



**MATERION**

// BALZERS OPTICS

# Industry

## Advanced Optical Solutions for Industry



# Materion Balzers Optics

Materion Balzers Optics, a global leader in optical thin film coating solutions, emerged in 2020 from the union of Optics Balzers and Materion Precision Optics. This collaboration created a premier market leader in optical solutions, showcasing extensive expertise in the field of photonics technology. We have been the preferred partner for providing innovative optical coatings and solutions for over 70 years. From the UV through the Far IR, we custom manufacture and supply precision optical filters and coatings. As a high-tech company with five production sites worldwide, our focus is on a variety of markets such as Automotive, Consumer, Defense, Industry, Life Science, Lighting, Semiconductors and Space.

With a full range of unparalleled products, services, and support technologies, our customers benefit from our strategically located global facilities that provide regional manufacturing and technical support. Materion Balzers Optics' superior quality products are fully supported by a large volume manufacturing environment that produces highly repeatable results, contributing to reduced costs and market advantage. We also have scalable processes that are economical for customers who require small quantities. Our technical expertise and access to broad resources throughout Materion, make us uniquely positioned to offer solutions to our customer's most demanding challenges.



Production Balzers/Principality of Liechtenstein



Production Jena/Germany



Production Penang/Malaysia



Production Shanghai/China



Production Westford/United States



# Gas Sensing

## Thin-film coatings for gas sensors guarantee reliable detection of leaks and hazards



### Gas Sensing

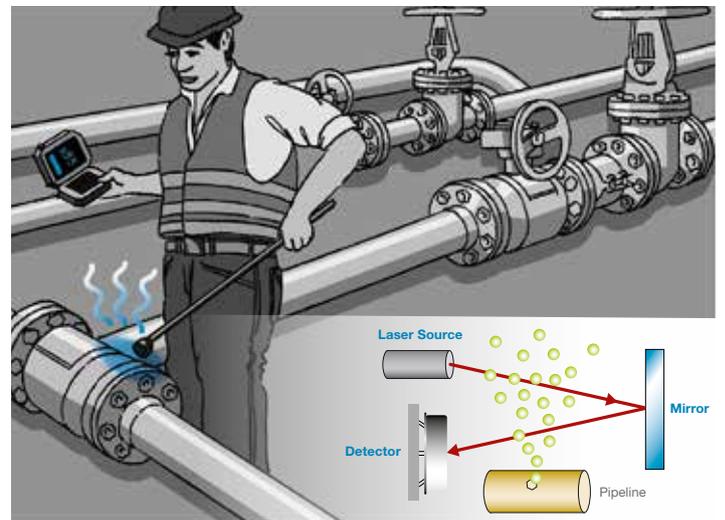
Gases can be detected by multiple ways. According to their characteristics, each gas shows a typical fingerprint. Typically, infrared (IR) gas sensors or non-dispersive infrared (NDIR) gas sensors are used for detection. These gas sensors use infrared light in different wavelength spectra to determine the concentration of a gas by absorption. The absorption strength is specific to each gas and depends on the wavelength of the infrared radiation used. For the detection of gases, the infrared wavelengths from  $3\ \mu\text{m}$  to  $7\ \mu\text{m}$  are used, the so called MWIR spectrum. Materion is a leading manufacturer of thin film coated MWIR optics used for the measurement of various gases. Our filters are specialized to detect gases like  $\text{N}_2\text{O}$ ,  $\text{CO}$  and  $\text{CO}_2$ ,  $\text{NO}$ ,  $\text{SO}_2$  and also  $\text{NH}_3$ . In addition to narrowband filters, notch filters and beamsplitter can be offered for this spectral range. The filters are characterized by a high transmission in the passband range, steep edges and an application adapted specific bandwidth. The manufacturing process makes them environmentally stable and thus suitable for gas sensing applications in the field of medicine and laboratory technology, in the mining segment as well as in the natural gas exploration of the oil and petrochemical industry. Furthermore, are applications covered like landfills or safety system in chemical industry along with growing applications in Carbon-Oxide detectors. Our filters also well suited to solve the application for monitoring the concentration of  $\text{CO}_2$  gases in enclosed spaces or public facilities.

Materion Balzers Optics' custom-designed infrared filters are used in a wide variety of photonic-related applications. Representative Commercial IR applications include:

- Safety applications – monitoring and detection of toxic and explosive gases
- Gas analysis including in automotive applications
- Detection of refrigerant gases
- Moisture analysis
- Medical applications – anesthesiology
- Remote sensing



Gas Sensing



Gas Detection

# Thermal Imaging

## Heat signature detection provides safety



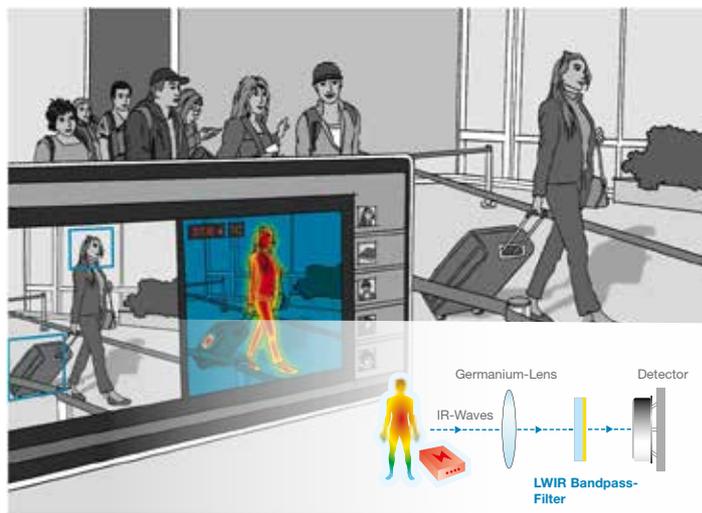
### Thermal Imaging

Thermal Imaging enables non-contact temperature measurement in industry, research and development. Precise non-contact temperature measurement is possible in the range  $-40\text{ }^{\circ}\text{C}$  to  $3000\text{ }^{\circ}\text{C}$ . This is made possible by filters, which are adapted to specific wavelength ranges in the LWIR and MWIR spectral range. MWIR and LWIR filters are also used in infrared cameras for thermography. Materion Balzers Optics is a leading manufacturer of customized thin film coated filters for thermal imaging cameras which allows a rapid identification of objects, persons or unidentified thermal sources. The special design of our narrowband filter components allows precise measurement of temperature distribution in electronic components for lifetime assessment. The characterization of the heat signature is needed in petrochemical production for precise assessment of process steps or for leak detection. Highspeed cameras with IR filters enable the determination of temperature data during fuel ignition and for the optimization of engine consumption.

