

## Projection Lenses for Headlights



GLASS | PMMA | PC

# STANDARD: FREEDOM IN DESIGN

Our key message is likely to interest all automotive engineers and optical designers: DOC3D®, DOCFast® and DOCLight® are three advanced processes developed by Docter Optics that permit economical industrial-scale production of virtually any optical components – no matter how complex their surface geometries.

## Free-Forms

Docter Optics produces free-form lenses with a wide variety of integrated optical functions to meet specific customer needs.

## DOCLight®

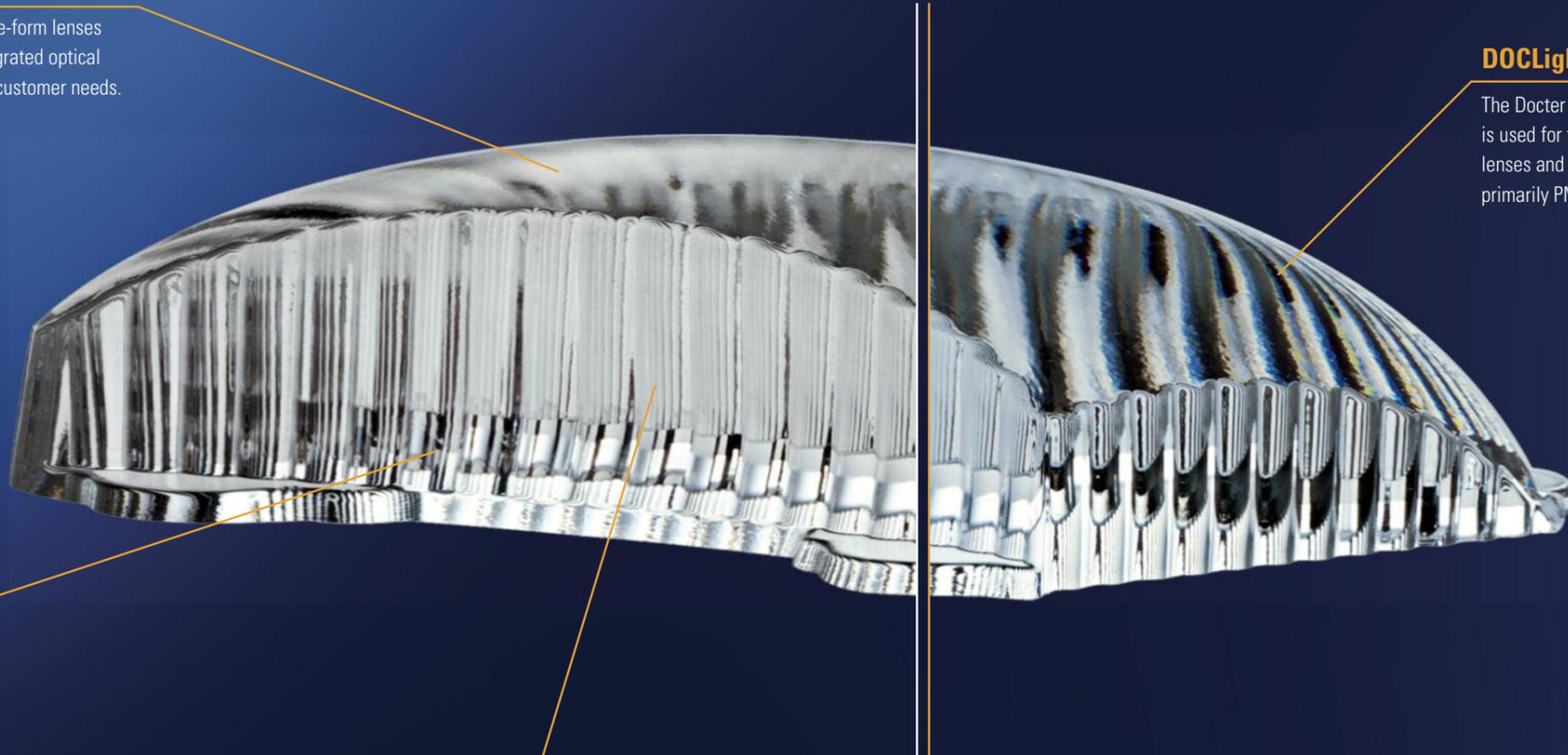
The Docter Optics DOCLight® process is used for the production of free-form lenses and aspheres of various polymers – primarily PMMA and PC – instead of glass.

