber lasers offer higher continuous-wave, or CW, output powers than any other commercial laser in the market. We rely on several key proprietary technologies including pumping technology, manufacturing of fiber to withstand the high output power of our lasers, gain blocks and optics. In addition, we have developed a wide range of advanced proprietary optical components that contribute to the superior performance and reliability of our products.

Vertically Integrated Development and Manufacturing. We develop and manufacture all of our key high-volume specialty components, including semiconductor diodes, active fibers, passive fibers and specialty optical components. Our proprietary components are capable of handling the stress of the high optical powers from our products and we believe many of them exceed the performance of commercially available components. We believe that our vertical integration and our high-volume production enhances our ability to meet customer requirements, accelerate development, manage costs, improve component yields and protect our intellectual property, while maintaining high performance and quality standards.

Breadth and Depth of Expertise. Since the founding of our company in 1990, our core business has been developing, designing, manufacturing and marketing advanced fiber lasers and amplifiers. We have extensive know-how in materials sciences, which enables us to make our specialty optical fibers, semiconductor diodes and other critical components. We also have expertise in optical, electrical, mechanical and semiconductor engineering, which we use to develop and manufacture our proprietary components, products and systems.

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Diverse Customer Base, End Markets and Applications. Our diverse customer base, end markets and applications provide us with many growth opportunities. In 2011, we shipped more than 15,000 units to over 1,700 customers worldwide, with no single customer representing more than 8% of our sales. Our products are used in a variety of applications and end markets worldwide. Our principal end markets and representative applications within those markets include:

Materials Processing

General manufacturing

Welding, hybrid welding and brazing

Cutting

Marking, engraving and printing

Annealing and hardening

Prototyping, cladding and stripping

Automotive

High-strength steel cutting and welding

Welding tailored metal blanks, frames, seats and transmissions

Brazing and welding of auto frames

Heavy industry

Hardening and welding pipes in nuclear, wind turbine and pipeline industries

Welding and cutting thick plates for ships and rail cars

Drilling for natural resources

Aerospace

Welding titanium air frames

Cladding parts

Percussion drilling of parts

Consumer

Electronics and credit card marking

Cutting and marking parts for electronics and medical devices

Cutting and welding parts for consumer products and appliances

Stent and pacemaker manufacturing

Semiconductor and electronics

Computer disk manufacturing and texturing

Photovoltaic manufacturing

Wafer processing, memory repair and trim

Advanced Applications

Obstacle warning and light detecting and ranging

Special projects and research

[Redacted]

Materials destruction testing and sensing

Communications

Broadband fiber to premises

Broadband cable video signal transport

Metro and long-haul wire-line DWDM transport

Medical

Skin rejuvenation and wrinkle removal

General surgery and urology

Dental

Broad Product Portfolio and Ability to Meet Customer Requirements. We offer a broad range of standard and custom fiber lasers and amplifiers that operate between 0.5 and 2 microns, enabling deployment of our

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products in a wide variety of applications and end markets. Our vertically integrated manufacturing and broad technology expertise enable us to design, prototype and commence high-volume production of our products rapidly, allowing our customers to meet their time-to-market requirements. Our manufacturing scale allows us to deliver large quantities of product with short lead times.

Our Strategy

Our objective is to maintain and extend our leadership position by pursuing the following key elements of our strategy:

Leverage Our Technology to Increase Sales. As fiber lasers become more widely accepted, we plan to leverage our position as the leader in fiber lasers and our applications expertise to develop solutions for customers and increase our position in the broader laser market. Over the last decade, our pulsed fiber lasers have become widely accepted in laser metal marking applications and now have a leading position in those applications. More recently, our high-power CW fiber lasers have been accepted by a growing number of laser cutting system OEMs for two- and three-dimension cutting, one of the largest laser materials processing applications. We plan to continue to leverage our fiber laser technology by pursuing large-scale laser applications where our fiber lasers offer improved customer value and performance. Some of the more significant applications we intend to target include: (i) welding of thick steel with our high-power lasers; (ii) micro-processing and ceramic cutting with our quasi-CW, or QCW, fiber lasers; (iii) processing of non-metals, such as plastics, with our new high-power thulium lasers; and (iv) fine-processing, scribing and marking with our high-power green lasers. We believe that our fiber lasers will continue to displace traditional lasers in many existing applications due to their superior performance and value.

