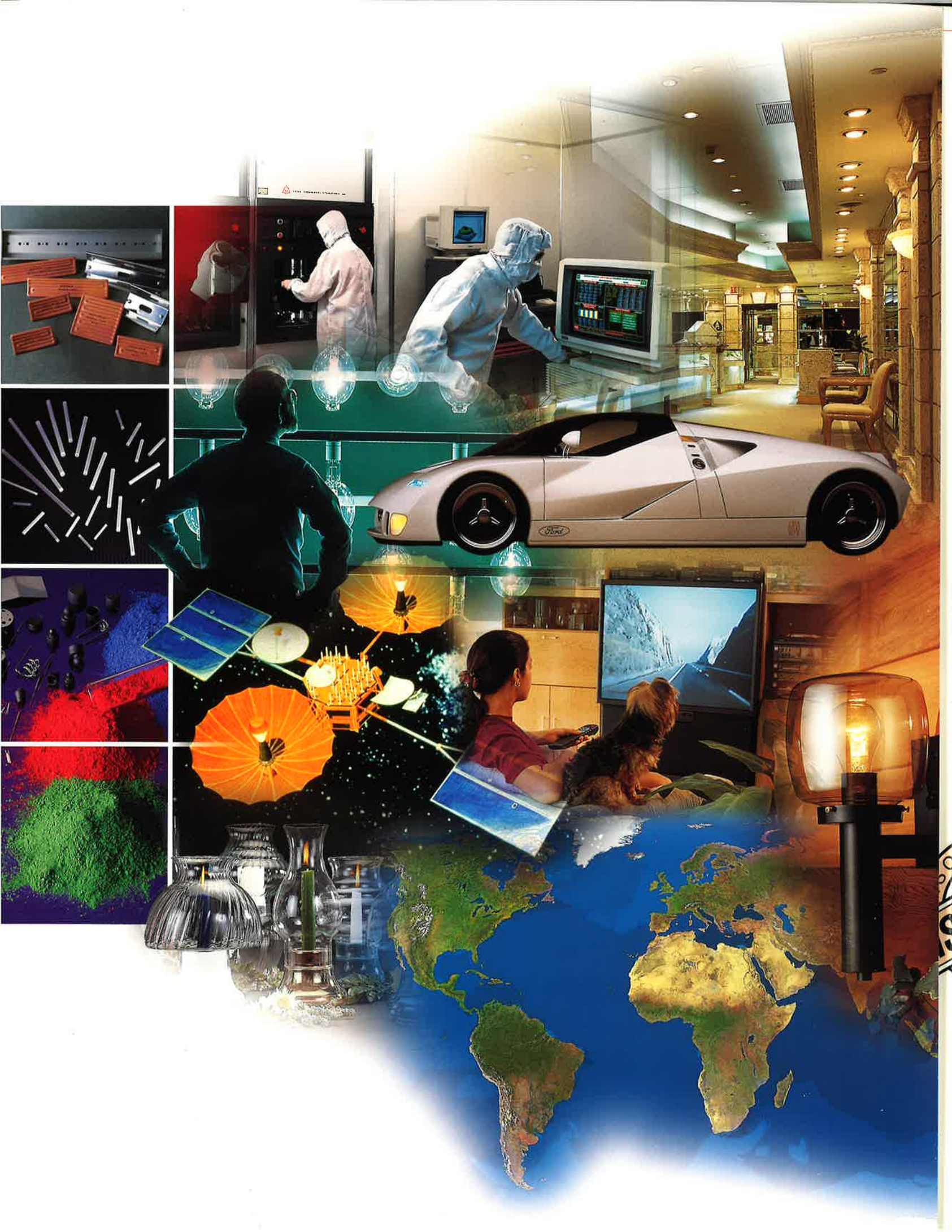
Precision Materials & Components

OSRAM SYLVANIA



We are committed to being the worldwide source for advanced materials technology and precision engineered components.

Our customers entrust us to help them create leading-edge products of world-class excellence.

We will deliver their expectations.

Advancing the World with Precision Materials & Components

A century of exacting research, development, and manufacturing

Early in the twentieth century, when electric light bulbs had their beginnings, the company known today as OSRAM SYLVANIA started in Middleton, Massachusetts. From 3,000 incandescent lamps a day in 1911, to the present 13,000 person organization with 22 manufacturing plants, nine research and development labs and a worldwide network of sales and distribution centers, OSRAM SYLVANIA is the North American subsidiary of OSRAM GmbH, one of the leading lamp manufacturers in the world and a part of the Siemens family of companies.