## Light Sources

No matter what the desired “look”, Docter Optics can deliver projection lenses with the ideal optical design for any light source – LED, HID or halogen.

## DOCTAN®

DOCTAN® is exceptionally brilliant optical glass that was developed by Docter Optics especially for use in the harsh automotive environment. DOCTAN® delivers outstanding performance in terms of thermal behavior, strength and UV stability. In addition, recycling friendliness and economy also help to make DOCTAN® the choice of preference for automotive applications.



# STATE-OF-THE ART: HEADLED®

Docter Optics presented the world's first free-form lens for use in LED projection headlights at the SAE World Congress back in 2007. With the development of its HeadLED® components, Docter Optics has now introduced a new industry benchmark: integration of various light functions in a single optical component to achieve unique packaging and unsurpassed efficiency when it comes to assembly.

## Efficient Assembly

Today's full-LED headlights can consist of innumerable individual parts. With its HeadLED® technology, Docter Optics has made it possible to achieve a significant reduction in the number of components required. The reason for this is of course that HeadLED® makes it possible to incorporate complex illumination functionality into headlight lenses.

## Design

HeadLED® is a high-quality Docter Optics solution that enables automotive and headlight designers to create multi-functional free-form lenses with a new look.

## Shutterless Low-Beam Function

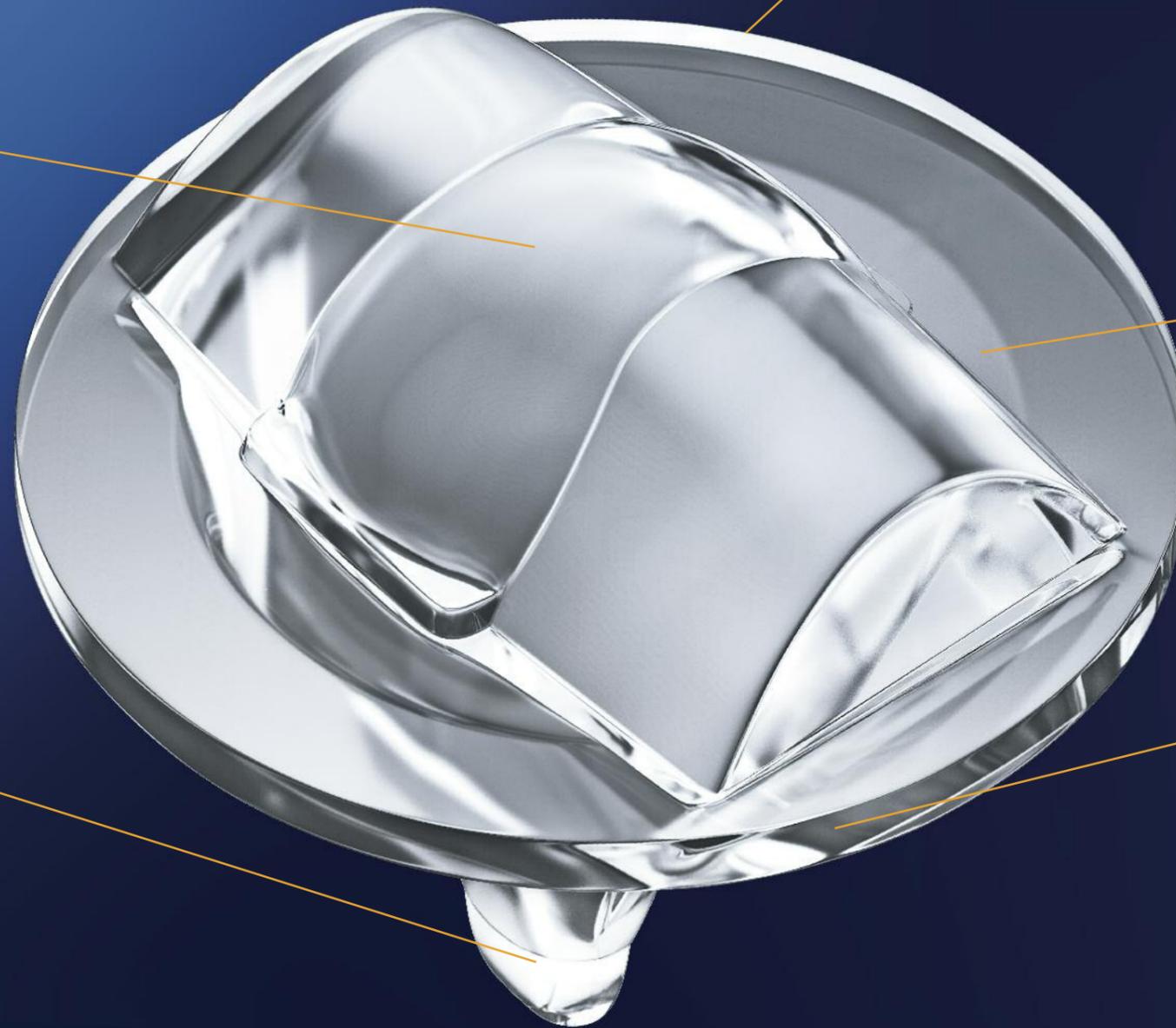
HeadLED® supports complete low-beam functionality without the use of shutter mechanisms. This not only makes it possible to do without costly mechanical solutions, but also permits substantial weight savings.

