Industrial Applications
Optical Solutions for Industrial Sensing & Automation Devices
It was at the suggestion of reigning Prince Franz Josef II of Liechtenstein that Dr Max Auwärter – in cooperation with Emil G Bührle – founded the company Balzers in the village of Balzers, in the Principality of Liechtenstein, in 1946. At that time, the technology of vacuum deposition was still in its early stages. With very few exceptions, high vacuum systems were being used only in research laboratories.

Due to the lack of commercially available high vacuum equipment, Balzers had to design and build most of the required vacuum components, equipment and systems necessary for the development of its novel and proprietary thin-film coating processes.

Today, Optics Balzers is a globally recognized leader in customized optical thin-film coatings and components for the photonics industry. The company possesses broad and in-depth know-how in optical thin-film coating processes, complemented by sophisticated patterning, glass bonding and sealing, and further processing capabilities necessary for producing optical thin-film coated components up to optical subassemblies. Highly experienced and skilled development and engineering teams collaborate closely with customers to develop innovative solutions meeting their specific requirements. The combination of these capabilities and skills places Optics Balzers at the forefront of markets in the photonics industry such as Automotive, Biophotonics, Laser, Space & Defence, Lighting & Projection, Industrial Applications, and Sensors & Imaging.

The continuous innovation, quality improvements and additions of expertise and production sites in Liechtenstein, Germany and Malaysia by Optics Balzers, will continue to support customers’ innovative product development efforts with Optics Balzers as a trusted, reliable, and innovative partner.
Industrial Applications

Our optical components and coatings guide, reflect, select and alter light for almost all customer specific applications in the processing industry.

We develop a close working relationship with our clients, creating a better understanding of customer needs. This deep insight enables our engineering team to deliver powerful, customized, comprehensive solutions for a surprisingly large number of different market segments and applications. Our coated optical components enable photonics to work for industrial automation, analytical and measurement instruments, and countless other applications.

Industrial Internet of Things

**Sensor Technology**
- Distance Measurement
- Laser Scanners
- Barcode Reading
- Waste Sorting
- Sun Simulation Systems
- Positioning Systems

**Cameras**
- Inspection Cameras
- Traffic Control
- Fabric Automation
- Retail Systems
- Food Industry
- Robotics

**Colors**
- Measurement Systems
- Multispectral Imaging
- LED Systems
- Textile Industry
- Printing / Painting Industry

**UV Applications**
- UV Illumination Systems
- Wafer Inspection
- Semiconductor Industry
- UV Curing
- Spectrometers
- Defect Inspection Systems
Optical Coatings & Components

**Alflex™**
The versatile aluminum mirrors show excellent, stable performance in a wide range of applications. The Alflex™ standard mirror has proven itself many times over with its hardness and durability. The Alflex™ product line incorporates both 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.

**Silflex™**
Mirrors with a Silflex™ coating can be used over a broad spectral range with reflectivity greater than 94.5% from 350 – 600 nm and greater than 98% from 450 nm to over 12 μm. Their proprietary silver-based coating makes them highly reflective from 0° to 45° and virtually insensitive to polarization. Protective dielectric coatings make them resistant to tarnishing and oxidation. Silflex™ is the coating of choice for many astronomy applications. Plus, they have minimal phase distortion, so they are useful for ultrafast-pulsed applications with Ti:Sapphire and other lasers.

**Goldflex™**
All types of network and optical sensing devices use light, which needs to be routed by reflectors. To optimize this, Goldflex™, a novel, gold based, metallic reflector is recommended. This is characterized by excellent reflectivity and the lowest polarization dependence through all telecom bands in the near infrared range. In addition to outstanding environmental durability, this reflector increases the quality and efficiency of network devices. Optics Balzers offers a broad range of bonding techniques, based on experience in a wide range of applications and volume production. Goldflex™ coated glass tested for 1000 hours after Telcordia GR-1221.

**Diflex™**
Optics Balzers provides the best choice of broadband high reflectivity mirrors. Diflex™ mirrors are characterized by extreme reflectivity, low scattering and a wide acceptance range for the angle of incidence. The consistent and high reflectivity for any polarization covers the wavelength range between 320 nm and 2000 nm. Diflex™ mirror coatings are composed of metal-oxide layers. They withstand harsh environmental conditions and can be cleaned repeatedly.
CrBlack™ Coatings (VIS, VIS-NIR)
CrBlack™ is an optical black coating, characterized by high absorption and low reflection in the VIS and near IR range as well as a low defect / pin hole level. Color impression and optical density can be adjusted at the request of the customer.