The organization is divided into five principal units — General Lighting, Precision Materials & Components, Automotive Lighting, Electronic Control Systems, and OSRAM SYLVANIA LTD./LTÉE in Canada.

Lighting is a primary focus of OSRAM SYLVANIA as a whole, and Precision Materials & Components (PMC) supplies the lighting industry's needs for parts, assemblies, and basic materials.

OSRAM plant, 1890
Berlin, Germany

Beyond lighting, PMC concentrates on supplying the needs of the CRT industry; developing and manufacturing connectors for the auto industry; and producing tungsten, molybdenum and other exotic chemicals for a wide variety of industrial uses. From these core focuses, various capabilities emerge to serve myriad businesses.

Sylvania plant, 1901
Middleton, Massachusetts

Reg U.S. Pat. Off.

Product display for an early advertisement

Glass worker

Commitment to customer satisfaction

Today, headquartered in Danvers, Massachusetts, Precision Materials & Components encompasses three divisions: Chemical & Metallurgical Products, Electronic Components & Materials, and Glass Technologies. Each is dedicated to providing their diverse customers innovative products, processes, and materials which help them compete in an intensifying world economy.

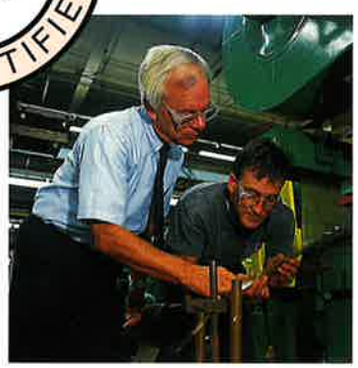
High Quality
Each manufacturing facility at PMC is ISO certified, assuring customers a standard of excellence understood worldwide. Pervasive programs such as Total Quality Management, Advanced Quality Planning, Statistical Quality Control, Supplier/Customer Partnerships and benchmarking, help us deliver the highest quality products, systems, and materials available in the world today.

Quick Response
Our commitment to customer satisfaction is centered on world class Total Cycle Time™ management. Our goal is to have the fastest cycle time from customer inquiry to product delivery.

Cost Effective
At PMC, we strive to be the low cost producer by constantly advancing our own processes and productivity to provide our customers with the highest value in products and services within each industry.

Ongoing Innovation
Each division has dedicated research laboratories applying the creative impulse to disciplines as diverse as high temperature metallurgy and powder technology to quantum physics. In Towanda, Pennsylvania, for example, we have over twenty scientists dedicated just to the development of luminescent materials. Our research is proactive, discovering solutions often before problems materialize.

Headquarters of OSRAM SYLVANIA, Danvers, Massachusetts USA




SYLVANIA

Lighting Products

Vertical manufacturing to assure precision excellence

Precision Materials & Components prides itself on innovating new processes and elements to make lighting products into leading edge consumer and industrial products. Our close relationship as a major supplier to many lighting manufacturers worldwide keeps PMC in a technology leadership position throughout the world.

Glass

The Glass Technologies division has developed state-of-the-art, high-speed, low variance, glass production equipment with vision systems to perform quality inspections on 100% of the product. Our production and automated packaging equipment reduces the cost and ensures consistent quality. Environmentally "friendly" glass is also a priority.

Phosphors

The Chemical & Metallurgical division is developing new technologies to reduce the phosphor coating required to achieve high lumen output and color quality. Lowering the cost of coating to the lamp manufacturer helps create cost efficient lamps while conserving precious resources.

Filaments

From the processing of tungsten ore, to the finished coil products, we offer over 40 years of filament engineering and manufacturing to meet specific needs of every lamp manufacturer. Our engineers utilize customized software to optimize coil designs based on the input of operating conditions, fill gases and other lamp components.

Quartz and Alumina Tubing

A wide range of quartz products are produced to meet the performance requirements of Metal Halide, Mercury, Halogen, and UV lamp technologies. In addition, we have the latest technology in ceramics, producing Polycrystalline Alumina (PCA) for High Pressure Sodium (HPS) arc tubes and lamps.

Bases

Since 1955 the Electronic Components & Materials division has supplied a wide array of bases for incandescent, fluorescent, HID, and halogen lamps. Utilizing SPC and fully automated "hands-off" manufacturing, we provide world-class quality and cost competitiveness. Additionally, our emphasis on product designs which require less solder helps to protect the environment.

