MATERION

// BALZERS OPTICS

Consumer

Optical Solutions for Mobile Devices

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.

Balzers / Principality of Liechtenstein

Jena / Germany

Penang / Malaysia

Shanghai / China

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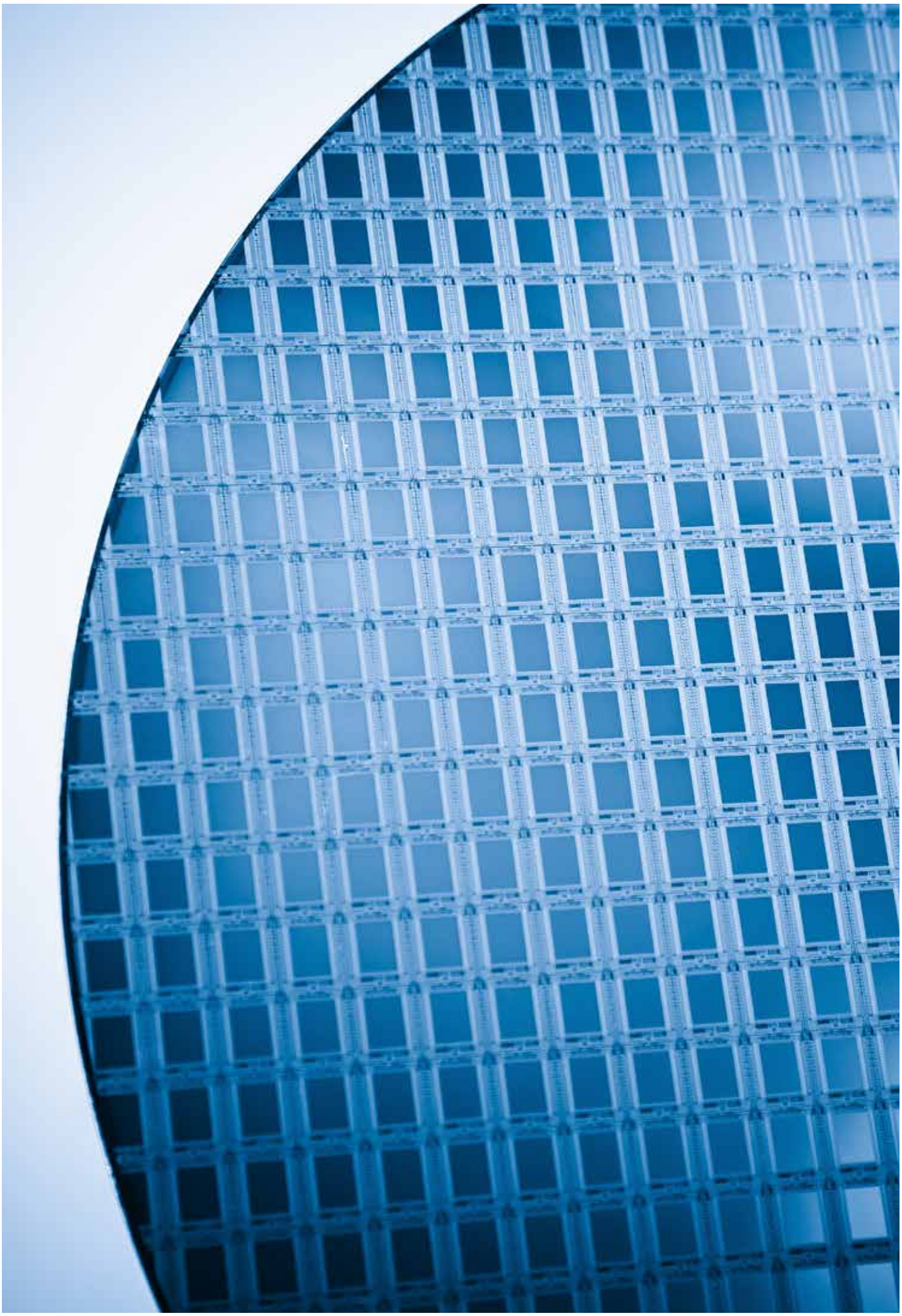


Mobile Devices

Our optical components are made for the filtering, guidance, and selection of light for mobile sensing applications

Thin-Film Coatings in Mobile Devices
Optical sensors have become ubiquitous in our everyday life. Today's mobile phones are packed with nearly a dozen optical sensors to measure, select and alter light for different purposes.

Thin film deposition is a key technology for optical sensor manufacturing. Vacuum-deposited optical thin films are a common and economical way to improve a photonic sensor's wavelength selectivity and to therefore reduce unwanted noise in a sensor configuration.