TopFlex™ 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 dirt-repellent. The coating exhibits good adherence to the substrate and other coatings, and is highly resistant to various forms of cleaning processes.

AR-Reflective Coatings
Optics Balzers offers a variety of broadband, anti-reflective coatings to cover a large field of applications: for example Iralin™, a multilayer AR coating designed for maximum efficiency in the visible range. The Iralin™ family can be shifted either into the UV range down to 350 nm or into the near infrared up to 1100 nm.

Micro Optics
Optics Balzers offers a range of different anti-reflective coatings for microlenses and rod lenses for endoscope applications with dimensions down to 1 mm. Other functional coatings can also be provided.

Iralin™ 185L – Duolin™ – Supertriolin™
Optics Balzers offers a range of different anti-reflective coatings to cover a large field of applications: multilayer AR coatings designed for maximum efficiency in the visible range. Our Iralin™ family can be shifted either into the UV range down to 350 nm or into the near infrared up to 1100 nm. Duolin™ is laid out for the visible range plus an additional laser line, which may be any conventional low power laser. Supertriolin™ covers a very broad range of the spectrum between 450 nm up to 1100 nm. The bandwidth can be extended as well, at the cost of slightly higher reflectivity. All these coatings are usable for most commercial glass substrates.
Thin-Film Coatings on Plastics
Optics Balzers offers customized coating solutions and components using all major optical plastics. Depending on the requirements, Optics Balzers applies state-of-the-art coating technologies such as IAD evaporation or sputtering to customer supplied substrates and to full turnkey components.

ITO Coatings on Glass and Plastic Substrates
Conductive and Transparent
Premium quality, indium tin oxide (ITO) coatings with high transmission and low electrical resistivity are based on dedicated sputtering processes. The ITO layer may be supplemented with dielectric layers for index matching or to obtain anti-reflective properties for the coating. Applications include surface heated cover glasses to prevent condensation or EMI shielding to improve the quality of the sensor.

Gelot™ 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 microlenses down to a diameter of 1mm.

NIR, IR-Blocking Filters
The NIR and IR-Blocker from Optics Balzers effectively remove unwanted infrared radiation produced by broadband light sources. A dielectric oxide coating design provides excellent transmission over the entire visible spectrum, without distorting the spectral emission of the light source in the visible spectrum. Filters can be optimized according to the spectral characteristic of the source and are particularly well suited to use in applications with high thermal loads or where NVIS compliance is required (e.g. AMLCD modules in avionics applications).

UV/IR-Blockers
UV/IR-Blockers from Optics Balzers effectively remove damaging ultraviolet and unwanted infrared radiation produced by broadband light sources. Filters are optimized for metal halide lamps and particularly well suited to use in applications where high thermal loads exist.
Optical Coatings & Components

**Cold Mirrors**
Cold mirrors reflect visible light and allow the transmission of infrared radiation. In general, these mirrors are used at an angle of incidence of 45°, thus reducing the temperature load of a light source by heat-light separation. Plane cold mirrors are an additional component of a high-performance heat management system.

**Conversion Filters**
The conversion filters from Optics Balzers match the color temperature of a light source to individual requirements, whilst maintaining good color rendition and high luminance. With conversion filters, customers can set their light sources to the right color temperature.

**Calflex™ – IR-Blocking Filters**
Some designs of medical lights require additional heat reduction. The Calflex™ filters from Optics Balzers reflect infrared radiation whilst transmitting visible light and allowing differing emission behaviors of various light sources. Calflex™ filters allow maximum transmission in the visible waveband without changing the colorimetric characteristics of the light source.

**Calflex™ 3000 SP – IR-Blocking Filter**
Heat protection filters of type Calflex™ 3000 SP are high performance blocking filters for IR radiation. These filters are produced with the magnetron sputtering technology from Optics Balzers, providing very dense coatings with excellent optical stability both at high temperatures and under harsh environmental conditions. Calflex™ 3000 SP is automotive OEM qualified and meets the ECE white requirements.