Leadwires

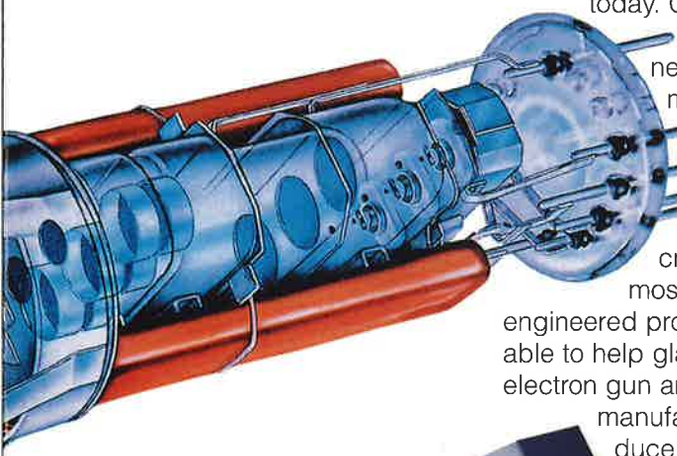
We offer a full range of one-, two-, and three-piece leads for lighting, CRT, and industrial applications. Through our in-house prototyping and equipment development facilities, we are able to work in partnership with our customers to meet the ever-increasing demands of the global marketplace for high quality, low cost, and innovative products.

Bringing Your Vision to Light

OSRAM SYLVANIA offers its broad range of technical expertise, combined with a material-to-manufacture quality program, to lighting manufacturers throughout the world to bring your own vision of quality products to light.

CRT Products

Unwavering commitment to the television industry for over forty years

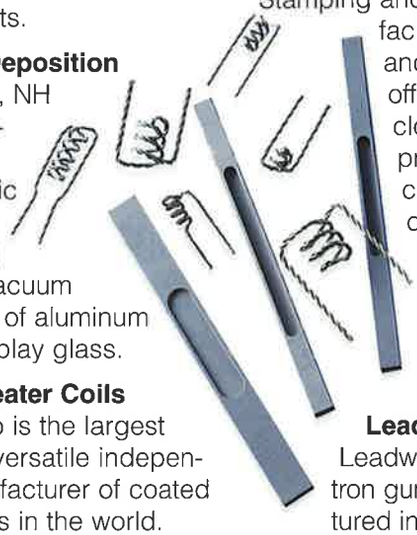


CRT devices have been around since the 1930s, gradually evolving into the sophisticated information processors of the late twentieth century. As a worldwide supplier to display manufacturers, OSRAM SYLVANIA provides some of the most highly evolved components on the market today. Continually researching new design and manufacturing methods, OSRAM SYLVANIA creates the most reliably engineered products available to help glass, tube, electron gun and display manufacturers introduce the most advanced products to market.

Phosphors
The Chemical & Metallurgical Products division develops and produces chemicals and phosphors for use in CRT displays. Over twenty scientists in the Towanda facility are dedicated to discovering and perfecting new and improved luminescent materials. These research and development efforts traditionally have targeted CRT phosphors, and have now been expanded also to address the unique requirements of flat panel display technologies. Phosphor testing capabilities include an in-house screening room, which provides us an exceptional ability to meet individual customer needs.

Wire
Also produced in Towanda, PA are tungsten and tungsten alloy wire, used by other Precision Materials & Components facilities to create CRT components.

Vacuum Deposition
The Exeter, NH facility produces Intermetallic Boats and Metallizing Coils for vacuum deposition of aluminum film on display glass.



Coated Heater Coils
Exeter also is the largest and most versatile independent manufacturer of coated heater coils in the world.

Face Panel Stud Pins and Anode Buttons
Electronic Components & Materials in York, PA produces a range of precision metal components for the CRT. More than forty different hollow, solid and hybrid configurations of Face Panel Stud Pins are manufactured to provide mechanical support of the shadow mask. Over twenty different configurations of Anode Buttons, which serve as a high voltage current path through the glass, are manufactured for both color and monochrome tubes.

Custom Metal Components
Stamping and deep drawn facilities in York, PA and Watertown, CT offer high volume, close tolerance production of custom metal components such as electron gun components, and suspension spring clips.

Leadwires
Leadwires, in the electron gun, are manufactured in Bangor, ME using a custom produced dumet wire. The brazed dumet wire enhances the copper-to-nickel iron core bond, providing excellent glass-to-metal seal properties.

From manufacturer's concept through on-line production, OSRAM SYLVANIA provides the technology needed to produce state-of-the-art displays for the television, computer, and instrumentation industries.

Automotive Interconnect Products

Custom interconnect systems from concept to completion

OSRAM SYLVANIA, through its Electronic Components & Materials (EC&M) division has committed significant resources to the highly competitive automotive industry. Creative solutions to complicated electronic interconnect designs are conceived, designed and manufactured with world-class timing and uncompromising quality.