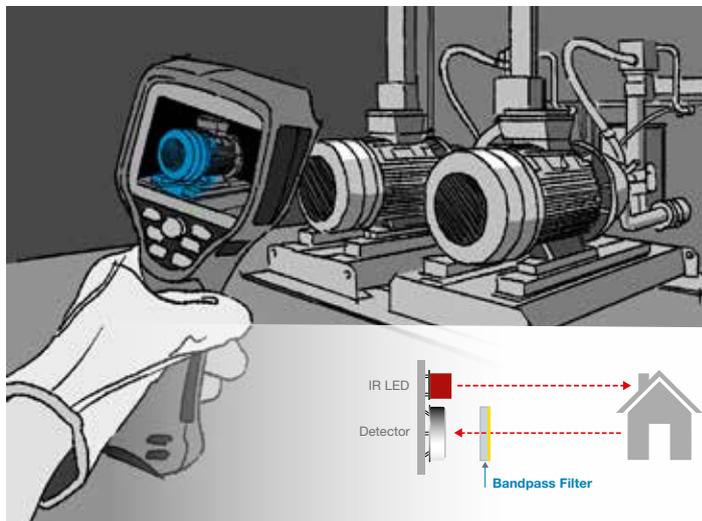
Materion Balzers Optics manufactures application specific filters, whose design in transmission, bearing of the optical edges and environmental stability, can be precisely adapted to the respective applications. Regardless of the solutions required, whether uncooled or cooled, open or hermetically encapsulated, a flexible range of solutions can be offered.

Materion Balzers Optics' custom-designed infrared filters are used in a wide variety of photonic-related applications. Representative Commercial IR applications include:

- Optical detection of fire, flame, and explosion
- Motion and body heat detection
- Pyrometry
- Radiometry
- Thermal Imaging



Thermal Imaging



Thermal Imaging

# Digital Imaging

## Imaging systems enable precise detection and monitoring



Materion Balzers Optics offers a wide range of coating solutions for industrial line- or area scan cameras, for multispectral solutions and hyperspectral imaging. Camera sensors for digital imaging usually work in the VIS and IR range. Depending on the information required, Materion Balzers Optics has unique experience in manufacturing a wide range of optical filter types that can be used in these cameras. In addition to anti-reflective coatings, these include narrow bandpass filters, steep bandpass filters and linear variable filters with custom gradient index. The range is complemented by structured filters and filter arrays composed of individual filters. For thermal cameras, filter coatings are offered in the spectral range from 8  $\mu\text{m}$  to 14  $\mu\text{m}$ .

### Coatings for Low-defect Cover Glasses

CCD or CMOS image sensors in digital cameras as well as LCOS micro-displays in projection applications are commonly packaged with protective cover glasses. These cover glasses consist of a clean surface plus a functional coating, such as AR coating, NIR blocking filter or index-matched ITO. A key factor of Materion Balzers Optics sensor lids and cavity lids is the superior low defect properties of the coatings as they define the quality of the device. Sealing or bonding solutions for the subsequent assembly process are an integral part of the products offered.

### Coatings for Imaging Sensors

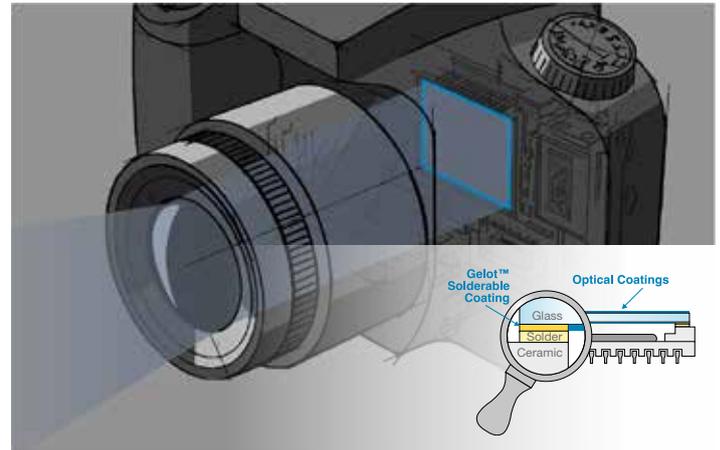
Cameras for traffic control typically operate in the VIS and IR range. Materion Balzers Optics has a unique background in manufacturing a wide range of filter types which can be used in these cameras. These include narrow bandpass filters, bandpass filters with steep edges, wide blocking range filters, and linear variable filters with customized gradient index.

### Coatings for Multispectral Imaging

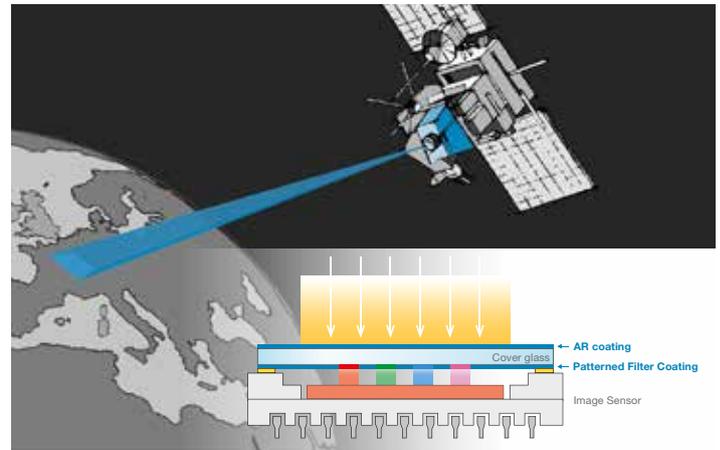
Multispectral image sensors require cover glass lids with integrated color-selective dichroic filters. Materion Balzers Optics provides patterned color filters for selective spectral filtering on different zones of the cover glass lids. The individual filter zones may be masked with an opaque chrome or titanium layer containing alignment marks.

### Coatings for Hyperspectral Imaging

Application-specific solutions using hyperspectral cameras are a significantly growing technology segment. Due to the high variation of applications, the requirements for optical filter solutions for this market are extremely demanding. Materion Balzers Optics has acquired the capabilities to design, produce and assemble filter solutions for hyperspectral applications due to its longstanding expertise in this segment.



Digital Imaging



Meteorological Satellite

# Factory Automation

## A variety of tasks in automated production processes today rely on optical sensors



Thin-Film Coatings in Automation – Object detection, distance and profile measurements, code identification and security access control are all critical tasks that optical sensors are assigned to in industrial automation. Our vacuum-deposited optical thin film coatings improve the photonic sensor's wavelength selectivity and thus reduce unwanted noise in a sensor configuration.