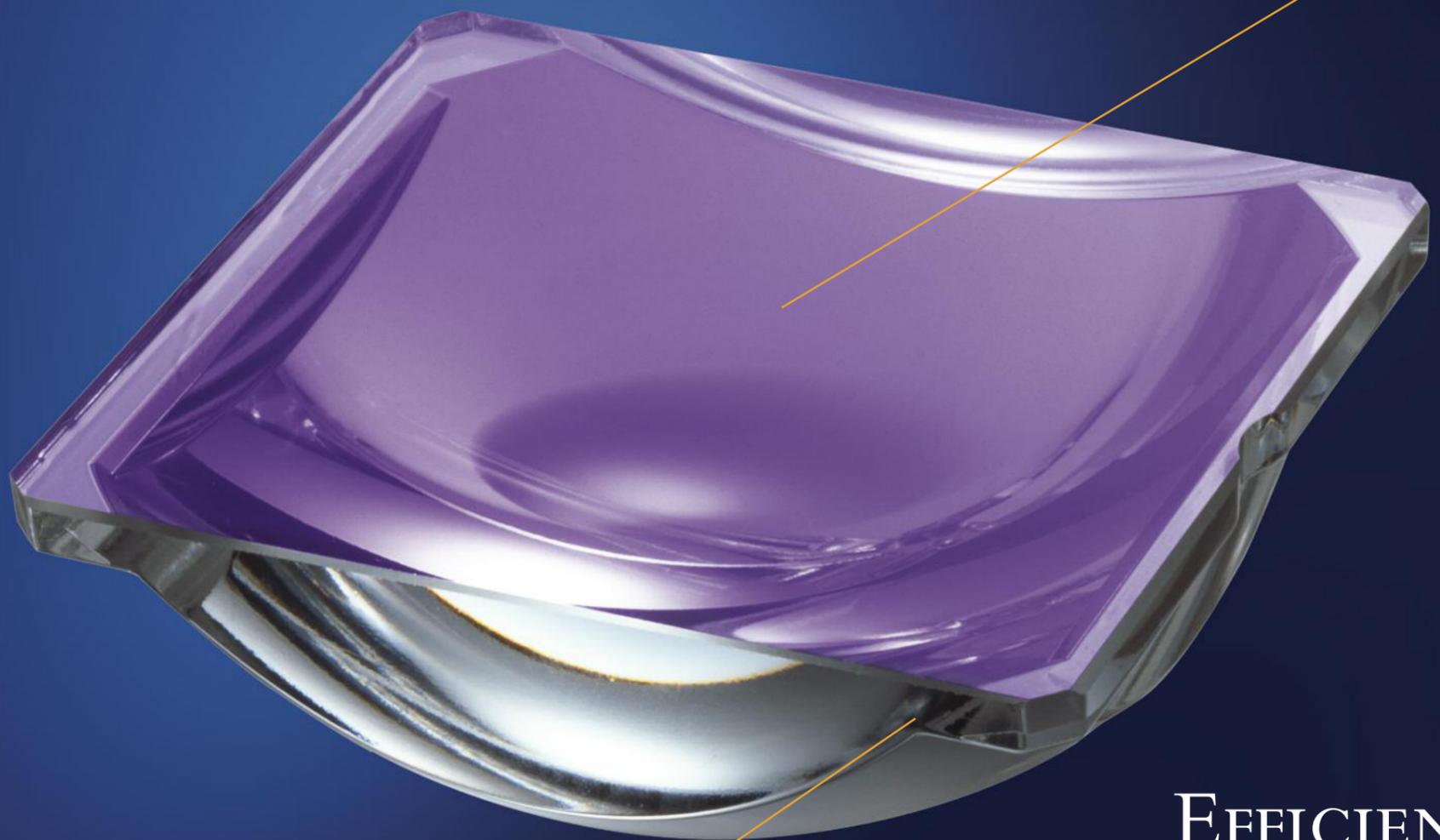
## Cut-Off-Line

HeadLED® technology allows Docter Optics to integrate the desired cut-off line into the optical design. The beam is shaped directly by the complex surface geometry designed into the lens.

## Shortest Installation Depth

HeadLED® now allows automobile designers to achieve the best possible installation depth to open up entirely new possibilities in automotive design.





#### DOCResist® UV and Heat-Protection Coating

IR filters can be a decisive factor when it comes to reducing the installation depth of headlights. Developed by Docter Optics especially for headlight heat and IR management, DOCResist® is a coating that sends much of the heat produced by the light source to the rear of the headlight architecture. As a result, lenses can now be installed closer to the cover lens of the headlight. At the same time, IR filter coatings provide a unique look that emphasizes the overall impression made by the vehicle.

#### DOCEdge® Variable-Angle Aspheres

DOCEdge® offers three benefits without any loss of optical functionality: components take up less space; they can be installed closer together; and simpler retention means are required. In addition, DOCEdge® can in many cases make assembly of headlights more economical. Plus DOCEdge® aspheres and lenses can be produced with virtually any geometric angles.

## EFFICIENCY: DOCEdge® PLUS DOCRResist®

Free-form lenses are not the only new development in modern projection headlights. Other possibilities include non-round aspheres and lenses in the form of trapezoids, rhombus, parallelograms as well as simple squares and rectangles, all of which are of course available with all functions known from round aspheres. Projection headlight components that are exposed to extreme conditions and must meet special requirements in terms of heat and UV management can be coated in house with DOCResist®, a special projection headlight coating developed by Docter Optics that not only provides effective protection but also looks good too.

# ADDED BENEFIT: OPTOSURFACES

The legal and regulatory requirements that manufacturer and developers of projection headlights have to meet are just as varied as the designs used by the automotive industry for individual vehicles. And that explains why Docter Optics offers solutions\* that meet so many different requirements and make each projection headlight unique.

## Surface Textures

Textured surfaces, which are standard for all Docter Optics aspheres or free-form lenses enable projection lenses with state-of-the-art light distribution and cut-off-line performance.

## Microstructures

Various types of microstructures make it possible to achieve a diffuse effect to enhance the cut-off line and support stressless driving. Microstructures are included as standard options in the design and production of Docter Optics products.