New Product Development
OSRAM SYLVANIA utilizes dedicated cross-functional teams for the design and development of new products. This approach results in the on-time delivery of quality products, which meet or exceed our customer's expectations. In addition to our fully equipped laboratories, exceptional testing facilities and versatile CAD/CAM systems, these teams utilize tools such as rapid prototyping, APQP, FMEA's and FEA's to assure the integrity and design intent of each new interconnect system.

Worldwide Resources
Along with our in-house capabilities and corporate R&D facilities, OSRAM SYLVANIA works in close alliance with other Siemens organizations to provide automotive customers with "systems solutions" to their automotive electronics needs as well as global manufacturing, technical and sales support.

Unparalleled Quality
In addition to ISO certification, each of EC&M's facilities, which manufacture components for the automotive industry, are QS9000 registered to assure world-class adherence to quality.

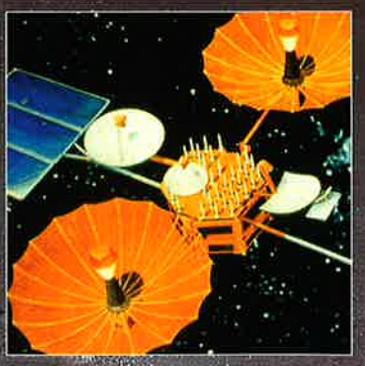
Vertically Integrated Capabilities
From on-site applications engineering support to the utilization of state-of-the-art manufacturing processes, EC&M maintains all required capabilities to deliver advanced interconnect products. Our capabilities include injection molding, insert molding, precious and non-precious metal plating, metal stamping, deep drawn metal fabrication, wire drawing, and high speed automated assembly with on-line testing.

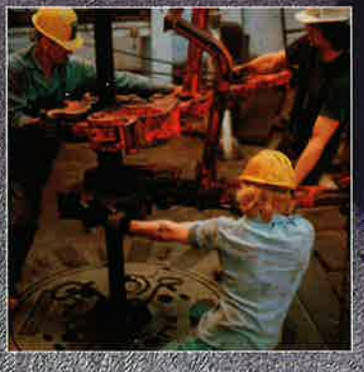
Automotive Electronics Applications
OSRAM SYLVANIA produces a wide array of custom and standardized interconnect products for numerous electronics applications including the following:

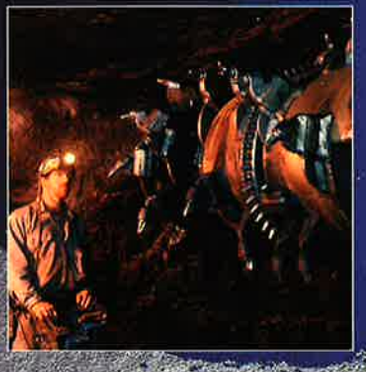
* Airbag systems
* Anti-lock braking systems
* Electronic engine control
* Traction control
* Speed control
* Mass air flow
* Proportional steering
* Power distribution
* Sensors housing centers
* Ignition systems
* Antenna connection systems
* Audio systems
* Lighting

Each interconnect system takes a customer's specifications and forms them into fully tested, cost effective and highly reliable products.