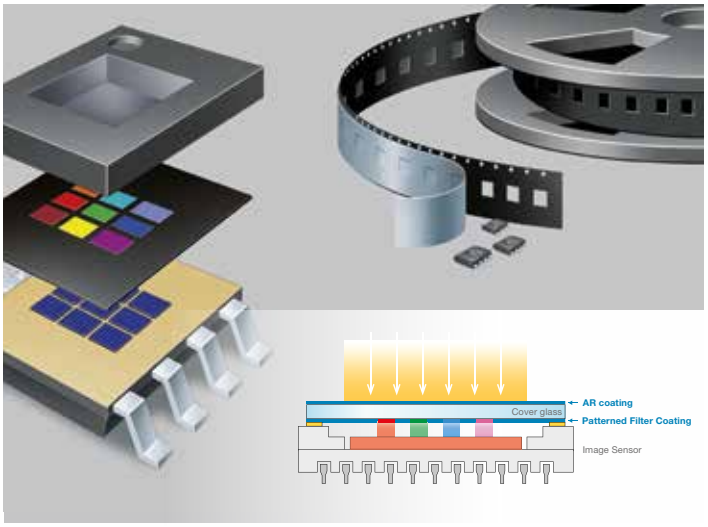
Coatings for Multispectral Sensing
Nowadays smartphones incorporate multiple optical sensors in order to measure light and color. For example, optical sensors are used to adjust the device display's back-light for better readability, power saving or for color correction in images taken with a smartphone camera.

Our customizable dielectric coatings allow the design of sophisticated filter characteristics for accurate ambient light and color measurements. These are ideal for use in mobile devices and other consumer electronics.

The capacity to pattern the filter coatings using lithography gives optical designers the possibility to tailor-make filters for multispectral measurements across several spectral bands. These range from ultra-violet to visual to the near-infrared range of the light spectrum. The dielectric filter coatings can also be deposited directly onto the sensor wafer or on to thin glass substrates for assembly into an optical sensor package.

For accurate color measurements or handheld NIR-Spectrometer applications Materion Balzers Optics has developed linear Variable Filters. The linear variable Filters provides a very high spectral resolution on the smallest footprints of commercially available image sensors. This filter technology was developed specifically for consumer applications with the aim to bring spectroscopy into Consumer Devices.

Optical sensors in today's Mobile Phones



Sensor Package for Ambient Light Sensing

Coatings for Smartphone Cameras
The excellent image quality achievable with today's high definition smartphone cameras is a result of careful design of the entire optical path within the built-in camera modules.

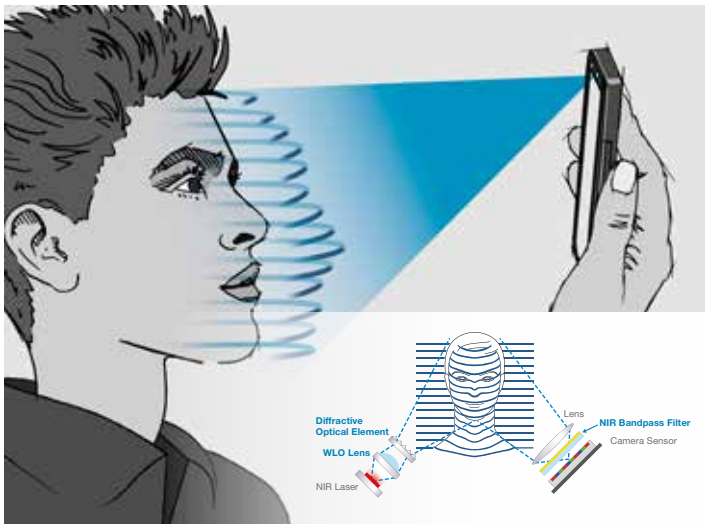
Materion Balzers Optics' anti-reflective coatings are an essential tool for optical designers to reduce unwanted reflections and ghost images inside the camera optics, producing the best imaging quality possible. Our proven Iralin™ multi-layer AR coating is the ideal solution to improve the efficiency of the camera modules. It provides thin-film deposition on anything from camera cover glasses, lenses or any other surface inside the optical path that creates unwanted reflections.

Our metallic mirror coatings with superior surface properties for imaging applications also allowed us to create periscope-style telephoto lenses. These bring real optical zoom functionality into smartphone cameras. Highly reflective Alflex™ or Silflex™ mirror coatings can even be deposited on the faces of the space-saving folded optics of zoom lens.