Target New Applications for Lasers and Expand into Broader Markets. We intend to expand the use of fiber lasers into additional applications where lasers have not traditionally been used. We believe that the advantages of fiber laser technology can overcome many of the limitations that have hindered the adoption of conventional lasers in broader industrial markets and processes. Fiber lasers enable customers to complete tasks at lower cost, faster and more efficiently than non-laser tools. Using our manufacturing scale and technology innovations, we have been successful in reducing the cost of manufacturing with lasers, making fiber lasers a more attractive manufacturing alternative. We target applications where higher power, portability, efficiency, size and flexible fiber cable delivery can lead customers to adopt fiber lasers instead of non-laser solutions. For example, some of our fiber lasers are displacing traditional welding techniques used in shipbuilding, pipelines and spot welding used in automobile manufacturing. In addition, certain industry trends such as the use of high-strength steel in automotive manufacturing are driving the use of fiber lasers over other manufacturing methods such as stamping. We are working on developing new applications for fiber lasers through internal research and in partnership with industrial institutes and other strategic alliances.

Expand Our Product Portfolio. We plan to continue to invest in research and development to add additional wavelengths, power levels and other parameters while also improving beam quality, as well as developing new product lines and laser-based systems. Using our core processes, we plan to expand the wavelengths at which our lasers operate. This includes ultraviolet lasers that can be used for fine-processing applications and mid-infrared lasers that can be used for medical applications, non-metal materials processing and other novel applications. We are working to improve the output power of our green lasers for use in the semiconductor market. We will continue to focus on the development of specialized laser-based systems to meet the specific needs of manufacturing end users whose requirements are not met by standard systems or in certain geographic areas where fiber laser systems are not currently available. We are also improving the flexibility of existing products. For example, we have developed a 2 kW air-cooled laser for use in dry environments and an ultra-compact 1 kW fiber laser for use in applications requiring a small footprint.

Lower Our Costs Through Manufacturing Improvements and Innovation. We plan to seek further improvements in component manufacturing processes and device assembly as well as innovation in

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components and device designs to improve performance and decrease the overall cost per watt for our products. As we increase our volumes, we are better able to negotiate price reductions with certain of our suppliers. We intend to leverage our technology and operations expertise to manufacture additional components in order to reduce costs, ensure component quality and ensure supply. In 2011, we redesigned the electronics of certain low and mid-power products to simplify manufacturing, improve quality and decrease costs. We also decreased the cost of packaged diodes. In addition, we manufactured additional components that we had previously outsourced. These initiatives are intended to decrease costs and allow us to further penetrate the market while sustaining profit margins. By reducing the cost per watt of our lasers and maintaining the lower operating cost of our products, we believe that we can increase laser use in applications in which conventional lasers could not be used economically.

Expand Global Reach to Attract Customers Worldwide. Our customers' manufacturing operations have expanded in emerging markets and are moving to lower-cost international locations. We have increased and will continue to increase our international sales and service locations to respond to our customers' needs. In 2011, we opened new application development centers as well as sales and service offices in Russia, Asia and Spain. We plan to open a sales and service center in Turkey in 2012 and we are considering increasing our presence in additional countries with large manufacturing infrastructures.

Products

We design and manufacture a broad range of high-performance optical fiber-based lasers and amplifiers. We also make packaged diodes, direct diode laser systems, communications systems and materials processing laser systems that utilize our optical fiber-based products. Many of our products are designed to be used as general-purpose energy or light sources, making them useful in diverse applications and markets.

Our products are based on a common proprietary technology platform using many of the same core components, such as semiconductor diodes and specialty fibers, which we configure to our customers' specifications. Our engineers and scientists work closely with OEMs and end users to develop and customize our products for their needs. Because of our flexible and modular product architecture, we offer products in different configurations according to the desired application, including modules, rack-mounted units and tabletop units. Our engineers and other technical experts work directly with the customer in our application and development centers to develop and configure the optimal solution for each customer's manufacturing requirements. We also make complementary products and components that are used with our high-power products, such as fiber couplers, beam switches, optical beam delivery cables and chillers.