Molybdenum alloy powder







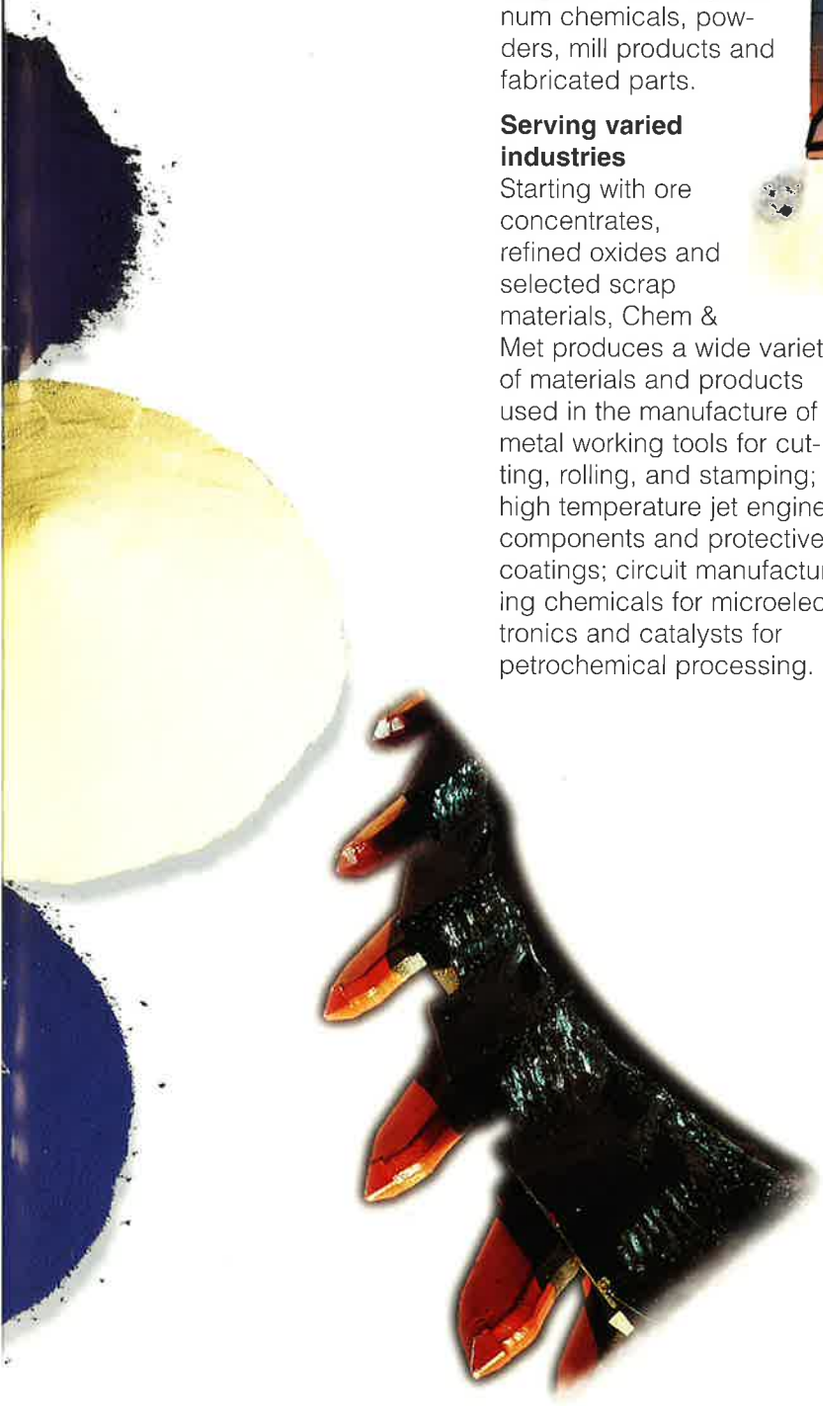
Tungsten & Molybdenum Products

Leading the world in high tech materials science

OSRAM SYLVANIA is a world-recognized leader in powder technology, high-temperature metallurgy, and inorganic chemistry. The Chemical & Metallurgical Products division (Chem & Met) in Towanda, PA is a leading producer of tungsten and molybdenum chemicals, powders, mill products and fabricated parts.

Serving varied industries

Starting with ore concentrates, refined oxides and selected scrap materials, Chem & Met produces a wide variety of materials and products used in the manufacture of metal working tools for cutting, rolling, and stamping; high temperature jet engine components and protective coatings; circuit manufacturing chemicals for microelectronics and catalysts for petrochemical processing.



Refractory metals

Refractory metal products are used by various materials processing industries. Tungsten carbide powder and ready-to-use tungsten carbide grade mix are major products of the refractory metals product line. Both products are custom designed and manufactured to meet the specialized requirements of individual manufacturers of cemented tungsten carbide products, including cutting tools for the metalworking industry, wear-resistant components, and tooling for manufacturing soda cans.

Refractory Chemicals

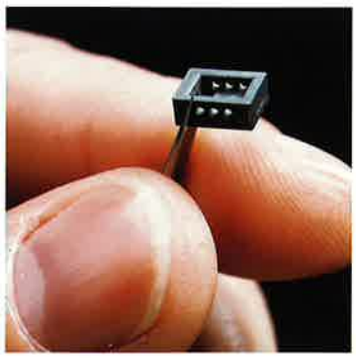
OSRAM SYLVANIA is the world's largest supplier of ammonium paratungstate, which is the key feed chemical for all downstream tungsten products. Ammonium metatungstate is used as a catalyst in refining oil. One of the many uses of tungsten oxide is in the production of glass opacifiers that block out sunlight.

Wire Products

Chem & Met is a leading world supplier of non-sag tungsten wire used in the lighting industry and of redraw wire for sale to fine wire producers. Tungsten welding electrodes, used in tungsten inert gas (TIG) welding, are sold under branded and private labels. Tungsten and molybdenum custom parts are formed for use in business machines, power tubes, electrostatic precipitators and other electrical/electronic equipment. Other molybdenum products include spray wire for the hardfacing of automotive piston rings and gold-plated molybdenum wire for telecommunication satellites.

