GTE Products Corporation

Chemical and Metallurgical Division

Phosphors and Chemicals

SYLVANIA GTE

Chemicals/Metals

Phosphors, Photoconductors, and Chemicals

Introduction

The Chemical and Metallurgical Division of GTE Products Corporation produces more inorganic phosphors and related high-technology materials than any other company in the world. Annual production from the Division's modern phosphor plants, headquartered in Towanda, PA, ranges from a few grams of a special formulation for a critical electronics application to hundreds of kilograms of rare-earth phosphors for color TV picture tubes to thousands of tonnes of calcium halophosphate for fluorescent lamps. Wherever you are we can fill your needs in a timely manner either to your specifications or to ours.

In addition, GTE research facilities and personnel are available to assist you in developing new formulations for special applications. GTE scientists and technicians conduct both basic and applied chemical research for process and product development. An analysis group supports R&D and manufacturing with complete materials characterization using a comprehensive range of modern instrumentation in one of the best equipped materials analysis facilities. Our highly skilled staff produces new phosphors, improves existing ones and devises new manufacturing techniques in our plants to lower costs and to increase production and productivity.

For TV picture tubes and CRT data displays, radar screens and oscilliscopes, fluorescent and mercury-vapor lamps, identification and tagging applications, photoconductors, photocopy lamps and black light applications, sign tubes, x-ray intensifying screens, electroluminescent devices, whatever your application, GTE supplies formulations to meet your specific requirements.

All are rigidly inspected to assure optimum particle size, purity, coating characteristics, brightness and uniformity of color. All fluorescent lamp colors specified by the U.S. National Bureau of Standards are available, and special colors can be created to customer specifications. Phosphors for tracing pollutants in air and water are available.

Numerous examples of how GTE phosphors, photoconductors, and chemicals are used worldwide in a variety of high-technology industries are described on subsequent pages. And there are many more, both today and in the future—limited only by our imagination and expertise and by our understanding of your needs and those of your customers.

For more information, or for specific product data sheets lisiting compositions of the more than 200 phosphors, chemicals and photoconductors produced by GTE, contact the nearest sales office listed on page 21.

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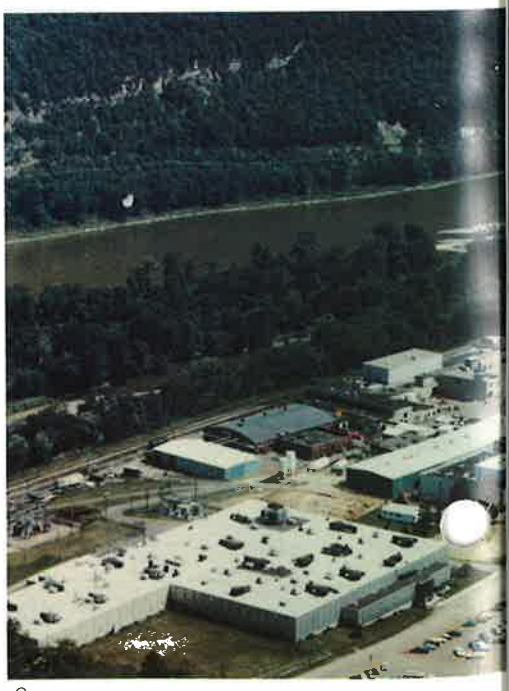

2.

1) Photoconductive materials developed and manufactured in Towanda for office copiers are routinely tested to ensure quality.
2) GTE Chemical and Metallurgical Division headquarters and manufacturing facilities at Towanda, PA.
3) Lab facilities are used to solve customer problems and to develop new products.
4) Research at Towanda has led to many new and modified luminescent materials.