### Coatings for Photo-Electric Sensors

Materion Balzers Optics' design portfolio for photo-electric sensors includes AR-coatings and bandpass filters for all of the commonly used wavelengths. The filters can also be incorporated into photo-electric sensors to accurately detect contrast and surface color. Some of the newer industrial sensors use Time-of-Flight principle for distance measurements. Our bandpass filters reliably filter the laser light of such ToF-based distance sensors.

### Coatings for Code Readers and Scanners

Product traceability solutions require reliable, automatic in-line identification of manufactured goods. Materion Balzers Optics offers suitable thin-film coatings for the most common industrial identification technologies such as laser-based barcode scanning or image-based 1D and 2D code readers. Our protected mirror coatings greatly enhance reliability of such readers.

### Coatings for Linear and Rotary Encoders

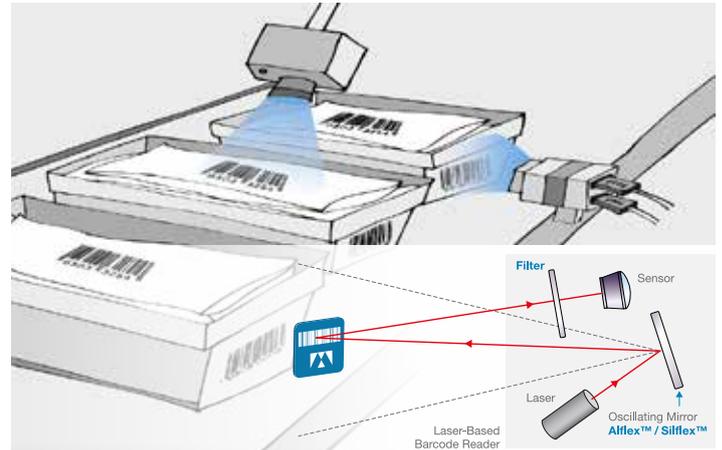
Our capabilities in lithographic patterning of thin films allows us to offer high resolution encoder discs based on patterned Chrome structures. With our Chrome-patterned encoder discs deposited on glass, much higher resolutions than with conventional metal encoder discs can be achieved.

### Coatings for Autonomous Vehicles

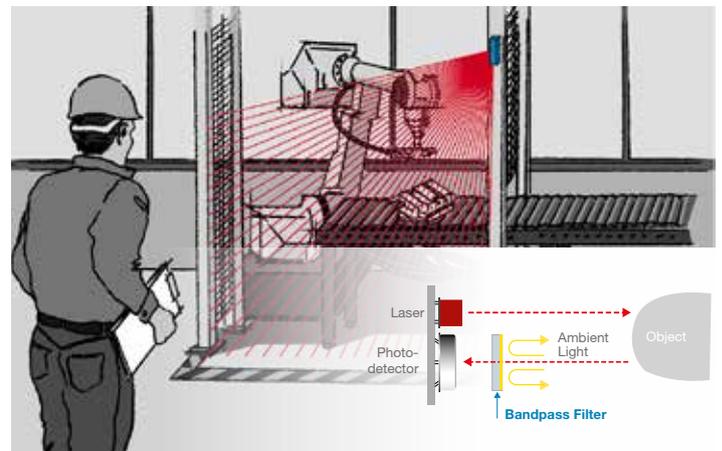
Optical signals are mostly used for communication with autonomous vehicles. Wavelengths in the NIR and IR range are used for this purpose. Materion Balzers Optics produces a wide range of AR-coatings on hydrophobic coatings, which meet the highest requirements. Besides BP- filters with blocking >OD5, we have also developed a variety of other coatings.

### Coatings for 2D and 3D-LiDAR Systems

LiDAR (Light Detection and Ranging) technology nowadays is also increasingly used in factory automation, e.g. as a safety sensor for collision avoidance. Our protected metallic mirror coatings are ideally suited to enhance reliability of such LiDAR systems.



Code Readers & Barcode Scanners



Light-Curtains for Safety Systems

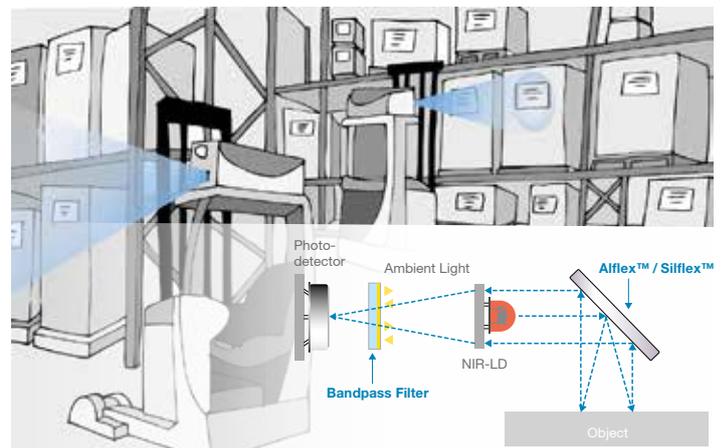


Photo-Electric Sensors & Reader Systems

# Laser Processing

## Laser systems in production processes require reliable and powerful optical components



For the wide-ranging field of laser applications, Materion Balzers Optics offers products with outstanding optical properties as well as excellent characteristics with regard to a high level laser stability. Besides the employment of state-of-the-art technologies through IAD (Ion Assisted Deposition) and IBS (Ion Beam Sputtering), especially low-absorption coating systems can be manufactured by Magnetron Sputter Technologies (PARMS).

### Optical Coatings used for Micromachining Application

Laser micromachining is a versatile material changing process and is used widely for almost all materials. Materion Balzers Optics offers specific products for such applications. Optics, like low absorption beam combiners, are perfectly tailored to the requirements according to power and lifetime. Our coating capability is used for Beam-Steering optics, Laser-Scanner, Laser-Cavity-Mirrors, Beam-Combiners, Laser-Line-Mirrors and their harmonics, in the spectral range from the UV, VIS, NIR & SWIR Band up to 10.6  $\mu\text{m}$ .

### Optics for Ultra Short Pulses

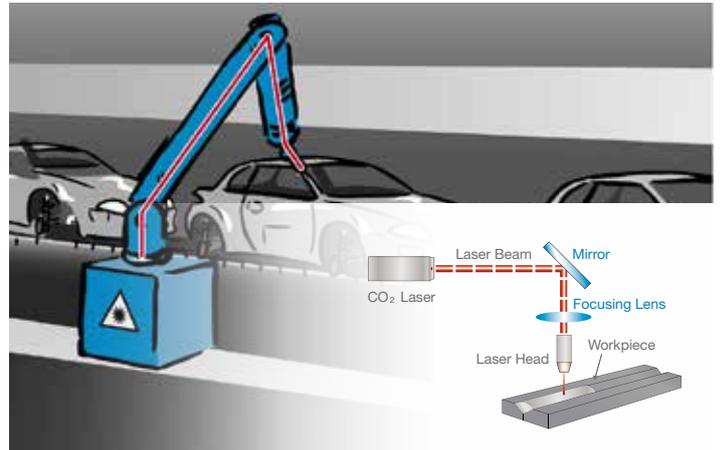
The trend of shorter laser pulses requires optical thin film coating which are adapted to the enormous energy density of the laser pulses during psec or fsec operation. Therefore, the knowledge of short pulse laser parameter, like Group Delay Dispersion, is a fundamental basic. Materion Balzers Optics is able to measure these parameters and to adapt the coating process accordingly.