Technological Innovations

Chem & Met is noted most for its advancement of the state-of-the-art. For example, Towanda has created Tungstar™, a pre-infiltrated powder that enables the powder metallurgy processing of tungsten-copper components to near-net shape. Wolftrax™, a specialty tungsten powder, provides producers of electronic packages (for high-end computer chips) an advantage — a high level of control over the flatness of their product and its electrical characteristics. New processes, such as spheroidization, whereby an irregular shaped powder is converted into a perfect sphere, demonstrate OSRAM SYLVANIA's continual push for technological innovations.



Injection molded microelectronic tungsten copper power package

Advanced Materials Technology Serving Industry

Glass Making
Glass Technologies primarily supplies the diverse needs of the worldwide lighting industry. State-of-the-art research and manufacturing at three separate facilities has made OSRAM SYLVANIA a leading producer of the finest quality glass for other products besides lighting such as Christmas tree ornaments, residential giftware, fuse bodies, thermometers, and myriad other applications. Glass Technologies manufactures three types of glass: soda lime, lead-silicate, and borosilicate. Each product is carefully monitored to satisfy stringent quality control requirements and provide the highest yield in customer processes.

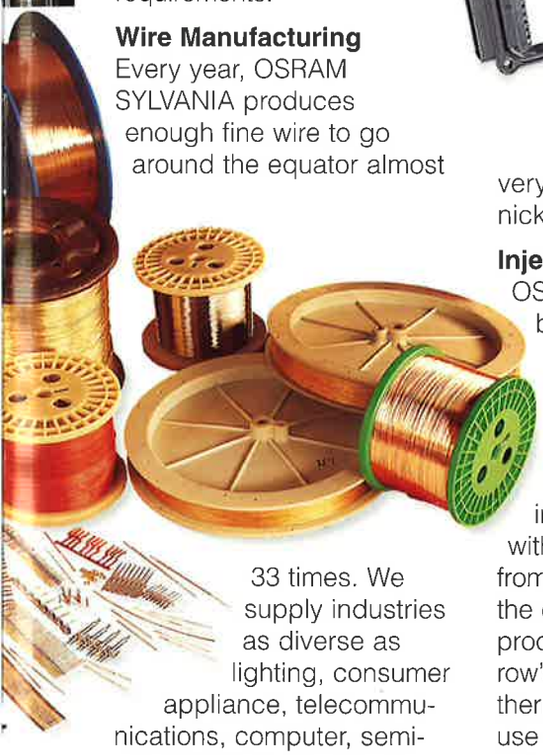
Quartz Tubing
OSRAM SYLVANIA has been manufacturing fused quartz products for over 30 years and controls quality through every step of the unique, vertically integrated process. Our semiconductor grades of fused quartz tubing are recognized by major semiconductor manufacturers throughout the world for their consistent high chemical purity and high-temperature resistance. Lighting quartz tubing grades are widely used in high-temperature arc and filament lamps for long life at high operating temperatures. OSRAM SYLVANIA maintains extensive stocks of fused quartz tubing in regional warehouses throughout the world to serve its customers' demands for quality, reliability and support of their developmental efforts.

Engineered Ceramics
From Polycrystalline Alumina (PCA) for the lighting industry to intermetallic evaporation boats used in the metallization process, OSRAM SYLVANIA has long been an industry leader in the development of

engineered ceramics. Supported by worldwide research, we help improve customers' processes with analysis of finished product, qualifying raw materials with such resources as scanning electron microscopes, atomic absorption, elemental analysis, x-ray diffraction, and other advanced techniques. Our ceramic products are made to withstand high temperature and stress and can be manufactured to accommodate the most demanding customer requirements.

Wire Manufacturing

Every year, OSRAM SYLVANIA produces enough fine wire to go around the equator almost



33 times. We supply industries as diverse as lighting, consumer appliance, telecommunications, computer, semiconductor, music, automotive and CRT with alloy, plated, and clad wire, as well as plated contacts and strip. Using both ferrous and non-ferrous alloys, we can draw extra fine wire. Our comprehensive plating facilities are a natural extension of our vast wire drawing capability. Finishes for plated wire include gold, nickel, solder, and copper. The thickness of the plating that can be deposited on base material ranges from a "flash" in gold plating applications to a

very heavy deposit on nickel plated products.

Injection Moldings

OSRAM SYLVANIA offers both injection and insert molding capabilities. With over 50 molding presses with press clamp ranges from 75 to 400 tons and over 26 insert molding systems with press clamp ranges from 30 to 200 tons, we have the expertise required to process today's and tomorrow's engineering grade thermoplastics. Through the use of computer process controls, fully automated systems, and robotics parts handling equipment, we manufacture for the automotive and lighting industries.