Lasers

Our laser products include low (1 to 99 watts), medium (100 to 999 watts) and high (1,000 watts and above) output power lasers from 0.5 to 2 microns in wavelength. These lasers either may be CW, QCW or pulsed. We offer several different types of lasers, which are defined by the type of gain medium they use. These are ytterbium, erbium, thulium and Raman. We also sell fiber pigtailed packaged diodes and fiber coupled direct diode laser systems that use semiconductor diodes rather than optical fibers as their gain medium. In addition, we offer high-energy pulsed lasers, multi-wavelength lasers, tunable lasers, single-polarization and single-frequency lasers, as well as other versions of our products.

We believe that we produce the highest-power solid-state lasers in the industry. Our ytterbium fiber lasers reach power levels up of to 50,000 watts. We also make single-mode output ytterbium fiber lasers with power levels of up to 10,000 watts and single-mode output erbium and thulium fiber lasers with power levels of up to 400 watts. Our compact, durable design and integrated fiber optic beam delivery allow us to offer versatile laser energy sources and simple laser integration for complex production processes without compromising quality, speed or power.

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We also sell laser diode chips and packaged laser diodes operating at 9XX nanometers. Recently, we started to sell our own family of high-power optical fiber delivery cables, fiber couplers, beam switches, chillers and other accessories for our fiber lasers.

IPG offers a retrofit service to replace CO₂ and YAG laser sources with fiber lasers in many welding, cutting, drilling and other systems, allowing customers to retain their existing laser systems. IPG also makes active and passive laser materials and tunable lasers in the middle-infrared region.

Amplifiers

Our amplifier products range from milliwatts to up to 1,500 watts of output power from 1 to 2 microns in wavelength. We offer erbium-doped fiber amplifiers, commonly called EDFAs, Raman amplifiers and integrated communications systems that incorporate our amplifiers. These products are predominantly deployed in broadband networks such as fiber to the home, or FTTH, fiber to the curb, or FTTC, and passive optical networks, or PON, and dense wavelength division multiplexing, or DWDM, networks. We also offer ytterbium and thulium specialty fiber amplifiers and broadband light sources that are used in advanced applications. In addition, we sell single-frequency, linearly polarized and polarization-maintaining versions of our amplifier products. As with our fiber lasers, our fiber amplifiers offer some of the highest output power levels and highest number of optical outputs in the industry. We believe our line of fiber amplifiers offers the best commercially available output power and performance.

Systems

Besides selling laser sources, we also offer integrated laser systems for particular geographic markets or custom-developed for a customer's manufacturing requirements. IPG makes a welding seam stepper and picker, which is an automated welding tool that integrates with our fiber lasers. The seam stepper and picker can be used in automotive assembly, sheet metal production and other materials processing applications. We also make laser marking and welding systems for certain applications and geographic markets. When requested by customers, we develop specialized laser systems for their unique applications.

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The following table lists our principal product lines that generated a substantial majority of our revenues in 2011, and the principal applications markets in which they are used:

| Product Line | Principal Markets | Principal Applications |
|---|--------------------------|-------------------------------|
| High-Power Ytterbium CW (1,000 – 20,000 Watts) | Automotive | Cutting |
| | Heavy Industry | Welding |
| | General Manufacturing | Annealing |
| | Natural Resources | Drilling |
| | | Cladding |
| Mid-Power Ytterbium CW (100 – 999 Watts) | General Manufacturing | Cutting |
| | Consumer | Welding |
| | Medical Devices | Scribing |
| | Printing | Engraving |
| | Microelectronics | Rapid prototyping |
| Pulsed Ytterbium (0.1 to 200 Watts) | General Manufacturing | Marking |
| | Semiconductor | Engraving |
| | Medical Devices | Scribing |
| | Consumer | Drilling |
| | Microelectronics | Coating removal |
| | Panel Displays | Cutting |
| Quasi-CW Ytterbium (100 – 900 Watts) | Medical Device | Welding and micro-welding |
| | Computer Components | Drilling |
| | Micro-Processing | Cutting |
| Erbium Amplifiers | Broadband Access | Telephony |
| | Cable TV | Video on demand |
| | DWDM | High-speed internet |
| | Instrumentation | Ultra-long-haul transmission |

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Scientific Research

Beam combining

Our products are used in a broad range of applications. The major application is materials processing, comprising approximately 88% of our sales in 2011. Our products also address other applications, including advanced applications (approximately 6% of sales), communications (approximately 4% of sales) and medical (approximately 2% of sales).