### Challenging Coatings for Multibandpass-, Polarizing Beam-splitters and Notchfilters

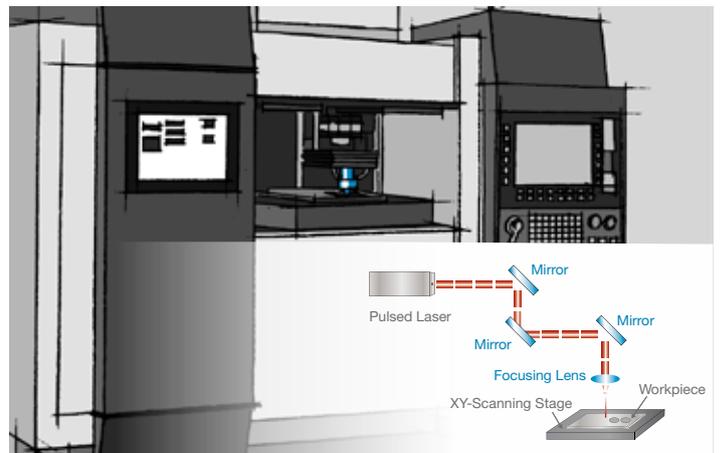
Steep edges and a secure deep blocking range is key specification for Multibandpass, Notchfilter and polarizing Beamsplitter optics. The design of these components can be adjusted precisely to specific laser lines and their harmonics wavelengths. Materion Balzers Optics specializes in custom design and quantities.

### Excellent Spectral Accuracy for High-End Laser Cavity Mirrors

Laser mirrors used in a cavity setup requires an excellent mirror surface accuracy and also a precise spectral accuracy, tailored to their application. In addition, Materion Balzers Optics offers cavity substrates where the polishing accuracy below 1.5  $\text{\AA}$  is guaranteed.



Laser Manufacturing



Laser Beam Processing Application

# Metrology & Inspection

Filters and coated optics used in the field of metrology & inspection have to meet a wide range of specifications



## Coatings for Metrology & Inspection

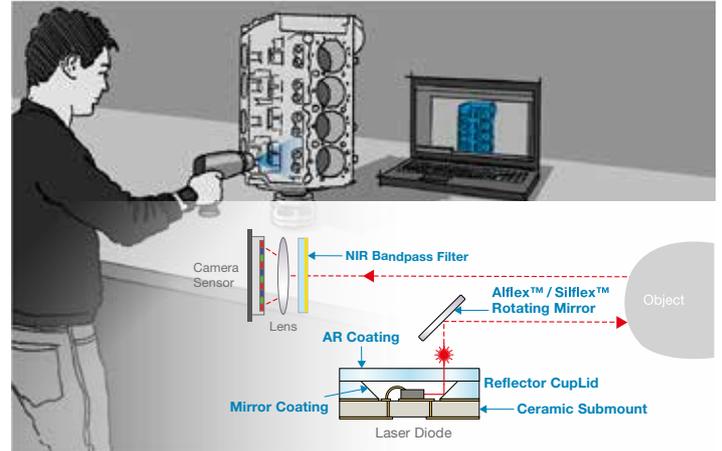
Filters and coated optics used in the field of metrology & inspection have to meet a wide range of specifications. Materion Balzers Optics combines many years of technical experience with the fundamentals of modern coating technologies. The measurement of physical parameters is mostly based on the use of optical signals. Well-known methods such as spectroscopy or interferometry are only a few examples of the diverse field of optical measurement technology. No matter for which application, whether UV-based wafer inspection, or the detection of counterfeits in banknotes, or the exact sorting of waste, for every variant in optical metrology, products from Materion Balzers Optics can be offered.

## Coatings for Spectrometry

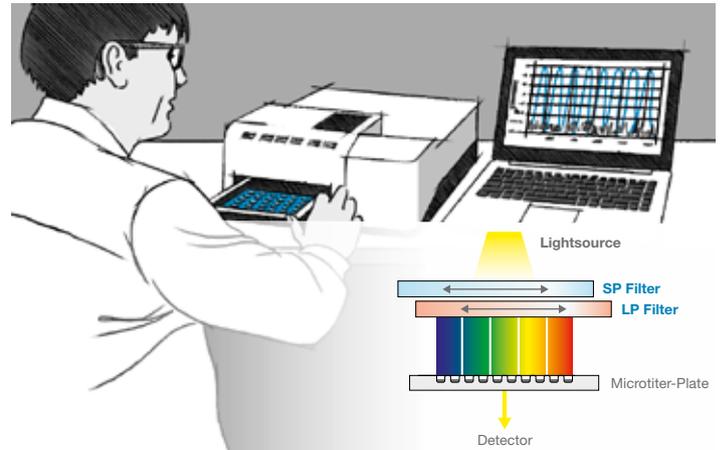
Spectrometers are widely used in industrial applications to control processes by obtaining spectral information. Materion Balzers Optics Filters are specifically designed for spectroscopy applications where the spectral response of processing goods needs to be measured accurately with excellent signal-to-noise ratio. Some filters, like the Order Sorting Filters, are patterned filters consisting of a number of spatially separated longpass filters whose purpose is to block the unwanted light from higher diffraction orders that is being created by the dispersive element in the instrument. Linear Variable Filters mitigate this issue because the coating is continuous and the cut-on wavelength changes in a linear manner across the filter. In contrast to patterned Order Sorting Filters, Linear Variable Filters suppress the stray light from higher diffraction orders even better because the cut-on wavelengths of the longpass filter moves together with the dispersion of the grating while with discrete filters the distance from the cut-on wavelength to the first order gets gradually bigger and allows more stray light to pass through the filter.