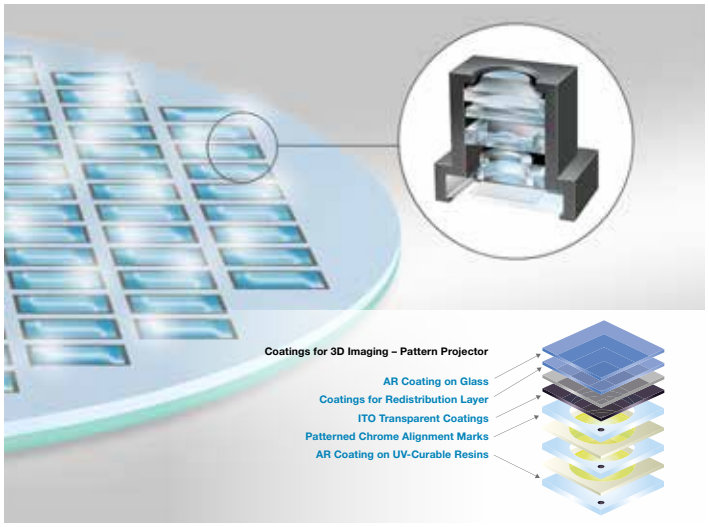
Coatings for 3D Imaging and Wafer-Level Optics
Recent technological advancements in wafer-scale manufacturing of Imaging Optics (wafer-level optics) have enabled the integration of compact 3D camera modules for gesture control and facial recognition into smartphones. Materion Balzers Optics is the sole coating supplier that has developed suitable AR coatings that reliably adhere to the epoxy-based, transparent resin materials used in wafer-scale lens production.

The sensor optics for facial recognition and Time-of-Flight (ToF) 3D imaging require best transmission performance in the range of the illumination wavelength. Outside the bandpass extraordinary blocking is required to suppress ambient illumination and provide a clearer contrast. Our near-infrared bandpass filters excel in this domain, as they feature only a minimal wavelength shift for a large field of vision. This provides the accurate levels of depth information needed for reliable facial recognition.

Materion Balzers Optics' capabilities for depositing and patterning electrically conductive coatings such as Chrome or transparent Indium-Tin-Oxide (ITO) enable customers to apply capacitive or resistive sensing electrodes on a glass substrate and into the illumination path. In 3D imaging applications this allows the integration of a sensing element that detects mechanical damage to the diffusor element of the vertical-cavity surface-emitting laser (VCSEL) illumination. This greatly minimizes the risk of eye injuries from the laser light emitted by the 3D camera module.



3D Imaging Facial Recognition



Coatings for Wafer Level Optics (3D Imaging & HD Cameras)

Augmented & Mixed Reality

Materion Balzers Optics shares the vision of painting the world in data

Thin Film Coatings in Augmented Reality
Augmented and Mixed Reality headsets have come a long way from science fiction to readily available products. With AR/MR glasses the visual perception of the real world is enhanced by computer generated graphics, offering a highly immersive user experience.

AR & MR devices are typically worn as a headset and pack an amazing amount of sensors and display components into a wearable, spectacle-style accessory.

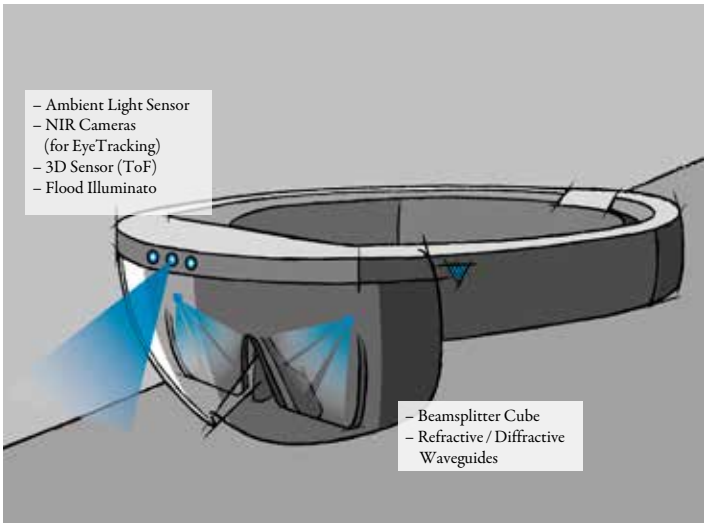
As an optical coating company, Materion Balzers Optics has been pushing the technological boundaries to bring this exciting technology to life. From the very beginning we have been working with the key players in AR & MR and have established ourselves as a supplier of key components for Augmented Reality headsets.

Coatings for NIR Cameras
AR headsets use a number of near-infrared cameras for 3D mapping of the environment, gesture and facial recognition, as well as eye tracking. Our NIR Bandpass Filters have a low angle dependent wavelength shift, providing a large field of view. These filters are an essential component in NIR based sensors and cameras, and contribute to the accurate acquisition of 3D depth information.