Our Markets

Materials Processing

The most significant materials processing applications for fiber lasers are cutting and welding, and marking and engraving. Other applications include micro-processing, surface treatment, drilling, soldering, annealing, hardening, rapid prototyping and laser-assisted machining.

Cutting and Welding Applications. Laser-based cutting technology has several advantages compared to alternative technologies. Laser cutting is fast, flexible and highly precise and can be used to cut complex contours on flat, tubular or three-dimensional materials. The laser source can be programmed to process many different kinds of materials such as steel, aluminum, brass, copper, glass, ceramic and plastic at various thicknesses. Laser cutting technology is a non-contact process that is easy to integrate into an automated production line and is not subject to wear of the cutting medium. We sell low, mid and high-power ytterbium

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fiber lasers for laser cutting. High electrical efficiency, low maintenance, operating wavelength, high beam quality, wide operating power range, power stability and small spot size are some of the qualities offered by fiber lasers for many cutting applications, which enable customers to cut a variety of materials faster.

Laser welding offers several important advantages compared to conventional welding technology as it is non-contact, easy to automate, provides high process speed and results in narrow-seamed, high-quality welds that generally require little or no post-processing machining. The high beam quality of our fiber lasers coupled with high CW power offer deep penetration welding as well as shallow conduction mode welding. In addition, fiber lasers can be focused to a small spot with extremely long focal lengths, enabling remote welding on the fly, a flexible method of three-dimensional welding in which the laser beam is positioned by a robot-guided scanner. Such remote welding stations equipped with fiber lasers are used for welding door panels and seat backs, the multiple welding of spot and lap welds over the entire auto body frame and welding body-in-white, which is welding pieces of metal with different thicknesses for automotive applications. Typically, mid to high-power ytterbium fiber lasers and long-pulse QCW ytterbium fiber lasers are used in welding applications. Our products are used also for laser brazing of visible joints in automobiles such as tailgates, roof joints and columns. Brazing is a method of connecting sheet metal.

Marking and Engraving. With the increasing need for source traceability, component identification and product tracking as a means of reducing product liability and preventing falsification, as well as the demand for modern robotic production systems, manufacturers increasingly demand marking systems capable of applying serialized alphanumeric, graphic or bar code identifications directly onto their manufactured components. Laser engraving is similar to marking but forms deeper grooves in the material. In contrast to conventional acid etching and ink-based technologies, lasers can mark a wide variety of metal and non-metal materials, such as ceramic, glass and plastic surfaces, at high speeds and without contact by changing the surface structure of the material or by engraving. Laser marking systems can be easily integrated into a customer's production process and do not subject the item being marked to mechanical stress. Our ytterbium pulsed fiber lasers are used for these applications.

In the semiconductor industry, lasers typically are used to mark wafers and integrated circuits. In the electronics industry, lasers typically are used to mark electrical components such as contactors, relays and printed circuit boards. Consumer electronic devices such as mobile phones, computers and handheld computers contain many parts that are laser-marked, including keyboards, logos and labels. With the increase in marking speed in the past few years, the cost of laser marking has decreased. In the photovoltaic or solar panel industry, pulsed lasers increasingly are used to remove materials and to scribe, or cut, solar cells. The high beam quality, increased peak output powers, flexible fiber delivery and competitive price of fiber lasers have accelerated the adoption of fiber lasers in these low-power applications.

Micro-Processing. The trend toward miniaturization in numerous industries such as consumer electronics, as well as innovations in materials and structures, is driving end users to utilize lasers in processing and fabrication. The ability of lasers to cut, weld, drill, ablate, etch and add materials on a fine scale is enabling new technologies and products across many industries. Our low-power CW and QCW lasers are used to cut medical stents and weld medical batteries. In photovoltaic manufacturing, our lasers etch and perform edge isolation processes. The aerospace industry requires precise manufacturing of engine parts so that cooling is effective and aerospace manufacturers use lasers to conduct percussive drilling. Our mid-power lasers are used in sintering, a laser-based three-dimensional prototyping method.