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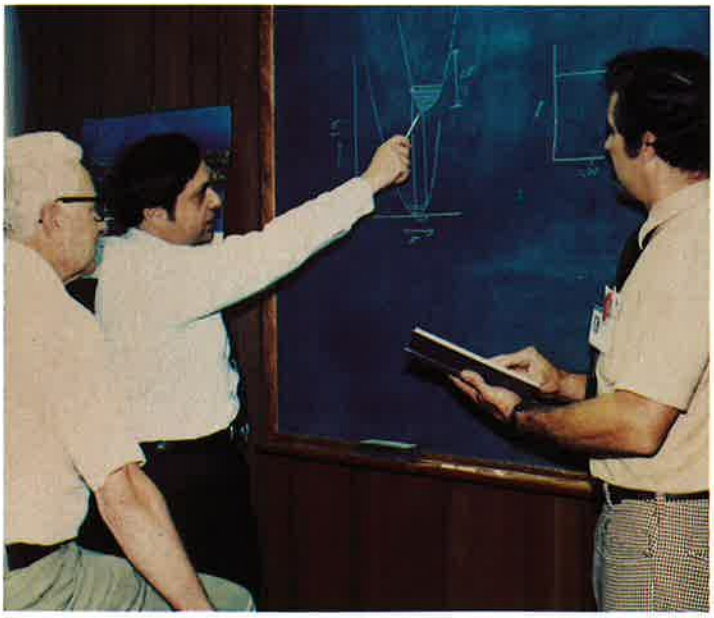

4.

Contents

Phosphor Production

Cleanliness and the ability to maintain the purity of the ingredients are the critical quality control elements which permit GTE to produce phosphors for a variety of end uses. Volume production is accomplished on automatic equipment designed at Towanda. During all manufacturing operations, from chemical purification, to precipitation, filtering and drying of pure raw materials, through blending of components, firing, crushing, dry blending and sieving–control of particle size, purity, coating characteristics, brightness and color are all rigidly maintained. This attention to the details of quality control, whether for large quantity production or small quantity special purpose phosphors, results in optimum luminescent properties.

Above: High purity chemicals for the manufacture of phosphors are engineered in a pilot facility at GTE.

Right: Phosphors are manufactured with automated equipment.

1.

1) Phosphors are automatically packaged to maintain purity.
2) Custom phosphors often require special handling.
3) Raw materials are precipitated and purified in large reactors.
4) GTE phosphors are formulated with the aid of computers.

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TV Phosphors

Red: GTE pioneered the development of rare-earth color TV phosphors with the introduction in 1964 of europium-activated yttrium orthovanadate which created a brighter and more saturated red. Since that time, other red phosphors have been developed including rare earth oxide and oxysulfide systems typically activated with europium. These phosphors are also available in a pigmented mode for improved contrast.

Green: For conventional color television, several zinc (cadmium-free) and zinc-cadmium-sulfide based green-emitting phosphors are available. These are typically activated by elements such as copper, silver, gold, alumimum and chlorine. For projection television, other green-emitting phosphors have been developed. These include terbium-activated rare earth oxysulfides, manganese-activated zinc orthosilicate, and europium-activated strontium thiogallate.

Blue: The blue phosphor used in color television is silver-activated zinc sulfide. GTE supplies this phosphor tailored to meet customer specifications.

Black & White: GTE supplies black and white TV phosphors in the form of blends or components to customer specifications. These consist of zinc sulfide or zinc cadmium sulfide phosphor systems activated by elements such as copper, silver, gold, aluminum or chlorine.

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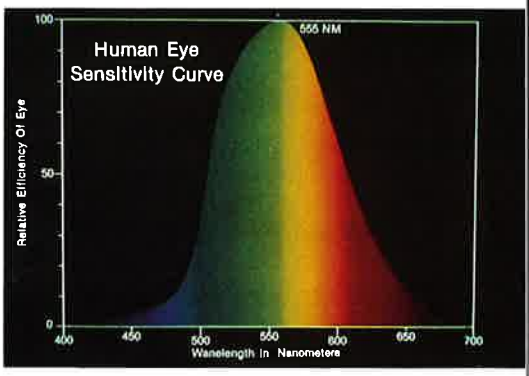