**High Transmission / Narrow Tolerance Dichroic Color Filters and Mirrors**
Shift-free color filters from Optics Balzers are dielectric coated interference mirrors, which transmit certain regions of the visible spectrum and reflect others with the highest possible degree of efficiency. The mirrors are manufactured with the Optics Balzers proprietary sputter technology, which makes them extremely stable in changing operating temperatures and harsh environmental conditions.
Optical Filters for UV-Applications
Optics Balzers provides bespoke, all-dielectric UV-filters from 200nm to the VIS range. Bandpass filters, edge filters and various other filter types are available on request. Blocking levels as low as OD5 can be achieved. The blocking is realized mainly by reflection, which yields good irradiation resistance. The all-dielectric filters exhibit extreme environmental stability and offer a long durability.

Steep Edge Bandpass Filters
Optics Balzers bandpass filters excel by steep transition between blockband, passband, and high passband transmittance (> 95%). Our sophisticated filter designs are optimized according to the requirements of the application. Typically, the filters provide broadband blocking (> OD5) from the UV to the NIR range. Even in the case of narrow bandpass filters (e.g. FWHM 2 nm), the filters combine high passband transmittance with a deep broadband blocking level.

Narrow Bandpass Filters in the VIS and NIR range
Optics Balzers narrow bandpass filters are characterized by high passband transmittance, accurate center wavelength, and steep filter edges between pass- and blockband, and broadband blocking range. With a typical passband width between 2 and 20 nm, and a blocking depth of OD5, the filters provide an excellent signal-to-noise ratio. In manifold applications, the filters are used to select the appropriate part of the spectrum either from a light source or in front of a photodetector.

NIR-Bandpass Filters SP
NIR Bandpass Filters SP are used in various optical sensor applications for blocking both ambient visible and longer wavelength infrared light whilst selectively transmitting the signal light of a specified near infrared (NIR) spectral range used for the sensing application. NIR Bandpass Filters SP are key components to achieve very high signal-to-noise ratios in optical sensing or distance measuring applications. This superior signal-to-noise performance can enable either accurate distance measurement with lower signal light power or higher sensitivity and increased precision with standard signal light levels.

VIS, NIR and SWIR-Bandpass Filters
VIS, NIR and SWIR bandpass filters with standard or self-blocking filter design for spectral sensing and imaging combine wide blocking and high passband transmittance. They feature extreme stability in harsh environments and are customized for Si, InGaAs or HgCdTe sensor applications.
SoFi™ Solar Conversion Filters
Solar conversion filters increase the performance of solar simulators by converting the radiation of a technical light source into a spectral distribution that is equivalent to sunlight. With Optics Balzers solar conversion filters, “better than class A” according to IEC 60904-9 is achievable for different lamp types (e.g., Xenon or Metal Halide). In addition to these international standards, Optics Balzers is also able to meet customer-specific spectral requirements in the UV, VIS and NIR spectral range.

Transflex™ – Neutral Beamsplitters
Splitting occurs uniformly on the entire mirror surface. The beamsplitter can therefore be installed at any location of a light path under an angle of 45° without interfering with the optical imaging. Neutral beamsplitters comprise an absorption-free dielectric coating. On Request, all neutral beamsplitters are available with a broadband anti-reflective coating on the rear.

Dichroic Beamsplitters
Optics Balzers dichroic beamsplitters separate the incoming light into a highly reflected and a transmitted component. The transition zone can be reduced to approx. 3% of the transition wavelength for random polarized light. The all-dielectric interference filters are deposited by plasma-assisted processes and show extreme environmental stability. The filter dimension, spectral characteristic and angle of incidence can be customized.

LED Color Dichroics™ – Dichroic Filters/Mirrors for LED Applications
Optics Balzers LED ColorDichroics™ are used to transmit and/or reflect the light from light emitting diode (LED) sources efficiently. These dichroic filters/mirrors are designed to combine light emitted from LEDs of different colors 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.

Beamsplitters
Beamsplitters – either as cubes or as plates – can be used to separate incoming light into two intensities, polarizations or wavelength ranges. For analytical purposes a portion can be separated from the incident beam or a selected wavelength can be extracted from or coupled into the optical path. The variety extends from simple plates to sophisticated beamsplitter assemblies. Such components are typically customized and can include custom IP.
**CoatingPlus™: More Than Just Coating**

Sophisticated optical thin-film components and subsystems require additional process steps beyond coating.

### Patterning

Optics Balzers offers patterning solutions for high quality optical components. Depending on the product and its applications, various patterning techniques such as photolithography, laser ablation or masked coatings are available to meet a broad range of customer requirements for feature sizes and shapes. The lift-off technology allows the deposition of filter arrays onto cover glasses or directly onto photodetector wafers.