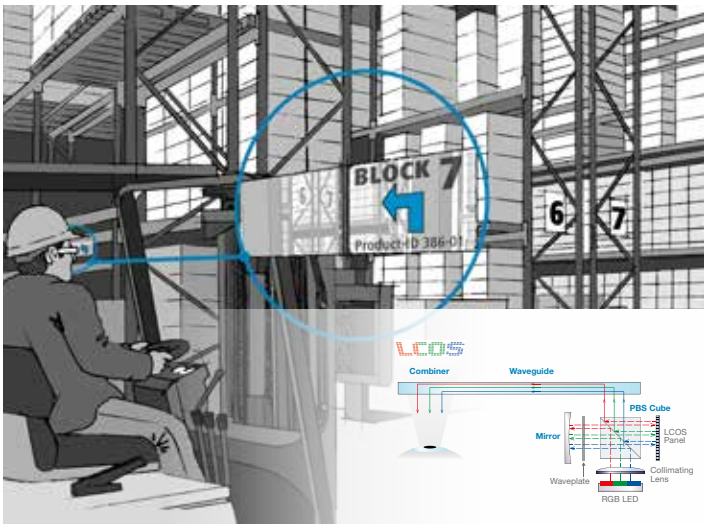
3D mapping of the environment requires active illumination of the scene in the near-infrared range. In mobile devices such as smartphones and headsets this is done with compact VCSEL laser flood illuminators. Our anti-reflex coatings, deposited onto the collimation lenses and diffusors for such illumination modules, greatly improve the overall system efficiency. They minimize overall power consumption, an important characteristic for battery powered mobile devices.

In order to safely operate the VCSEL lasers and prevent damage to the human eye the illumination modules often come with an inter-lock circuit in the optical stack of the illumination module. With our resistance controlled, patterned chrome coatings we offer a safe solution that facilitates the integration of sensing circuits into the illumination path of a 3D imaging module.

Coatings for multi- and hyperspectral Imaging
A true immersive experience is not only achieved by positioning virtual objects in the correct geometrical location, but by adapting their brightness and appearance to the environmental lighting. Ambient light sensors using our multispectral filters can be integrated into a headset to detect environmental light intensity and color temperature.



Optical Components in Smart Glasses



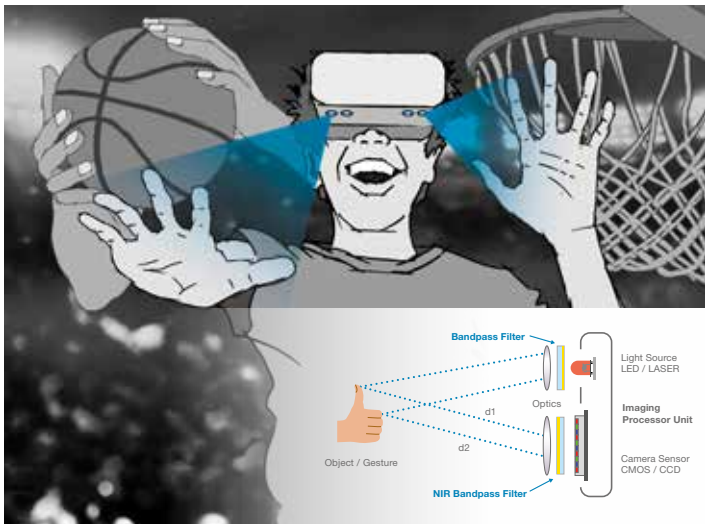
Augmented Reality in Logistics

Coatings for Near-Eye Display Combiners and Waveguides
Multiple technological approaches are being pursued for near-eye displays that combine the real-world perception with the virtual image overlay. Materion Balzers Optics has played a leading role in industrializing the manufacturing of both reflective and diffractive optical waveguides.

For reflective-type waveguides we have developed highly optimized beamsplitter designs that allow an unobscured view of the physical world while delivering crisp and high-contrast images of the digital content. Our leading-edge magnetron-sputtering platforms are the workhorses for this coating task. Compared to other evaporation systems our platform performance is unrivaled when it comes to optical performance and throughput.

As of today, near-eye displays built with diffractive waveguides are still limited in terms of field of view and efficiency. This is due to the lack of commercially available materials with sufficiently high refractive indices. Our inorganic high-index coatings are a way to extend the palette of high-index materials, creating an increase in effective field of view and in the overall efficiency of the waveguide. Our thin-film materials are compatible with a wide range of commercially available imprint materials commonly used in the manufacturing of diffractive waveguides for near-eye displays.

Components for Near-Eye Display Projection Modules
Miniaturized LCoS, DLP and LBS (laser beam steering) projection systems are shaping the AR/MR industry. Our heritage as a pioneer in projection display optics also puts us at the forefront of the AR space. Our patented 3D Wafer-Level process allows us to cost-effectively manufacture polarizing beamsplitter (PBS) cubes and RGB combiner prisms at record-setting small sizes, and in the large quantities the industry demands. For more details on optical assemblies for projection such as PBS and LightGate™ please refer to the chapter Projectors on next page.