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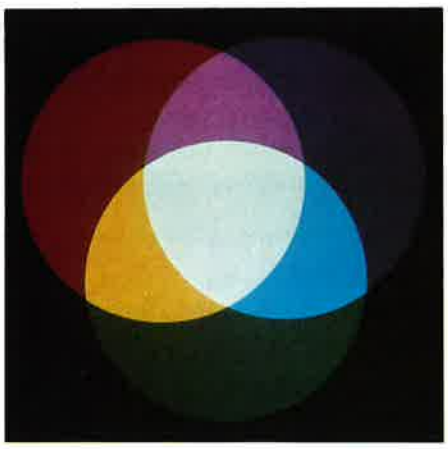
1) GTE is a major supplier of color TV phosphors.
2) Monitor tubes are used in TV program production.
3) Games and other forms of video entertainment are expanding the market for cathode-ray phosphors.
4) TV phosphors are designed to accommodate the color sensitivity of the human eye.
5) Luminescent characteristics of CRT phosphors are routinely measured and evaluated.

Data Display Phosphors

GTE produces a wide range of phosphors for data-display cathode-ray tubes. These CRT phosphors are manufactured to meet the stringent color, decay, resolution, bightness and contrast requirements of the industry.

Special blends are available to obtain white and yellow with long persistence. For improved tube contrast, phosphors are available pigmented or dark-body colored.

CRT applications represent one of the most significant areas of growth for the use of phosphors and GTE has assisted numerous companies in the entertainment, defense, communications, transportation and office product industries in improving existing products and developing new ones.



Colors in CRT tubes are obtained by mixing primary blue, red and green.

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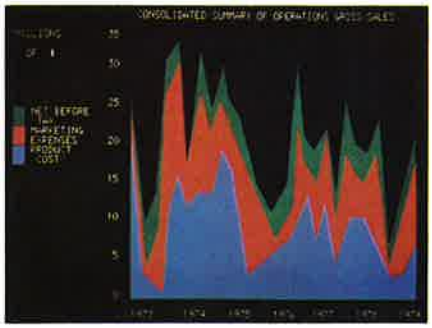
1) *CRT data displays are important additions to the modern office.
2) The volume and efficiency of business communications are increased with data-display equipment.
3) *Color phosphors dramatize and simplify information display.
4) GTE phosphors are used in CRT displays for air-traffic control.
5) Information displays are used in science and technology.



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*Reprinted by permission from "IBM's Color Display—The Perceptible Advantages." G520-3471-0. ©1979 by International Business Machines Corporation.

Fluorescent Lamp Phosphors

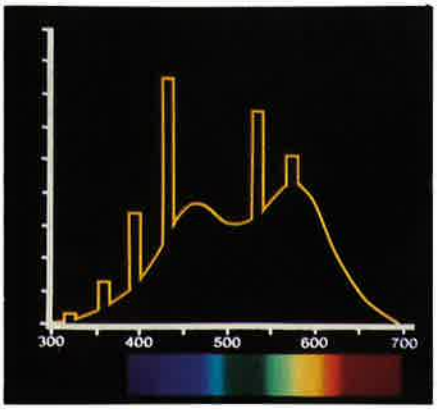
From phosphors for black light to phosphors for lamps for healthy indoor plants to energy efficient phosphors for general lighting, GTE produces the industry's widest selection and largest volume of lamp phosphors. Current emphasis is on energy-saving lamp technology with phosphors which produce a higher radiant and luminous output in relation to power consumption. Improved color rendition through lamps that deliver more natural-looking light without distortion is another characteristic of GTE phosphors.

Trends toward higher lamp efficiency and the removal of cadmium from the basic halophosphate system are being met by new phosphor developments and existing phosphor modifications.

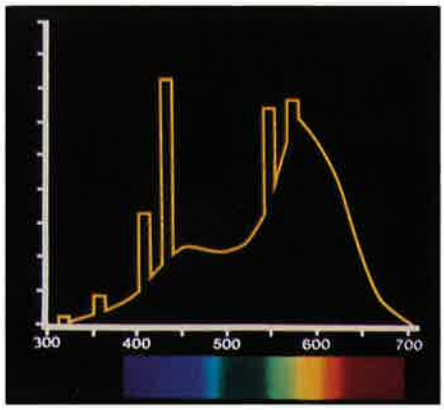
From basic raw materials through phosphor synthesis, critical quality control and the high capacity of GTE plants assure uniformity in lamp phosphor production and provide batch-to-batch matches.