Metal Stampings

OSRAM SYLVANIA custom designs and manufactures precision metal stampings from both deep drawn and stamping processes. Working in metals as diverse as stainless steel, nickel alloys, brass, aluminum and beryllium copper, we design and produce high volume precision components for industries as varied as the military, automotive, lighting, television, electronics and health care. Tolerances as close as +.0002" (.005mm) are routinely dealt with, and technical expertise in areas such as flatness, burst pressure control and coining are supported by a fully integrated CAD/CAM system. Unique shapes can be provided by coining, thread rolling, reverse drawing, shearing and knurling.

High Temperature Heating Products and Related Components

OSRAM SYLVANIA has been in the forefront of the heating industry for over 25 years. Combining varied expertise in manufacturing, development, and application engineering, OSRAM SYLVANIA is the leader in the air heater, infrared heater, and lampholder industries. We manufacture heaters capable of producing hot air or inert gas up to temperatures of 2273°F (1245°C). Thanks to our extensive development and test center, custom designing and manufacturing for tomorrow's engineering heating needs are possible today. We manufacture for various industries including packaging, printing, plastics, semiconductor, electronics, rubber, automotive, medical, and pharmaceutical.

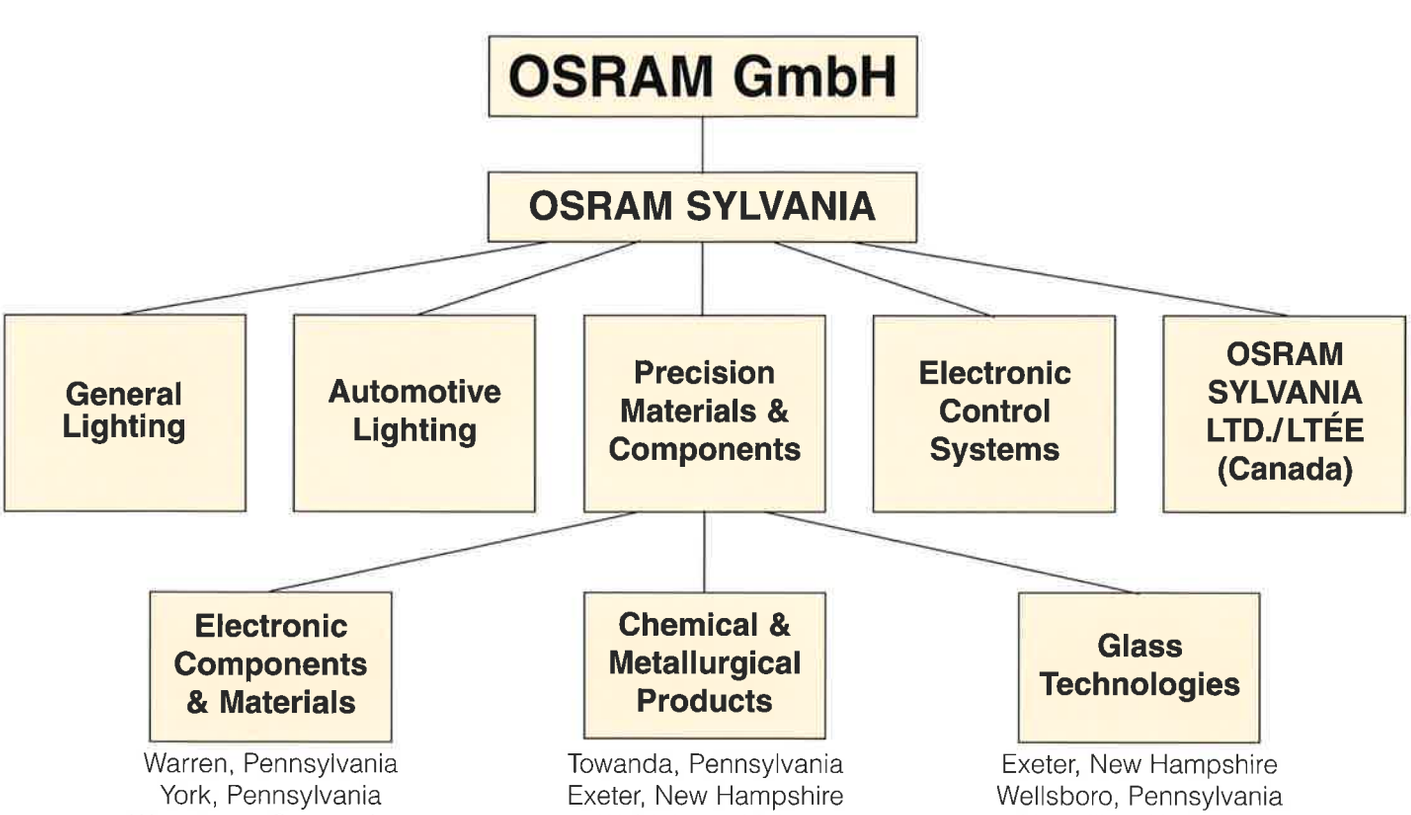
Precision Materials & Components
Advancing the World