Advanced Applications

Our fiber lasers and amplifiers are utilized by commercial firms and by academic and government institutions worldwide for manufacturing of commercial systems and for research in advanced technologies and products. These markets may use specialty products developed by us or commercial versions of our products.

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Obstacle Warning and Mapping. Our products are used for obstacle warning and 3-dimensional mapping of earth surfaces.

Special Projects. Due to the high power, compactness, performance, portability, ruggedness and electrical efficiency of our fiber lasers and amplifiers, we sell our commercial products for government research and projects. These include materials testing, ordnance destruction, coherent beam combining, directed energy demonstrations, advanced communications and research.

Research and Development. Our products are used in a variety of applications for research and development by scientists and industrial researchers, including atom trapping. In addition, our lasers and amplifiers are used to design, test and characterize components and systems in a variety of markets and applications.

Optical Pumping and Harmonic Generation. Several types of our lasers are used to optically pump other solid-state lasers and for harmonic generation and parametric converters to support research in sensing, medical and other scientific research in the infrared and visible wavelength domains. Our lasers are used as a power source for these other lasers. Green visible lasers are used to pump titanium sapphire lasers. Visible lasers can be used in optical displays, planetariums and light shows.

Remote Sensing. Our products are used in light detection and ranging, also called LIDAR, a laser technique for remote sensing. Optical fiber can be used as a sensor for measuring changes in temperature, pressure and gas concentration in oil wells, atmospheric and pollution measurements and seismic exploration.

Communications

We design and manufacture a DWDM transport system with varying output power and wavelengths and a full range of fiber amplifiers and Raman pump lasers that enhance data transmission in broadband access and DWDM optical networks. We are leveraging our high-power diode and fiber technology through the qualification and sale of high-value integrated solutions for network suppliers.

DWDM. DWDM is a technology that expands the capacity of optical networks, allowing service providers to extend the life of existing fiber networks and reduce operating and capital costs by maximizing bandwidth capacity. We provide a broad range of high-power products for DWDM applications including EDFAs and Raman lasers. We provide a DWDM transport system that offers service providers and private network operators a simple, flexible, optical layer solution scalable from 8 to 40 channels that operates at 10 gigabits per second per channel. We also have introduced a DWDM system capable of wavelengths operating at 40 gigabits per second per channel with optical terminal network, or OTN, multiplexing capabilities.

Broadband Access. The delivery to subscribers of television programming and Internet-based information and communication services is converging, driven by advances in IP technology and by changes in the regulatory and competitive environment. Fiber optic lines offer connection speeds of up to 1 gigabit per second, or 100 times faster than digital subscriber lines, or DSL, or cable links. We offer a series of specialty multi-port EDFAs and cable TV nodes and transmitters that support different types of passive optical network architectures, enabling high-speed data, voice, video on demand and high-definition TV. We provide an EDFA that supports up to 64 ports, which allows service providers to support a high number of customers in a small space, reducing overall power consumption and network cost. End users for our products include communications network operators for video wavelength division multiplexing overlay solutions, operators of metro and long-haul networks for DWDM and amplification solutions, as well as cable and multiple system operators for optical amplification solutions.

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Medical

We sell our commercial fiber and diode lasers to OEMs that incorporate our products into their medical laser systems. CW erbium and thulium fiber lasers from 1 to 100 watts and diode laser systems can be used in various medical and biomedical applications. Aesthetic applications addressed by lasers include skin rejuvenation, skin resurfacing and stretch mark removal. Purchasers use our diode lasers in dental and skin tightening procedures. Surgical applications include prostate surgery. Fiber lasers have the ability to fine-tune optical penetration depth and absorption characteristics and can be used for ear, nose and throat, urology, gynecology and other surgical procedures.

Technology

Our products are based on our proprietary technology platform that we have developed and refined since our formation. The following technologies are key elements in our products.