Above: Phosphor research and developement continues to increase the energy efficiency of fluorescent lamps.

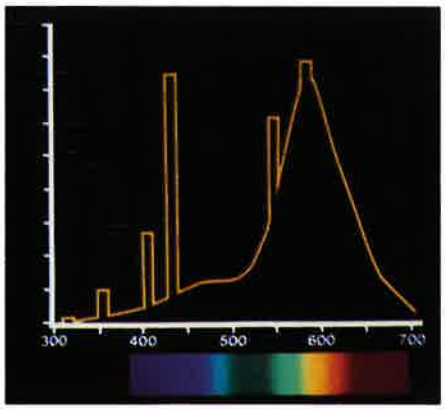
Right: Phosphors are used in lamps for commercial plant growth.



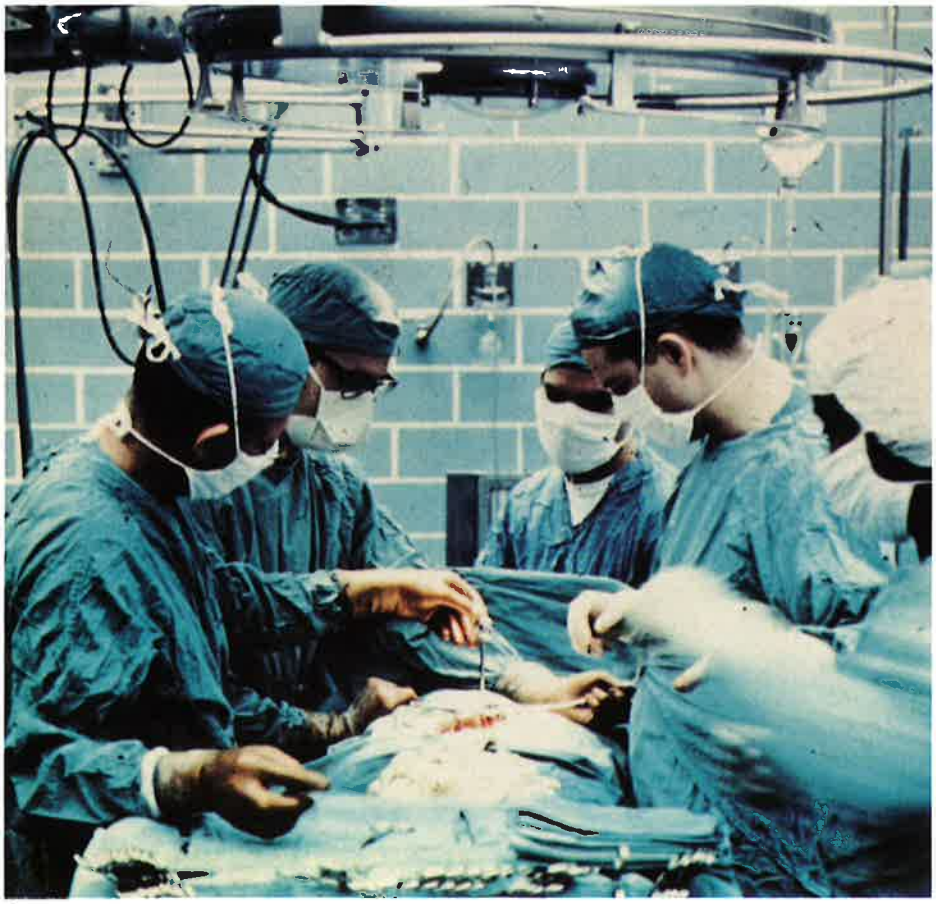
Daylight



Cool White



Warm White



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1) Phosphors in surgical lamps enhance color contrast.
2) Plants thrive indoors under fluorescent lamps.
3) Colors are more vibrant with special GTE phosphors in aquarium lamps.
4) Commercial displays are more appealing under lamps with improved color rendition.