## Multispectral and Hyperspectral Imaging

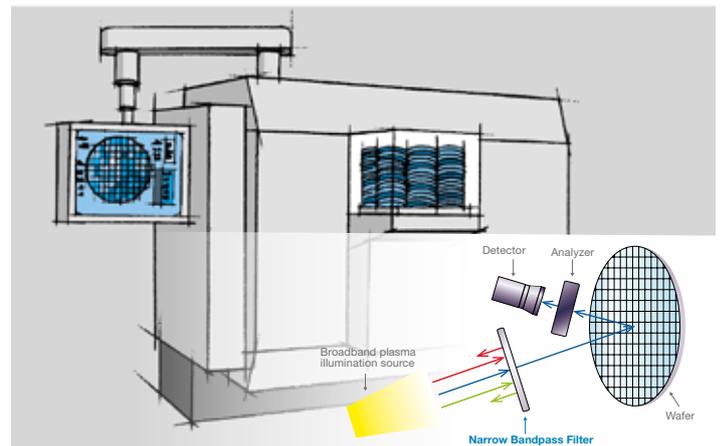
Materion Balzers Optics is a leading manufacturer of optical filter for multispectral and hyperspectral imaging sensors. Sophisticated coating and bonding technologies allows us to manufacture multiband pass filters by means of a lithography process, as well as in the variant as an assembled filter arrays. For hyperspectral imaging, application linear variable graduated filters are offered. These are manufactured to customer specifications, whereby the gradient can be adapted directly to the detectors of the line scan cameras, for example.



3D Surface Measurement



Linear Variable Filters



Wafer Inspection

# Environmental Monitoring

Process technologies, based on optical components, enable a variety of applications for environmental analysis, resource identification and the determination of environmental pollution



The monitoring and preservation of the environment is now of the utmost importance to consumers. Photonics makes it possible to effectively combine environmental analysis and protection, e.g. for:

- The spectrometric measurement of water pollution and wastewater
- The detection of air pollution and emission balance using sensor technology in the NIR and FIR spectrum
- The inspection of the geological composition of soils
- The identification of resources which make hyperspectral imaging technology possible, using mobile drones and multi-bandpass filters

## Food and Waste Sorting

The fully automated sorting of food and waste is now as familiar as energy-efficient and intelligently controlled lighting technology. Unique optical filters from Materion Balzers Optics are used in these systems. High reflective mirrors, with dielectrical or metallic coatings, passband filters and linear variable graduated filters, which realize hyperspectral imaging, enables sorting of foodstuffs not only by size but also by degree of ripeness and product specific quality characteristics.

## Water Analysis

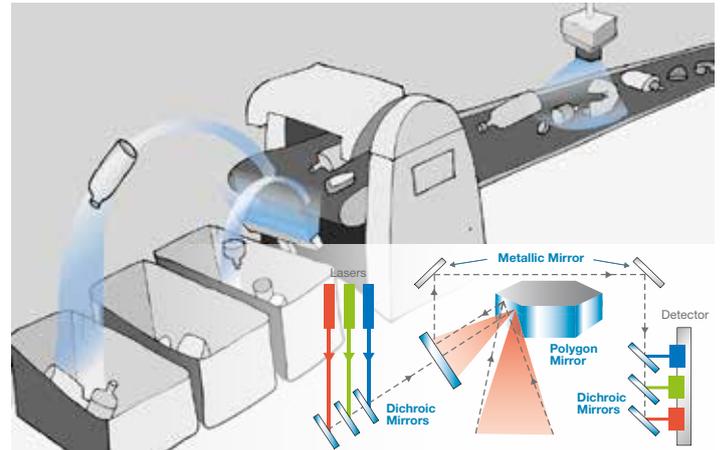
Determining the quality of water and measuring the pollution of wastewater is a typical field for spectrometric measurement tasks. Materion Balzers Optics develops and produces optical coatings for corresponding bandpass, blocking, and shortpass filters for measurements in the VIS and NIR spectrum. We also offer highly reflective, slow-time stable broadband mirrors for such measurement systems, which enable reliable results even under demanding environmental conditions.

## Coatings for Sun Simulation

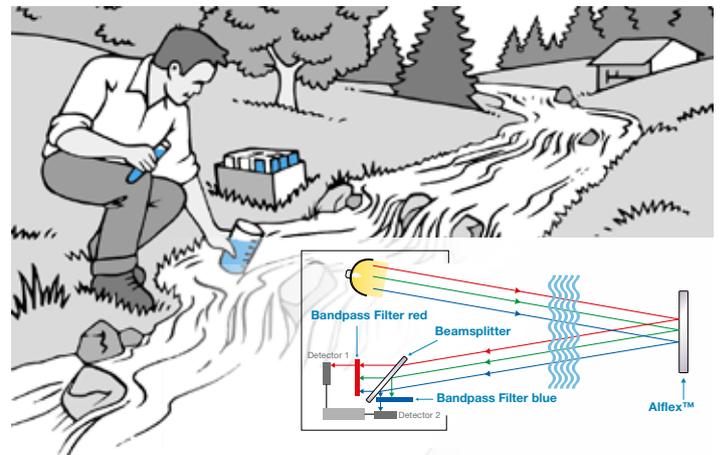
Sun simulation is used to simulate and investigate the processes and reactions that occur in components and systems exposed to solar radiation. Spectral influences can be simulated, and their effects investigated using specially coated filters. Materion Balzers Optics also manufactures filters for high-energy systems that meet these requirements, and which can be integrated into corresponding lighting systems.

## Light Management

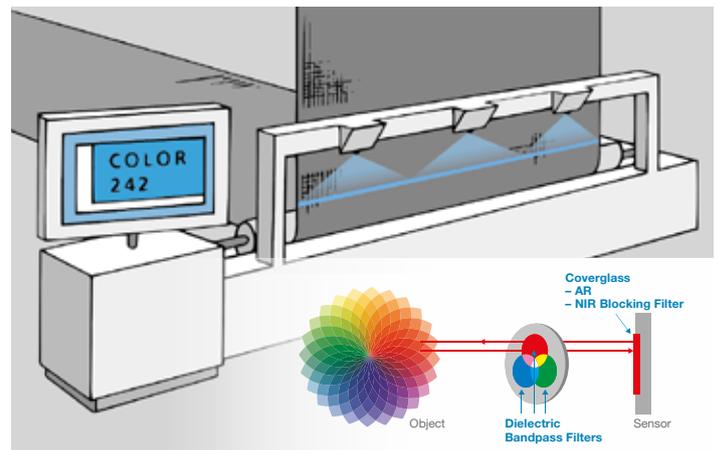
Light management is not only essential in terms of energy resources, but also in relation to light pollution. Light pollution affects the lives of insects and other nocturnal animals and is a significant issue that is receiving more and more attention. Materion Balzers Optics filters for the VIS and NIR ranges are used in combination with the corresponding sensor technology to fully optimize this segment.