Specialty Optical Fibers

We have extensive expertise in the disciplines and techniques that form the basis for the multi-clad active and passive optical fibers used in our products. Active optical fibers form the laser cavity or gain medium in which lasing or amplification of light occurs in our products. Passive optical fibers deliver the optical energy created in our products. Our active fibers consist of an inner core that is infused with the appropriate rare earth ion, such as ytterbium, erbium or thulium, and outer cores of un-doped glass having different indices of refraction. We believe that our large portfolio of specialty active and passive optical fibers has a number of advantages as compared to other commercially available optical fibers. These advantages include higher concentrations of rare earth ions, fibers that will not degrade at the high power levels over the useful life of the product, high lasing efficiency, ability to achieve single-mode outputs at high powers, ability to withstand high optical energies and temperatures and scalable side-pumping capability.

Semiconductor Diode Laser Processing and Packaging Technologies

Another key element of our technology platform is that we use multiple multi-mode, or broad area, single-emitter diodes rather than diode bars or stacks as a pump source. We believe that multi-mode single-emitter diodes are the most efficient and reliable pumping source presently available, surpassing diode bars and stacks in efficiency, brightness and reliability. Single-emitter diodes have substantially reduced cooling requirements and typically have estimated lifetimes of more than 100,000 hours at high operating currents, compared to typical lifetimes of up to 10,000 to 20,000 hours for diode bars.

We developed advanced molecular beam epitaxy techniques to grow alumina indium gallium arsenide wafers for our diodes. This method yields high-quality optoelectronic material for low-defect density and high uniformity of optoelectronic parameters. In addition, we have developed numerous proprietary wafer processes and testing and qualification procedures in order to create a high energy output in a reliable and high-power diode. We package our diodes in hermetically sealed pump modules in which the diodes are combined with an optical fiber output. Characteristics such as the ability of the package to dissipate heat produced by the diode and withstand vibration, shock, high temperature, humidity and other environmental conditions are critical to the reliability and efficiency of the products.

Specialty Components and Combining Techniques

We developed a wide range of advanced optical components that are capable of handling high optical power levels and contribute to the superior performance, efficiency and reliability of our products. In addition to fibers and diodes, our optical component portfolio includes fiber gratings, couplers, isolators and combiners. We also developed special methods and expertise in splicing fibers together with low optical energy loss and on-line loss

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testing. We believe that our internal development and manufacturing of key optical components allows us to lower our manufacturing costs and improve product performance.

Side Pumping of Fibers and Fiber Block Technologies

Our technology platform allows us to efficiently combine a large number of multi-mode single-emitter semiconductor diodes with our active optical fibers that are used in all of our products. A key element of this technology is that we pump our fiber lasers through the cladding surrounding the active core. We splice our specialty active optical fibers with other optical components and package them in a sealed box, which we call a fiber block. The fiber blocks are compact and eliminate the risk of contamination or misalignment due to mechanical vibrations and shocks as well as temperature or humidity variations. Our design is scalable and modular, permitting us to make products with high output power by coupling a large number of diodes with fiber blocks, which can be combined in parallel and serially.

High-Stress Testing

We employ high-stress techniques in testing components and final products that help increase reliability and accelerate product development. For example, we test all of our diodes with high current and temperatures to accelerate aging. We also have built a large database of diode test results that allows us to predict the estimated lifetime of our diodes. This testing allows us to eliminate defective diodes prior to further assembly and thus increase reliability.

Customers

We sell our products globally to OEMs, system integrators and end users in a wide range of diverse markets who have the in-house engineering capability to integrate our products into their own systems. We have thousands of customers worldwide. Our primary end market is materials processing, comprised of general manufacturing, automotive, heavy industry, natural resources, aerospace, consumer products and medical device manufacturing, photovoltaic semiconductor and electronics customers. We also sell our products to other end markets, including advanced applications (comprised of commercial companies, universities, research entities and government entities), communications (comprised of system integrators, utilities and municipalities) and medical (comprised of medical laser systems manufacturers and researchers). We believe that our customer and end-market diversification minimizes dependence on any single industry or group of customers.

The following table shows the allocation of our net sales (in thousands) among our principal markets:

| | Year Ended December 31, | | | | | |
|-----------------------|-------------------------|-------|------------|-------|------------|-------|
| | 2011 | | 2010 | | 2009 | |
| Materials Processing | \$ 419,443 | 88.4% | \$ 252,014 | 84.2% | \$ 140,864 | 75.8% |
| Advanced Applications | 25,918 | 5.5% | 25,196 | 8.4% | 26,557 | 14.3% |
| Communications | 20,368 | 4.3% | | | | |