Phosphors for High-Pressure Mercury-Vapor Lamps

For color correcting and improving brightness of high-pressure mercury-vapor lamps, GTE offers a variety of colors and particle sizes. As with all phosphors, these materials are produced in an isolated area to avoid cross contamination and can be purchased ready-to-use or as component materials to be mixed by the lamp manufacturer. Several are optimized to meet unique lamp-watting techniques. Phosphors for slurry coating and for electrostatic deposition are available.

Mercury-vapor lamps aid safety and security in industry.

Bright, low-cost lighting is achieved with mercury-vapor lamps.

Identification and Tagging Phosphors

These phosphors are fine grained, nonabrasive, inert to moisture, long-lived and insoluable in inks. The larger particle size versions are suitable for overprinting while the smaller particle sizes are more applicable for direct printing.

These phosphors are used for sorting, tracing, identification and adding color to printing inks.

Above: Crop dusting coverage can be easily assessed when GTE phosphors are added to agricultural chemicals.

Right: Many countries use phosphors in stamps to speed the mail.

Photoconductors

Photoconductive materials become electrically conductive when excited by radiant energy of various wavelengths. One of these, cadmium sulfide, is produced by GTE for use in the imaging devices found in office copiers and laser printers. CdS photoconductors for use in solar energy conversion devices are also produced.

Photoconductors provide power to remote equipment.

1) *Photoconductors are tested at GTE by preparing a photoreceptor which is then evaluated for imaging characteristics.*
2) *Photoconductors can be used for solar heating.*
3) *Extensive testing at GTE leads to improved performance in copier applications.*

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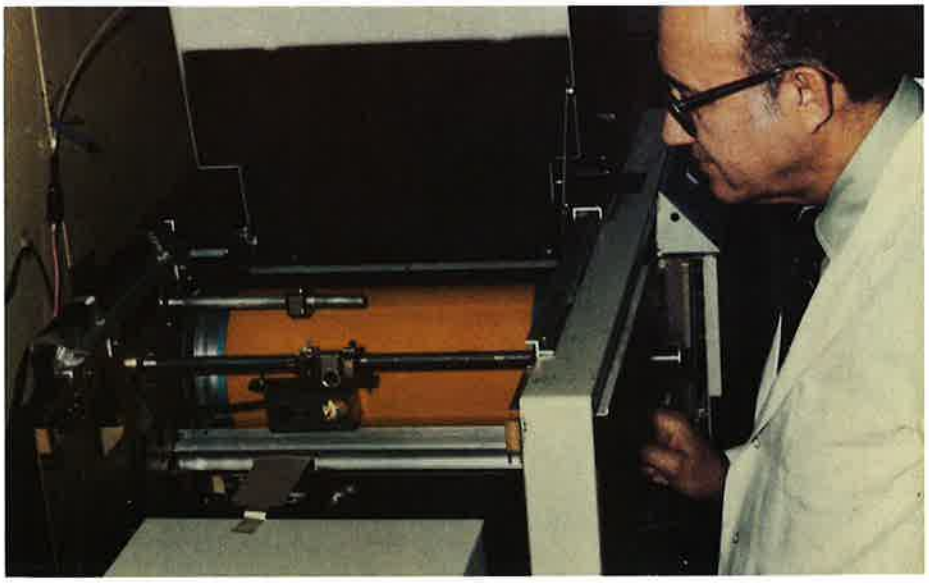

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Actinic Lamp Phosphors

Actinic phosphors are used in lamps which induce photochemical and photoconductive phenomena. They feature narrow-band emission in the near-ultraviolet and visible spectra.

Commercial uses include: therapeutic lamps for medical applications including psoriasis and bilirubinemia treatments; suntan lamps; exposure lamps for photocopiers and for photochemical processes such as polymerization.