Headset with Gesture Recognition and Eye Tracking

Projectors
Opto-mechanical Assemblies for Projection Systems

At Materion Balzers Optics we combine best-in-class thin-film coatings with highly accurate glass processing and opto-mechanical assembly. This enables us to manufacture some of the key components found in projection systems, all the way from compact consumer devices to large-scale, professional high-end projection systems.

A variety of projection displays found in modern systems, such as DLP, Laser Beam Scanning or Liquid Crystal on Silicon (LCoS) require different optical combiner types. Projection systems based on reflective light valves such as LCoS displays are driving the need for advanced polarizing beamsplitter (PBS) cubes.

Materion Balzers Optics has developed a cost-effective, high-volume manufacturing process for the production of PBS with small physical dimensions. By using automated manufacturing, we ensure consistent quality at high-volume scalability. The small form factors of the miniaturized components also allow a projection display to be added to home appliances, gaming machines and even mobile devices such as smartphones, as well as in Augmented Reality headsets.

Besides custom-designed beamsplitter coatings, additional optical coatings (e.g. anti-reflective, black chrome) can be applied to individual faces of the PBS. The patterning of selective coatings completes the customer specific PBS portfolio from Materion Balzers Optics.

For DLP-based projection systems we have set an industry standard with our LightGate™ manufacturing of total internal reflection (TIR) and reverse total internal reflection (RTIR) prisms. Our bonding technology reduces the airgap height to 2 µm and provides complete airgap sealing. This results in less long-term image degradation by preventing dust or gas from entering the gap.

LightGate™ for DLP Projectors

Color Management in High-End Cinematic Projectors

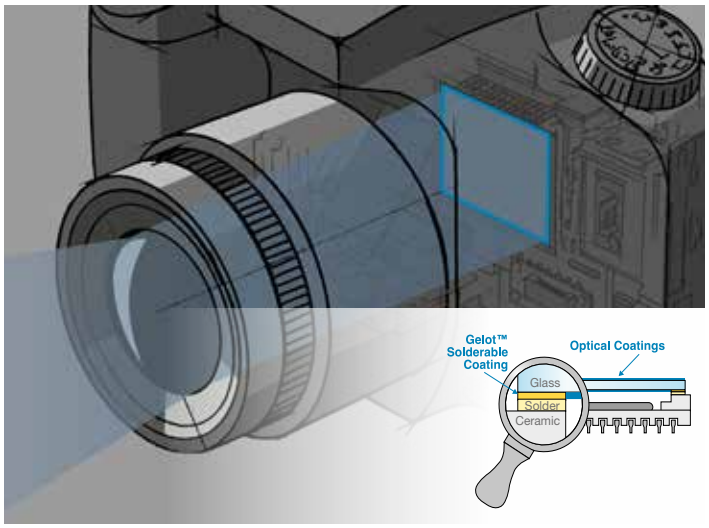
Digital Photography
Thin-Film Coatings in Digital Photography

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. Where needed additional chrome structures as optical apertures or solderable Gelot™ frames for device packaging can be offered as well. Depending on the final application the choice of substrate material and corresponding surface qualities can be very important. Materion Balzers Optics has experience with thin film deposition on a broad variety of glass substrates, such as borosilicate, filter glasses, sapphire, and others.

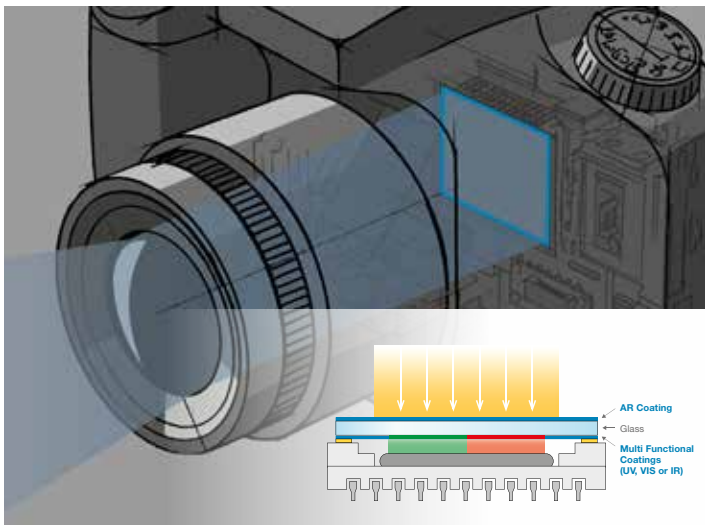
A key factor of Materion Balzers Optics' sensor lids is the superior low defect properties of the coatings as they define the quality of the device. Sealing or bonding solutions for the subsequent assembly process are an integral part of the products offered.

Patterned Dichroic Filters on Glass
Multispectral image sensors require cover glass lids with integrated color-selective dichroic filters. Materion Balzers Optics provides patterned filters for selective spectral filtering on different zones of the cover glass lids. Our patterned filters may include individual R/G/B Filters or UV and IR Filters. The individual filter zones may be masked with an opaque chrome layer containing visual alignment marks supporting wafer fabrication.