#### Photolithography

Photolithography capabilities such as lift-off and etching techniques allow the production of precision patterned coatings and submicron gratings. The photolithography techniques are specifically used in producing masked cover lids for MEMS devices and CCD/CMOS image sensors.

- **Lift-off**
- **Wet etching**
- **Reactive ion etching**

#### Masked Coatings

Precision etched metal masks attached to the substrates provide patterned coatings during the coating process. While the achievable feature sizes and shapes are limited with direct masking, patterning can be applied with almost any coating process and coating material, also with processes that require higher temperatures.

- **Substrate**
- **Metal mask**
- **Coating**

### Marking

Application-critical thin-film optical components may require unambiguous marking and labeling, either on the substrate surface or on the coating. The pattern can be generated according customers’ specific needs.

### Laser Ablation / Marking

Laser ablation offers novel opportunities in the patterning of optical filter coatings. By using adapted processes for each specific application, high precision patterns can be produced on the coated components. Laser ablation offers excellent flexibility for customized shapes and patterns together with high speed processing capabilities.
Bonding and Sealing

In various applications, thin-film optical components need to be precision mounted on other components such as sensors or subassemblies. Optics Balzers offers epoxy bonding patterns as well as solder seed layers with a hermetic sealing quality.

**B-stage Epoxy**  
A B-stage epoxy frame on the lid facilitates the assembly process: The epoxy is provided in the dry state and is cured by simple tempering at 100°C – 130°C. The epoxy is applied to the lids in a way which allows for precise patterns and high cosmetic standards. Further adhesive solutions can be developed on customer’s demand.

**Gelot™ Solderable Coatings**  
Light sensitive semiconductor devices require a packaging including a transparent glass lid. Soldering is the assembly technology which provides best hermeticity values of such packaging. Gelot™ solderable coating gives the glass a surface which has good adhesive properties for soldering such as gold or palladium. Gelot™ is applied to the lid as a frame pattern with a clear aperture.

Varnishing

**Blackening**  
High-accuracy dispensing technologies enable continuous or selective blackening of optical parts and complement the low reflection, high absorption coating portfolio from Optics Balzers.

Subassembly

Optics Balzers offers customized optical subassemblies to support its customers’ ever increasing demands. We develop individual solutions for and together with our customers.
Glass Processing

Efficient light management requires ultra precise surfaces. Therefore, Optics Balzers is ever extending the limits of its polishing and glass handling capabilities. Our experience is based on the manufacturing of products where exceptional surface quality is essential. Further, Optics Balzers applies semiconductor cutting technology on coated glass wafers. This is the way to provide cost effective high volume components with small dimensions.

Wafer Dicing and Scribing

The economical production of thin-film coating components often requires substrate wafer based processing. With advanced dicing and scribing capabilities, Optics Balzers manufactures thin-film components to customer specific shapes and sizes with high precision.

Grinding & Polishing

The performance of any optical surface depends to a high degree on the grinding and polishing process. Optics Balzers constantly develops its in-house capabilities for these critical manufacturing steps. Based on our long-standing experience, we are able to identify the most economical solution for your specific application.

Faceting

Faceting helps to avoid the chipping of the workpiece edges in the subsequent manufacturing flow as well as in the final application. Our capabilities include manual as well as fully automated faceting for various workpiece geometries. Standard 45° chamfers as well as other shapes (e.g. C-shape) are available.

Volume Production

The utilization of high-tech singulation equipment paired with sophisticated manufacturing processes allow for a cost-effective mass production of optical parts with small physical dimensions.

Packaging and Handling

Customized packaging and shipping ensures top quality in surface protection and cleanliness during transportation and in subsequent process steps at the customer’s site.

Development Partners

Optics Balzers relies on strong partnerships. Therefore our competence centers in Liechtenstein and Germany count on the close cooperation with scientific institutes, universities, and colleges. Those partnerships allow our teams of engineers to develop innovative solutions, tailored to the individual requirements of our customers.
Applications
The Industry is using more and more optical sensors and camera systems in various fields:

- Color Measurement
- Light Curtains
- Logistics
- Machine Vision
- Range Finder
- Traffic Control
- Wafer Inspection
- Warehousing
- Waste Sorting
- Water Analysis

Color Measurement

Light Curtains

Logistics

Machine Vision
Headquarters

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