Phosphors for photocopy lamps are engineered for specific copier applications.

Cosmetic and therapeutic lamps use GTE phosphors with carefully selected ultraviolet spectra.

Phosphors for Sign Tubing

GTE is among the leading producers of phosphors for the colorful advertising signs that have been adopted throughout the world. Custom colors can be produced by mixing standard types. The fluorescent color of a sign is a combination of phosphor emission, mercury discharge and fill gas.

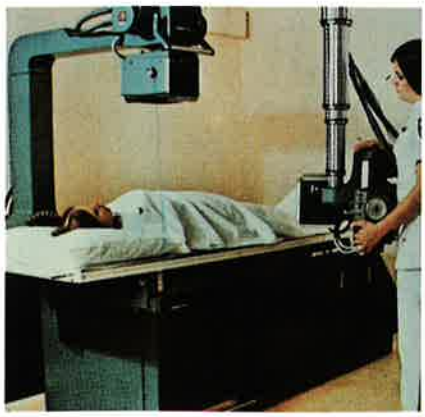
1.

2.

1) Patrons are attracted by the bright lights of Las Vegas.
2) Sign tubing compliments other forms of lighting in outdoor advertising.

X-Ray Intensifying Screen Phosphors

GTE pioneered the commercialization of a new group of rare earth containing phosphors that marked a significant advance in medical x-ray technology by reducing patient exposure to radiation.



Above: Reduced radiation protects both patients and technicians.
Right: Improved image resolution from GTE rare-earth phosphors aids diagnosis.

Electroluminescent Phosphors

In an electric field, these phosphors emit light in colors such as green, blue or yellow and provide soft, glare-free illumination in darkened areas. Electroluminescent phosphors are used extensively in instrument panels and other applications where glare might hamper visibility.

Design flexibility, linear dimming, wide temperature stability, and vibration resistance are key features offered by electroluminescent lighting.

Chemicals

GTE produces a wide range of high purity chemicals for electronic, electrical equipment, lighting, and optical applications. They are sold in quantities ranging from five-gram sealed ampules of iodides for discharge lamps to several thousand kilograms of carbonates, fluorides, sulfides and phosphates. Potassium silicate solutions for monochrome cathode-ray tubes are shipped in liter containers and in stainless-steel tankers.

Other high-purity chemicals include: fluorides for optical coatings and phosphor synthesis; carbonates for lamps, cathode-ray tubes, and electronic devices; alkaline-earth phosphates; electronic-grade zirconium dioxide; basing cements for lamps, TV tubes, and receiving tubes; sulfides for making infra-red lenses and for phosphor synthesis.

1.

Reproducibility of small lots of special chemicals is assured.

2.

1) Thousands of kilograms of high-purity raw materials are produced in Towanda.
2) Large uniform lots are routinely manufactured by GTE.

Domestic Sales Offices

GTE Electrical Products
Chemical & Metallurgical Group
60 Boston Street
Salem, MA 01970
Telephone: 617-777-1900

GTE Products Corporation
Chemical & Metallurgical Division
5700 West Genesee Street
Camillus, NY 13031
Telephone: 315-672-3111

GTE Products Corporation
Chemical & Metallurgical Division
1000 Huyler Street
Teterboro, NJ 07608
Telephone: 201-288-9484

GTE Products Corporation
Chemical & Metallurgical Division
100 Constitution Plaza
Hartford, CT 06103
Telephone: 203-249-5823

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Devon, PA 19333
Telephone: 215-293-9330

GTE Products Corporation
Chemical & Metallurgical Division
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P.O. Box 5246
Charlotte, NC 28205
Telephone: 704-334-4671

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Cleveland, OH 44135
Telephone: 216-267-6800

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Dearborn, MI 48126
Telephone: 313-582-8754