Patterned Dichroic Filters on Wafer
The spectral response of photodiodes, phototransistors or CMOS image sensors can be modified by deposition of thin-film filter coatings directly onto the silicon wafer. Several spectrally different filter coatings are deposited and patterned by photolithographic technology onto wafers with sizes up to 8 inches. Electric bondpads on the wafer are kept free from coating by means of a masking layer. The high positioning accuracy of our processes allows several spectrally different filters to be deposited onto a single sensor die.



Structured Light 3D Imaging



Digital Imaging


ZOOM LENS
f=5.7-57mm

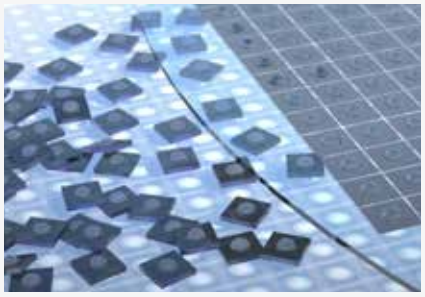
Optical Coatings & Components

The core competencies of Materion Balzers Optics are the design and manufacture 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 cus- tomer specific component characterization ensures consistent and high quality in volume manufacturing.

Page		Mobile Devices	Augmented & Mixed Reality	Projectors	Digital Photography
12	Anti-reflective Coatings	x	x	x	x
12	Anti-reflective Coatings for UV-Curable Polymers	x	x		
12	ITO and IMITO	x	x		x
12	Patterned Chrome	x	x		x
12	CrBlack™ Narrowband & Broadband Absorbers	x	x	x	x
13	Alflex™ Protected Aluminium Mirrors	x	x	x	x
13	Silflex™ Protected Silver Mirrors	x	x	x	x
13	Gelot™ Solderable Coatings	x	x		x
13	NIR Blocking Filter for Image Sensors	x			x
13	NIR Bandpass Filters	x	x		
14	Patterned Multispectral Filters	x	x		x
14	LED ColorDichroics™		x	x	
14	Dichroic Filters		x	x	
14	Dichroic Mirrors		x	x	
15	LightGate™ for DLP Projection		x	x	
15	Polarizing Beamsplitters for Wearable Devices		x	x	
15	Waveguides and Combiners		x		

Anti-reflective Coatings

Materion Balzers Optics offers a range of different anti-reflection coatings to cover a large field of applications. These include multi-layer AR-coatings designed for maximum efficiency in the visible and near-infrared range. Our Iralin™ family can be shifted either into the UV range, down to 350 nm, or into the near-infrared range, up to 1100 nm. Duolin™ is available for the visible range plus an additional laser line. This can be any conventional low power laser. Supertriolin™ covers a broad range of the spectrum between 450 nm up to 1100 nm. The bandwidth can even be extended, at the cost of slightly higher reflectivity. All these coatings can be used with most commercial glass substrates.

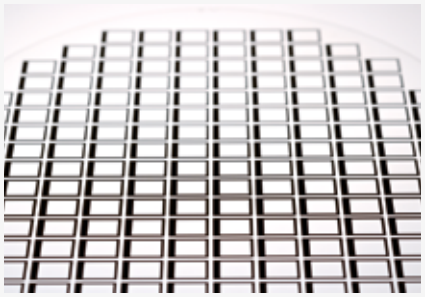


Anti-reflective Coatings for UV-Curable Polymers

Materion Balzers Optics has developed highly efficient and environmentally stable multi-layer AR coatings. These are specifically made for deposition on UV-curable polymers used for lens replication in wafer-level optics manufacturing. The multilayer AR designs are optimized for the near-infrared range and are partially transparent in UV-range to facilitate curing under UV light. All our AR coatings for UV-curable polymers have been extensively tested for their environmental stability and durability.

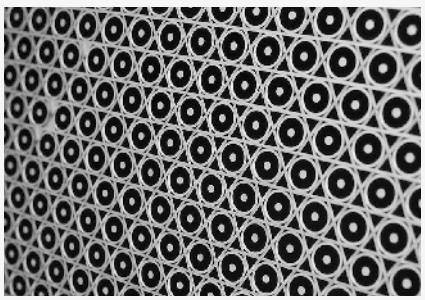
ITO and IMITO

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 – an Index Matched ITO (IMITO). The Materion Balzers Optics ITO is very dense and remarkably free of pinholes.



Patterned Chrome

Chrome patterns on planar components are widely used in the optical and semiconductor industry. Materion Balzers Optics puts strong emphasis on high resolution, low defect patterns. These can also come in combination with low defect functional coatings. In most applications the Chrome transmittance and reflectance will be low, with the edge performance of the Chrome pattern playing an important role.