Waste Sorting



Water Analysis



Color Temperature Measurement

# Safety & Security

## Process monitoring and quality control by using advanced camera technology



Optical filters are used to select specific wavelengths on the light spectrum, from the UV to the IR range. Depending on the application, certain wavelengths are used to obtain a desired signal or to help transmit signals. In the field of safety and surveillance technology, systems based on optical modules are used to monitor production processes. Cameras with the appropriate image processing software enable a high degree of automation in quality control. Light barrier systems have become indispensable in security technology. A specific room or work area can be monitored by sensors to prevent accidents at work and to detect errors. Transmitters and receivers are connected by optical signals that are matched to each other by means of corresponding bandpass filters. Materion Balzers Optics develops and manufactures precisely fitting bandpass filters, filters with a blocking  $>OD7$  outside the fitting range, anti-reflective coatings, metallic mirrors, and absorbing coatings to suppress unwanted reflections and interference signals.

### Filters for Surveillance Cameras

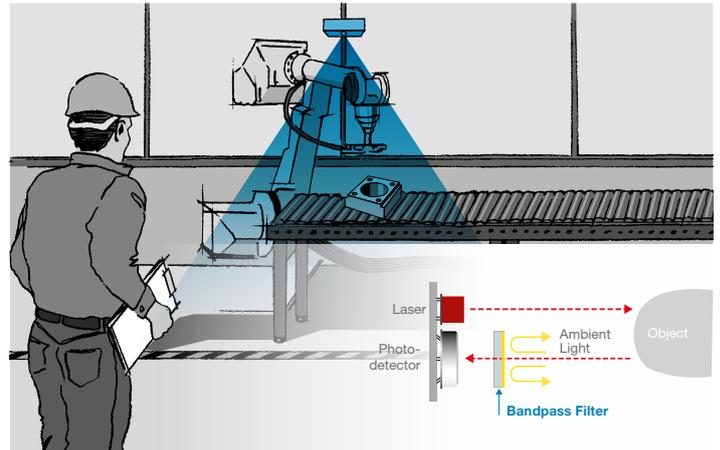
These cameras typically operate in the VIS and NIR range. In addition to cameras used for security purposes, such as CCTV or traffic cameras, a wide range of cameras also operate in the IR range to detect human body temperature, such as in airports. Special filters are used to separate ambient light from the range of wavelengths which should be detected by the sensor element.

### Laser Blocking Filters / Eye Safety Filters

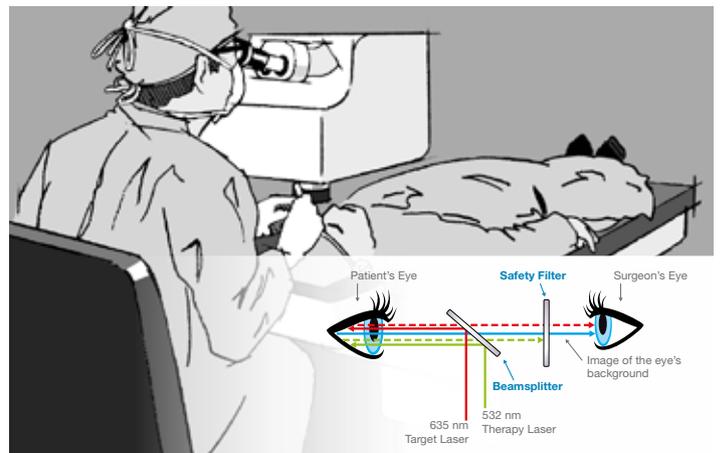
Human eyes can only pick up a small segment of the wavelength spectrum. In some industries, such as medicine, high intensity wavelengths are used. These can be damaging to the human eye. Materion Balzers Optics manufactures filters, catering to these applications. Our filters provide safe light blocking in accordance with the applicable standards. We can even ensure protection against laser systems with high energy outputs.

### Filters for Currency Recognition

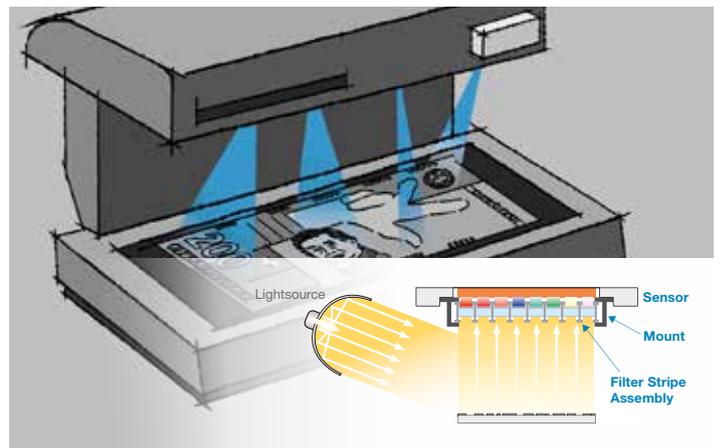
As long as physical currencies exist, attempts will be made to counterfeit them. Furthermore, banknotes are exposed to extreme stresses in daily use. Optical filters are used not only to identify counterfeits, but also to check the quality of the banknotes in circulation.



Surveillance Cameras for Industrial Safety



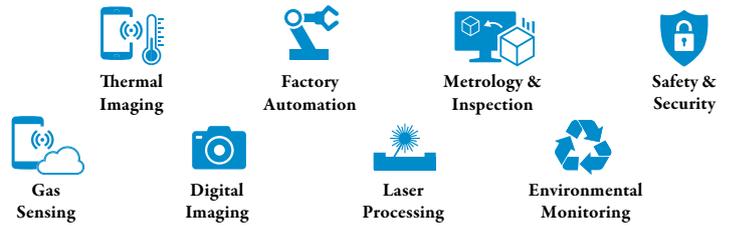
Laser Safety & Eye's Protection



Currency and Counterfeit Identification

# Optical Coatings & Components

The core competencies of Materion Balzers Optics are the design and manufacturing of high precision thin-film optical coatings and their integration into sophisticated optical components. Materion Balzers Optics' coatings and components are characterized by excellent spectral performance, low defect quality and superior environmental stability. The coatings are produced with state-of-the-art evaporation and sputtering equipment platforms with process and product specific adaptations. The components are both customized to the specific product requirements and optimized for high yield production. Continuous process control, like monitoring of the coating process or customer specific component characterization, ensures consistent and high quality in volume manufacturing.