## Microcylinders

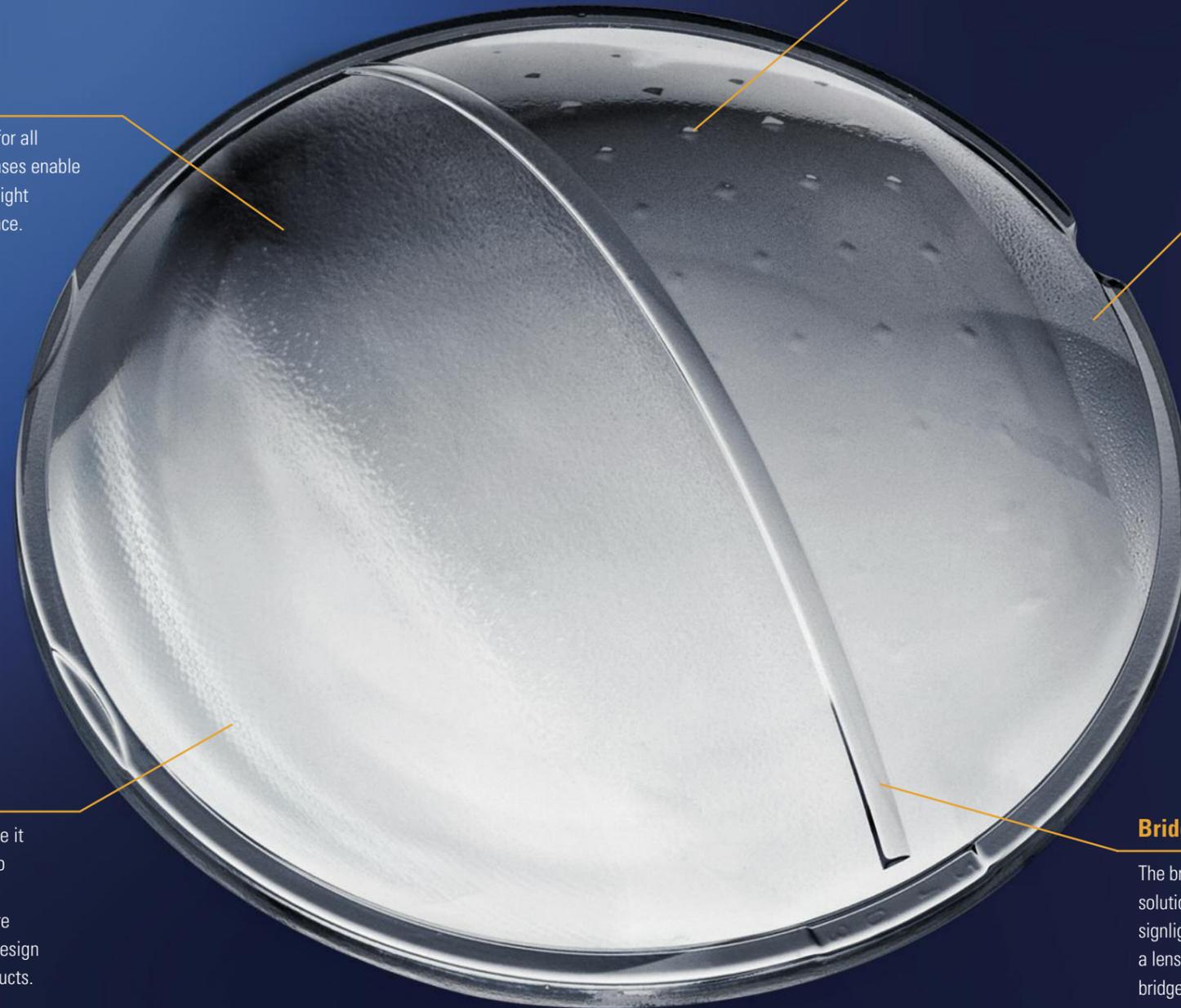
Microcylinders serve to enhance the performance of overhead signlight functionality built into projection headlights.

## Overhead Signlight Surfaces

Overhead signlight functionality can be designed into projection lenses produced by Docter Optics. At the same time, Docter Optics can supply lenses designed to take into account the specific characteristics of different light sources as well as any other customer or country-specific requirements.

## Bridge Cylinders

The bridge solution is one of several available solutions that can be used to integrate overhead signlight functionality into the optical design of a lens or asphere. The location and size of the bridge are chosen as a function of the respective technical and illumination requirements.



\*) The asphere above is intended exclusively to illustrate different surface geometries and is not a representation of an actual lens.

# BENCHMARKS: MATERIALS AND METHODS

Optical designers need benchmarks, and those shown below are the most important for automotive design applications. In this context, we would also like to point out that the polymers used by Docter Optics for DOCLight® production have been chosen for their best-of-class performance. Docter Optics offers an array of outstanding solutions for LED, HID or halogen light sources to meet the specific needs and requirements of the company's customers worldwide.