CrBlack™ Narrowband & Broadband Absorbers

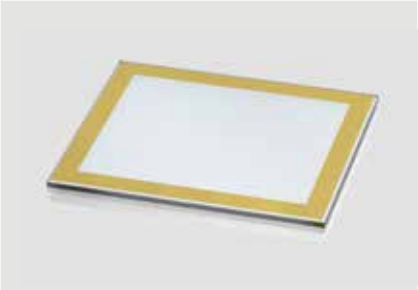
In almost any demanding optical setup minimum scattered light is required for each part of the optical setup. This includes pinholes, apertures for lenses, filter arrays or cover lids. Materion Balzers Optics' CrBlack™ is the ideal solution for this purpose. CrBlack™ is an optical black coating, characterized by high absorption and low reflection in the VIS and near-infrared range. This product is manufactured in the clean room to achieve a minimum defect/pinhole level. CrBlack™ can also be (micro)patterned by lift-off techniques, and the color impression and optical density can be adjusted to specific customer requests.

Alflex™ Protected Aluminium Mirrors

These versatile aluminum mirrors show excellent stable performance across a wide range of applications. The Alflex™ standard mirror coating has proven itself many times over due to its hardness and durability. The Alflex™ product line incorporates a broadband and a color-optimized narrowband mirror. Depending on the application it is generally insensitive to polarization and angle of incidence over a wide range. All types of Alflex™ are equipped with a protective layer against tarnish and oxidation.

Silflex™ Protected Silver Mirrors

Silflex™ MK II is a broadband, high-reflectivity mirror coating offering unprecedented performance and durability. It is virtually insensitive to polarization and angle oincidence, yet it maintains more than 98% reflectivity from the visible to the far infrared range.



Gelot™ Solderable Coatings

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 micro-lenses, or to provide electrical contact on conductive coatings such as Indium Tin Oxide (ITO).

NIR Blocking Filter for Image Sensors

High performance digital image capture with CMOS or CCD sensors requires efficient blocking of the near-infrared range (NIR) in a broad wavelength range. The edge shape of such a filter depends very much on the application and is therefore 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.

NIR Bandpass Filters

3D imaging applications such as Gesture Recognition, Structured Light and Time-of-Flight (ToF) depth sensing require best transmission performance when it comes to illumination wavelength (Laser or LED source) over a wide field of view. Outside the pass-band an extraordinary blocking is required to suppress sun- and ambient light for better signal-to-noise ratio of the 3D sensor. Our bandpass filters, designed with extremely low wavelength shift over a large AOI, are ideally suited for 3D imaging applications.

Patterned Multispectral Filters

Multispectral image sensors require cover glass lids with integrated color-selective dichroic filters. Materion Balzers Optics provides patterned color filters for selective spectral filtering for different zones of cover glass lids. Such dichroic filters may include RGB, NIR, and PAN filters or monochrome UV or IR filters. Materion Balzers Optics offers different processes for arranging several spectral filters next to each other on one single component.

LED ColorDichroics™

Materion Balzers Optics LED ColorDichroics™ dichroic filters/mirrors are used to efficiently transmit and/or reflect the light from light emitting diode (LED) sources. These dichroic filters/mirrors are designed to combine light emitted from different color LEDs into one beam. The thin film coatings of these LED ColorDichroics™ are specifically optimized for random polarized light. Both the high reflection and the high transmission wavelength ranges are specifically adapted to LED spectral emission characteristics.

Dichroic Filters

Materion Balzers Optics´ shift-free color filters are dielectric coated interference filters which transmit certain regions of the visible spectrum and reflect others with the highest possible degree of efficiency. The filters are manufactured with the Materion Balzers Optics proprietary sputter technology which makes them extremely stable despite changing operating temperatures and harsh environmental conditions.

Dichroic Mirrors

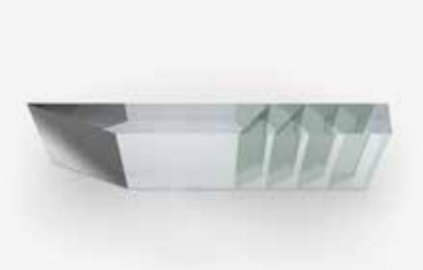
Dichroic color separating mirrors are dielectric interference mirrors which reflect certain regions of the visible spectrum and transmit others with a high degree of efficiency. Dichroic mirrors are designed for incidence angle of 45° and virtually absorption free, highly reflecting and with optimum color saturation. Filters are mechanically and chemically resistant without fading and aging.

LightGate™ for DLP Projection

New abilities have enabled Materion Balzers Optics to improve the standards in LightGate™ manufacturing (aka. TIR- and RTIR-Prisms). Our bonding technology reduces the airgap height to 2 µm and provides complete airgap sealing, resulting in less long-term image degradation by preventing dust or gas from entering the gap. Precision blackening technology allows accurate positioning and patterning of the absorptive paint. Envisioning a growing market, all processes have been automated to meet high quality standards at large production volumes.