Customer contact at all levels

The PMC commitment to world class excellence extends far beyond high volume production and material diversity. An individualized customer approach yields the necessary market sensitivity required in today's rapidly changing environment and equips our worldwide customers for tomorrow's technological challenges. From custom research and development through manufacturing and delivery, let us help you create leading-edge products. We will deliver your expectations.

We welcome you to contact us and put our team to work for you.

The OSRAM SYLVANIA Business Organization



PMC Manufacturing Locations and Products

Connecticut

Watertown	Metal formed parts, custom deep-drawn metal stampings

Kentucky

Versailles	Glass products for lighting applications

Maine

Bangor	Precision welded and bonded components
Waldoboro	Tungsten filaments used in lamps

New Hampshire

Exeter	Polycrystalline alumina products, process heaters, coated coils, intermetallic boats, fused quartz tubing

Pennsylvania

Towanda	Molybdenum and tungsten chemicals, rod, wire and fabricated parts; phosphors; powders
Warren	Electroplated components; connectors; insert/injection-molded components; custom metal stampings; alloy, clad, plated and glass sealing wire
Wellsboro	Glass products for lighting applications and glass shells for Christmas ornaments
York	Metal lamp bases, and formed metal components for the lighting industry; custom metal stampings; connector products

Rhode Island

Central Falls	Glass products for lighting applications and for residential and giftware applications

Puerto Rico

Gurabo	Lighting components and connector products
Luquillo	Wire products, filament coils

OSRAM SYLVANIA

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BACKGROUND INFORMATION

TOWANDA, PA — Chemical & Metallurgical Products is a leader in powder technology, high-temperature metallurgy, and inorganic chemistry. It is one of the world's foremost producers of tungsten and molybdenum chemicals and products as well as phosphors. The operation is organized into three product lines — refractory metal powders, wire products, and phosphors.

Since its creation in 1941, Chemical & Metallurgical Products has been a major innovator and supplier of advanced materials and precision parts used in the following: manufacture of lighting and television products, industrial tools, components for technology-based industries. The division's expertise covers the periodic table, and its reputation spans the globe.

The Towanda facility has one of the most complex operations in the country with three plants located on 65 acres. An on-site research and development group of more than 80 scientists, engineers, and technicians is responsible for new product development, advanced technical support, and analytical services.

Division Milestones

- Produces high-quality materials and products for high technology industries in more than 50 countries on six continents.
- Produces the world's widest variety of tungsten and molybdenum materials and products.
- Produces the world's widest variety of inorganic phosphors and related chemicals.
- Produces enough fine wire annually to go around the equator almost 33 times.
- Developed patented methods for the production of many high-purity materials and products.
- Achieved ISO9001 certification for all manufacturing sites.
- MRPII Class A certified.

Telephone (717) 268-5000
Fax (717) 268-5178
Hawes Street
Towanda, PA 18848-0504

Research and Development Efforts

The Chemical & Metallurgical Products' R&D group employs scientists, engineers, and technicians to advance the division's position in materials science and technology. Research and development activities in high-temperature metallurgy and inorganic chemistry focus on the division's core businesses and on emerging technologies. These include: extraction, synthesis, purification, analysis of various metallurgical and luminescent materials, compaction, sintering, thermo-mechanical metalworking, plasma processing, and testing of refractory metals and alloys.

Chemical & Metallurgical Products' scientists present their research findings to various symposiums and conferences around the world. Our technical staff have received hundreds of domestic and international patents. The Chemical and Metallurgical Patent Hall of Fame has fourteen members, each of whom has at least 25 patents.

Operations

Chemical & Metallurgical Products is based in Towanda, Pennsylvania and has operations in Luquillo, Puerto Rico.

For More Information

Information and requests should be directed to:

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Fax: (610) 725-8939

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Fax: (412) 836-0857

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Fax: (719) 528-8446

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Telephone: (714) 963-7582
Fax: (714) 964-3560

Emissive Products/Fused Quartz
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Fax: (603) 772-1072

Coil Operations
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OSRAM SYLVANIA

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