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Telephone: 415-697-3500

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Telephone: 39-2-656920 or 25303206
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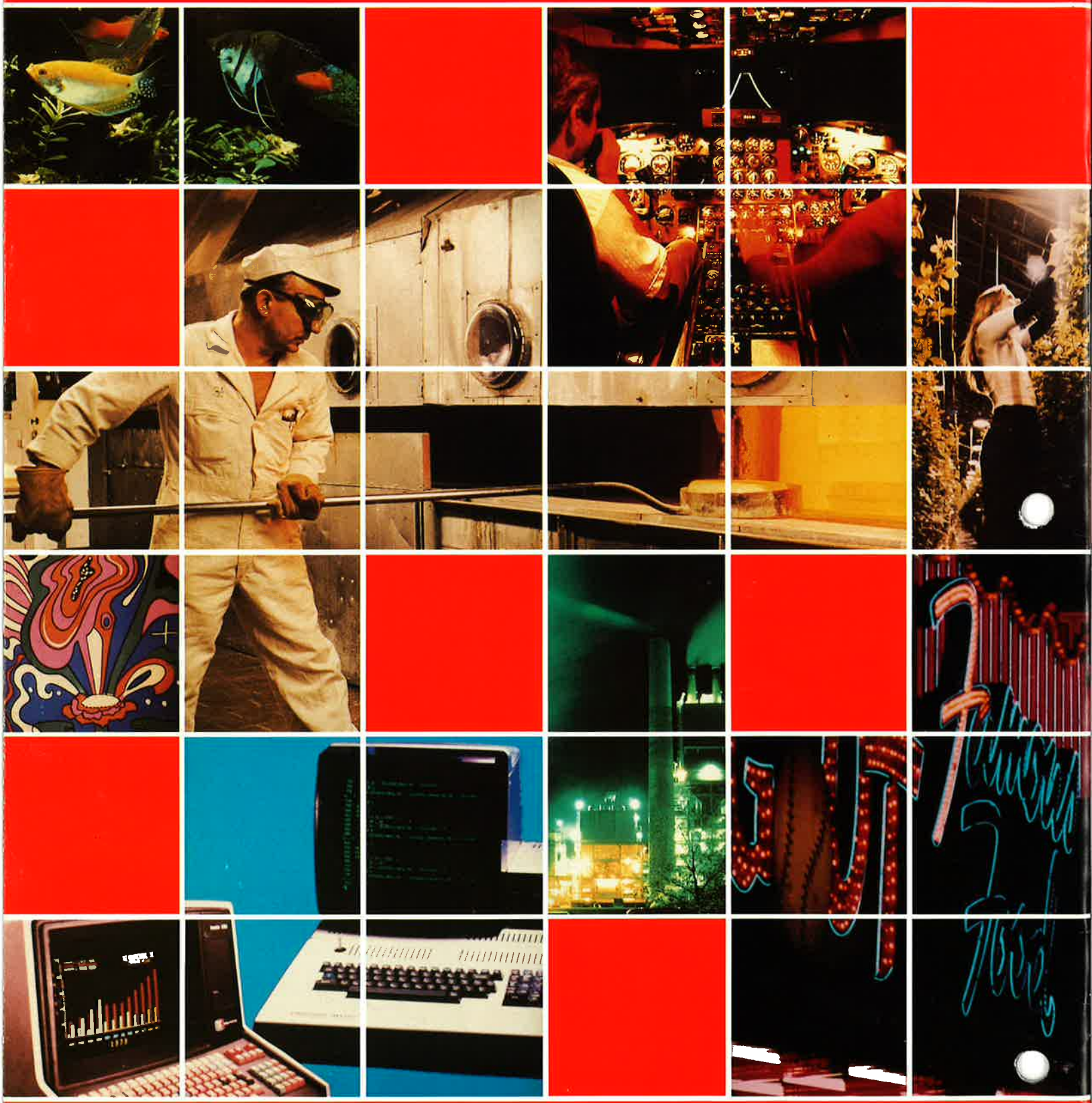
Ing. Militares NO. 85-60 Piso
Apartado Postal 17-711
Mexico 17, D.F.
Telephone: (525) 576-7444
Telex: 017-72-515

GTE Phosphors and Chemicals Are Marketed in Over 50 Countries



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