Polarizing Beamsplitters for Wearable Devices

Materion Balzers Optics understands the considerations of lumens, weight, and size when it comes to optical systems for wearable devices. We have therefore developed technologies to miniaturize the Polarizing Beamsplitter (PBS) without compromising its excellent light throughput characteristics. Chamfer-free manufacturing and our edge-to-edge coating procedure reduce the non-functional area to zero. This improved utilization of substrate surface also enables smaller component design. Patterned or uniform black chrome coating may be added to eliminate unwanted stray light.



Waveguides and Combiners

We also understand the constraints of lumens, weight, and size when it comes to Near-Eye Displays (NEDs). Stray light and ghosting provide additional challenges thanks to system design trade-offs, increased by manufacturing limitations. Materion Balzers Optics has established thin film coating and substrate manufacturing technology to break those limitations, because we have reinvented the entire process flow for thin film coated assemblies.

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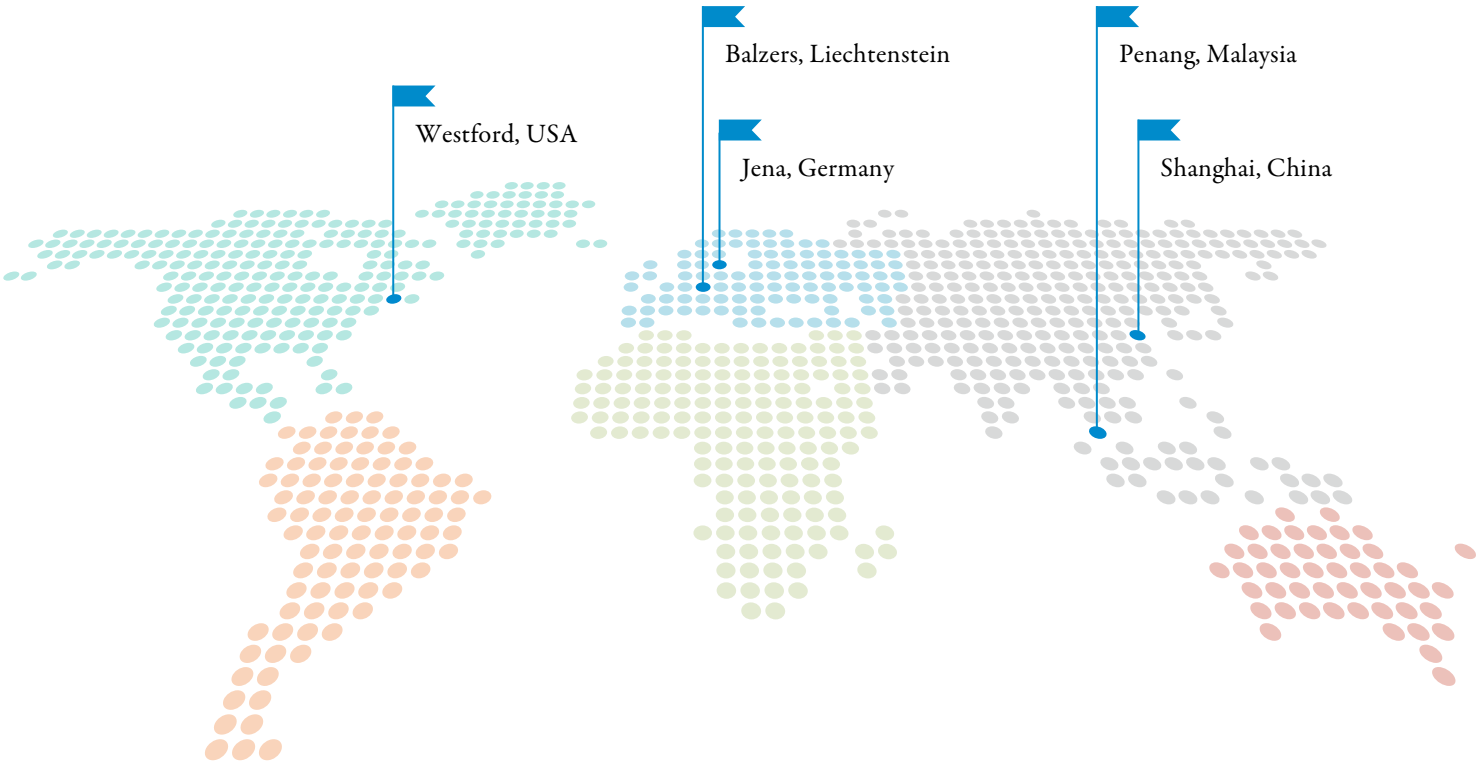

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