	Gas Sensing	Thermal Imaging	Digital Imaging	Factory Automation	Laser Processing	Metrology & Inspection	Environmental Monitoring	Safety & Security
Anti-Reflection Coatings	x	x	x	x	x	x	x	x
Black Coatings		x	x			x	x	x
Coatings on Plastics & Polymers				x		x	x	
Conductive Coatings			x	x		x	x	x
CupLids	x	x	x	x	x		x	
Dichroics			x	x	x	x	x	x
Hermetic Sealing Components	x	x	x	x	x	x	x	x
Hydrophobic Coatings			x	x		x	x	x
Laser Ablation			x	x		x	x	x
Laser Beam Splitters					x	x	x	
Laser Beam Steering Mirrors					x	x	x	
Laser Cavity Mirrors					x			
Laser Scanner Mirrors					x		x	x
Linear Variable Filters			x		x	x	x	
LWIR Coatings & Filters	x	x						
Metallic Coatings			x	x	x	x	x	x
Multi-Bandpass Filter	x	x	x	x		x	x	x
Order Sorting Filter			x	x		x	x	
Solderable Coating			x	x	x	x		x
SWIR Coatings & Filters			x			x	x	x
UV Coatings & Filters						x	x	
VIS and NIR-Bandpass Filter			x	x	x	x	x	x



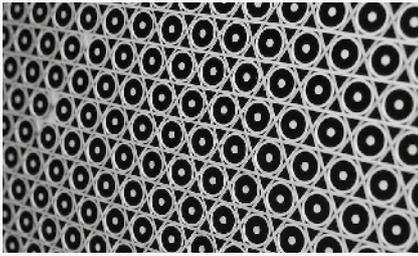
### Anti-Reflection Coatings

Materion Balzers Optics offers a range of different evaporated Multilayer AR-coatings designed for maximum efficiency in the visible range.

**Iralin™** is designed for wavelengths in the visible range from 450 to 650 nm.

**Duolin™** is laid out for the visible range (475–670 nm) plus an additional laser line. This can be any conventional low power laser in near infrared (NIR) range.

**Supertriolin™** covers the broadest range of the light spectrum with wavelengths from 450 nm up to 1100 nm.



### Black Chrome – CrBlack™ & Black Titanium – TiBlack™

For best possible image quality any source of light scattering needs to be reduced. Materion Balzers Optics' black coatings technologies are the ideal solution for this purpose. CrBlack™ is an optical black coating, characterized by its high absorption and low reflection in the VIS and near IR range.

TiBlack™ is an optical black coating, based on Titanium. Because the coating is fully RoHS compliant, it can be used for various types of applications.



### Metallic Mirror Coatings

The Alflex™ mirror coating has proven itself many times over due to its durability. Mirrors with a Silflex™ coating can be used over a broad spectral range from 450 nm to beyond 12 μm. Protective dielectric coatings make them resistant to tarnish and oxidation. All types of network and optical sensing devices utilize light which needs to be routed by reflectors. Goldflex™, a gold based metallic reflector is recommended for this purpose.



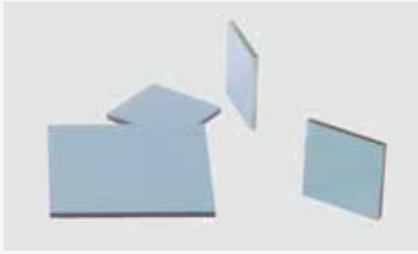
### Gelot™

Gelot™ is a solderable gold-based multilayer coating that can be applied to glass, fused silica, sapphire and crystals, as well as to ceramics and similar materials. Gelot™ is used in various bonding and sealing applications with optical glass components such as microlenses, or to provide electrical contact on conductive coatings such as Indium Tin Oxide (ITO).



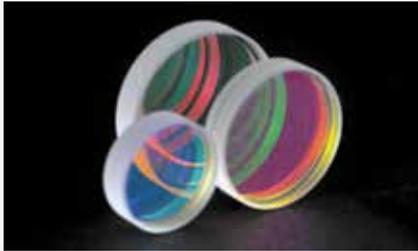
### Patterned Chrome

Patterned Chrome is widely used in the optical and semiconductor industry as a standard absorber material for optical masks, apertures, or dark mirrors. Our Chrome is available for various purposes. Low defect levels and good etching behaviour of our Chrome allows for accurate transfer of high-resolution patterns making it an excellent choice for micro-patterned filters, visual alignment marks or barcodes. Our chrome coatings are also used for electrically conductive structures.



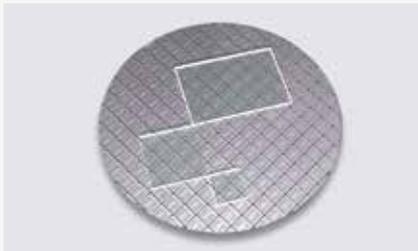
### VIS and NIR Bandpass Filters

VIS and NIR bandpass filters are used in various optical sensor applications. They block the visible ambient light on one hand and the long-wave infrared light on the other hand. Only the selected signal or measuring light from the near infrared (NIR) range may be transmitted. These filters are therefore key components in achieving excellent signal-to-noise ratios, which are relevant for optical measurements, distance measurement applications, or specific systems for gesture recognition (TOF, Time-of-Flight).



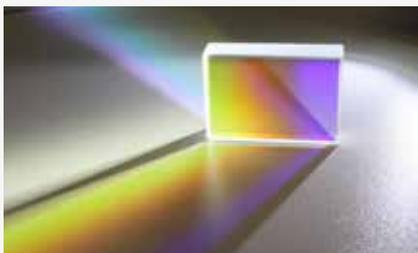
### Multi-Bandpass Filters

Materion Balzers Optics bandpass filters excel by steep transition between blocking band, passband and high-passband transmittance (> 97%). Based on application background, Multi-Bandpass filters can be offered in a monolithic design. These sophisticated coating processes allow blocking up to OD8 level. Additional filter dimensions, spectral characteristic and angle of incidence can be customized to complement the specific sensor and light source performance.



### Low Defect NIR Blocking Filter for Image Sensors

High performance digital image capture with CMOS or CCD sensors requires efficient blocking of the Near Infrared (NIR) in a broad wavelength range. The edge shape of such a filter depends very much on the application and therefore is custom designed. Furthermore, only a low defect density can be tolerated as every defect may lead to pixel loss. Finally, some high end applications require cover glass apertures to mask sensor framework.



### Linear Variable Filters

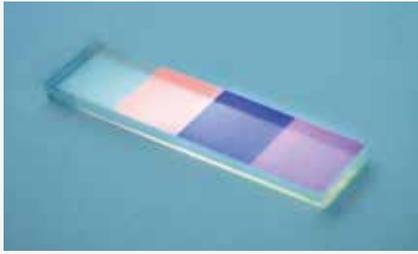
Linear variable filters (LVF) are applied in numerous optical fields like spectroscopy, hyperspectral imaging (HSI) and fluorescence microscopy. LVFs are in particular beneficial in applications which require lightweight and compact instrument like HSI devices, installed on unmanned aerial vehicles (UAV), which are increasingly used in agriculture or for environmental observations.

LVFs components are applied as wavelength selectors, order sorting filters in grating based systems or in purely filter based spectrometers.



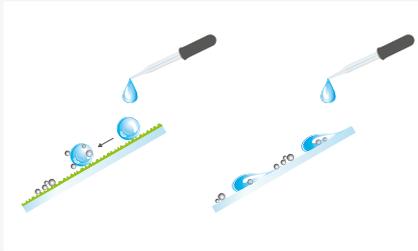
### LWIR Filter Coatings

Expansion of the commercial market is already evident with the availability of IR imagers for fire and rescue personnel, and the installation of IR imagers on automobiles. Mobile phones and cameras also introduce an IR capability. These popular applications were made possible by the economical development of wafer-level production capability of micro-bolometers for the 8 to 12  $\mu\text{m}$  region. Materion Balzers Optics specifically prepares and refines infrared (IR) coating materials to meet these increasing demands in various applications.



### Order Sorting Filters

Miniaturized photospectrometers are an integral part of an increasing number of optical systems. A compact set-up for such minispectrometers is based on a fixed grating for wavelength separation. However, using diffraction gratings, one has to face higher diffraction orders which have to be eliminated. One way to effectively achieve their suppression is to use well positioned longpass filters. Materion Balzers Optics provides tailored filters deposited by a plasma assisted process and showing excellent optical performance and long-term stability.



### Hydrophobic Coatings

TopFlex™ hydrophobic coatings are chemically resistant to water, oil and grease. This UV to IR transparent top-layer is easy to clean and also dirt-repellent. The coating exhibits a good adherence to the substrate and other coatings and is highly resistant to various forms of cleaning processes.



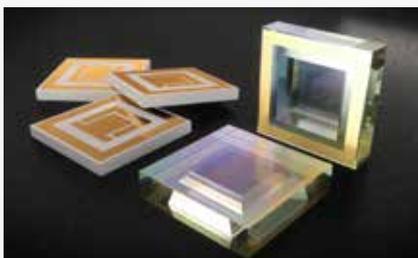
### Conductive Coatings

Indium-Tin-Oxide (ITO) is a widely used material for thin film coatings with electrically conductive and optically transparent properties. The reflectance of light on interfaces or surfaces of an ITO layer may be reduced considerably by integrating it into an anti-reflective multilayer – a so called Index Matched ITO (IMITO). The Materion Balzers Optics ITO is very dense and remarkably free of pinholes.



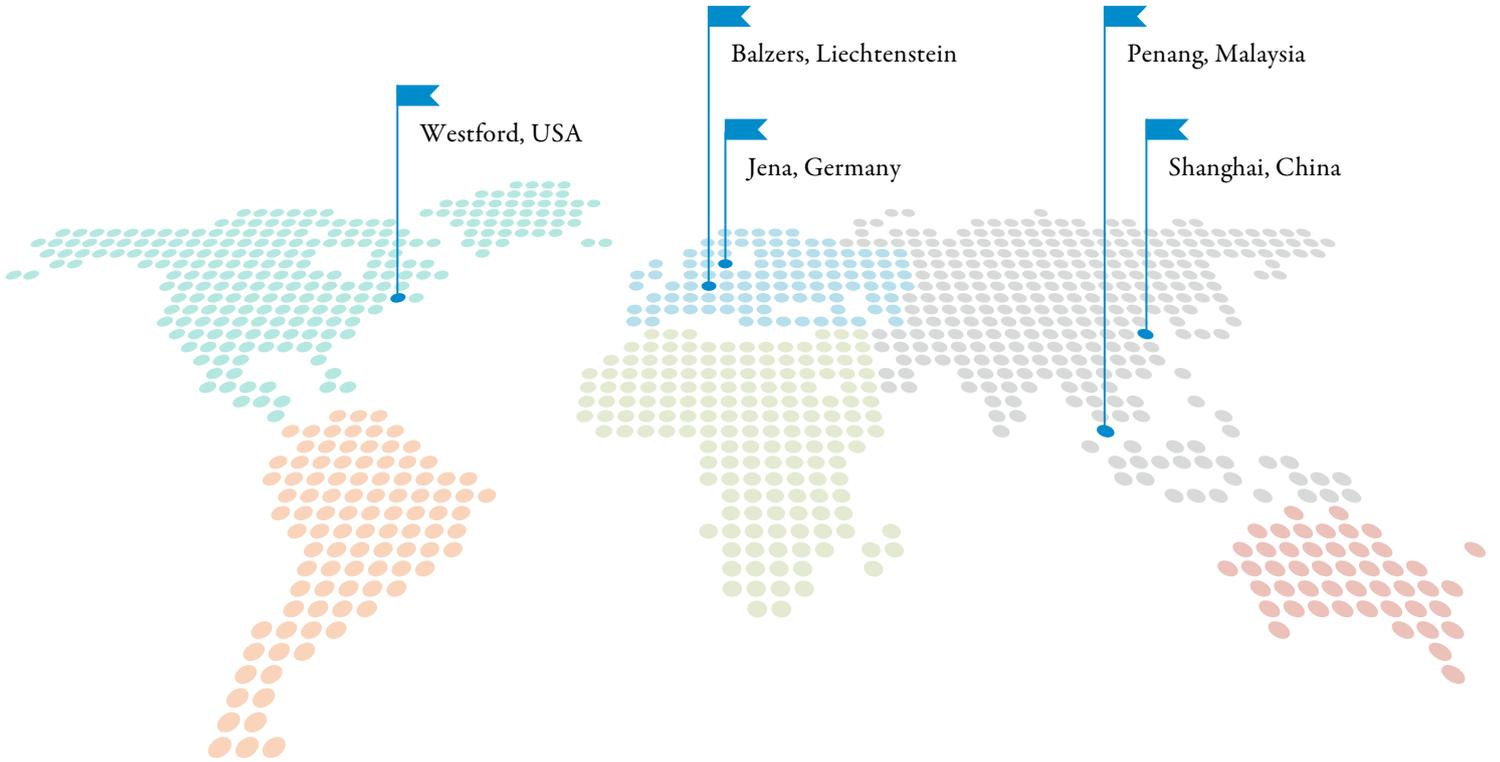
### Coating on Plastics & Polymers

Plastic substrates often need hardcoating in order to improve the surface hardness and to enable additional thin-film coatings on top. Materion Balzers Optics offers different types of hardcoating solutions depending on the application and the substrate type (e.g. PMMA, PC, COC). The hardcoating solutions developed, are optimized for dielectric and metallic top coating and meet the harsh environmental requirements of different industries.



### CupLid - Optical Cavity Window

For miniaturized packaging of photonic chips, including photodetectors, LEDs and MEMS mirrors, Materion Balzers Optics has developed CupLid Cavity Windows, a space-saving surface-mount photonic package. CupLids are available with various anti-reflective or filter coatings and can be shipped fully-furnished with tack-welded solder preforms (AuSn or SnSb) for easy handling and assembly. For prototyping we provide a number of reference designs of different AlN submounts for either wirebond or flip-chip die-attach.



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