KOPP GLASS

UV LONGPASS GLASS

portfolio

PORTFOLIO INDEX

Click index item to jump to page.

INTRODUCTION

In response to the growth of UV technologies and applications, Kopp Glass developed a unique portfolio of proprietary glass compositions that offer high transmission across the UV and visible spectrum.

The clear borosilicate glass features high transmission across the UV and visible spectrum with tailorable transmission cut-offs ranging from 240 nm to 400 nm. Our UV glasses are designed to meet common industry requirements, but our research and engineering team can also create custom glass compositions that meet strict transmission requirements for target UV spectra.

The advantages of choosing Kopp's specialized UV compositions are evident in the mechanical, optical, thermal, and chemical properties of the glass. Along with these optic material properties, UV lighting system designs should consider the operating environment, temperature range, light output, and durability requirements.

This portfolio dives into the properties of Kopp's UV Longpass Glass and how they come together—with optical design—to create custom glass lens solutions that enable the cutting-edge, transformative advancements only possible with UV light.

UV APPLICATIONS

Kopp's UV Longpass Glass is ideal for a wide range of applications that require high transmission in critical UV regions.

UVC	UVB	UVA
200-280 nm	280-320 nm	320-400 nm

APPLICATIONS

- Decontamination and disinfection of surfaces
- Water disinfection
- Sterilization
- DNA analysis
- Fluorochemistry
- Mercury detection
- Sulphur detection

- Bacterial identification
- Fluorescence
- Medical imaging of cells
- Medical diagnosis
- Drug discovery
- DNA sequencing
- Detection of food contamination
- Nucleic acid visualization
- UV curing

Source: https://www.laserfocusworld.com/lasers-sources/article/14068301/ultraviolet-leds-illuminate-the-scientific-landscape

SUPERIOR DURABILITY

In harsh, demanding applications, Kopp's UV Longpass Glass is preferred due to its superior durability and resistance to abrasion, chemical corrosion, UV degradation, and thermal shock.

This composition can also be heat strengthened to further improve mechanical durability. Kopp's UV Longpass Glass performs in demanding operating environments where other materials—like some plastics—might not be up to the challenge. Plastics like silicone or polycarbonate may become damaged after long term exposure to chemicals or UV radiation.

UV GLASS CUSTOMIZATION

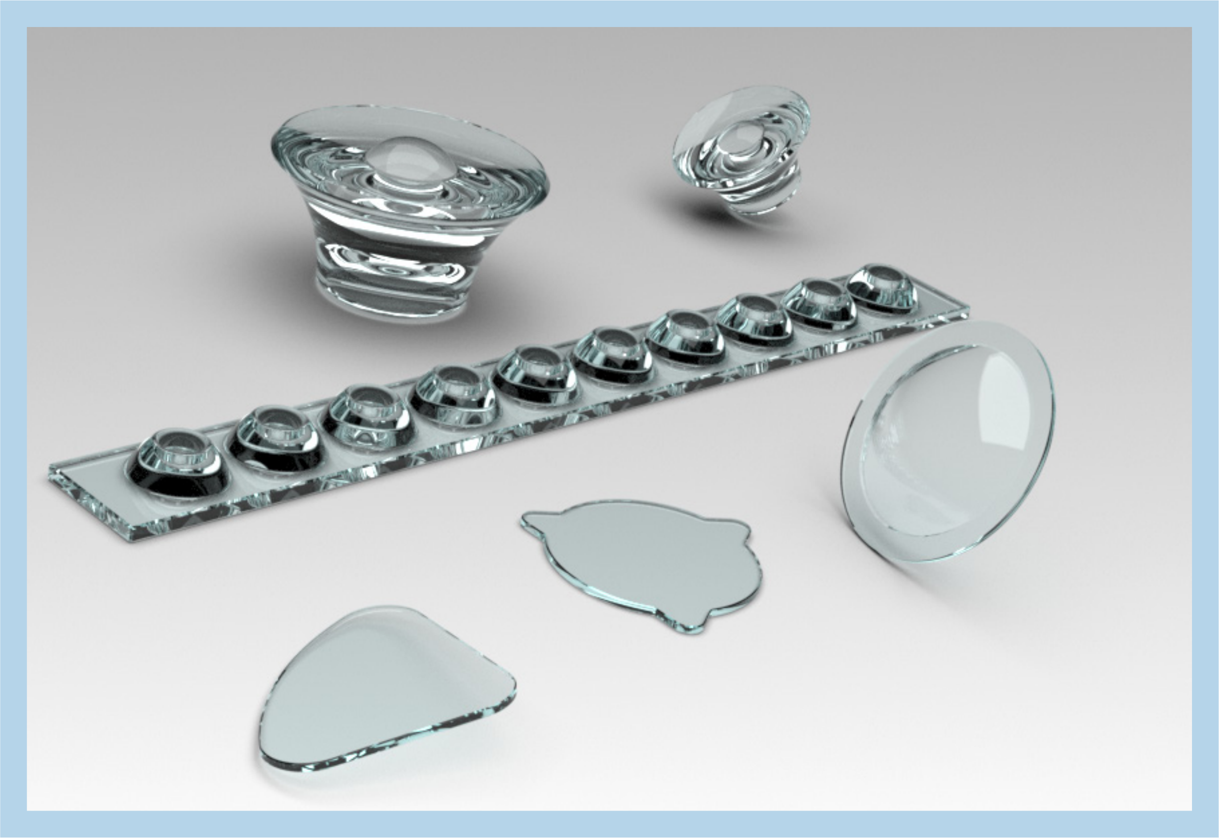
Kopp's UV Longpass Glass is customizable for emerging technologies and applications to meet environmental challenges. Our UV Longpass Glass can be customized to your specifications, application, and UV light output goals. Our research and engineering team formulates glass compositions to meet strict transmission requirements for target UV spectra—with tailored cut-on wavelengths that range from UVA to UVC.

To determine the best-suited composition for your application, we recommend collaborating with our technical team early in the lighting design phase to understand how material properties impact product design.

SUPPLY FORMAT

Kopp's UV Longpass Glass was designed to be molded into optics that enhance an the performance of UV light sources. While all of our filter glasses are available in 6" - 6.5" unfinished square blanks, our glass molding capabilities allow for truly customizable lens designs.

We can create complex contoured shapes that are traditionally difficult and expensive to achieve through machining. With our UV Longpass Glass, engineers have the flexibility to design optics that can meet demanding light output requirements for new or existing lighting systems.



MECHANICAL PROPERTIES

The mechanical properties of Kopp's UV Longpass Glass are important to consider in relation to the application and operating environment in which a UV lens or optic will be implemented. The physical properties of glass determine its ability to resist damage. Some applications require optics that are resistant to pressure, abrasion, and impact.

Choosing a reliable material is crucial for successful product design and function. While the primary purpose of glass lenses and optics is to optimize light output, they also function to protect UV light sources. A durable material like Kopp's UV Longpass Glass will ensure a long lifetime of protected and enhanced light output.

DENSITY	2.46 g/cm^3 *or* 153.04 pcf
YOUNG'S MODULUS	9.80E+06
POISSON'S RATIO	0.109
MODULUS OF RUPTURE	7780 psi
SHEAR MODULUS	4.42E+06
IMPACT RESISTANCE	The impact resistance of Kopp's UV Longpass Glass will vary based on the geometry of the part, how it is fixtured, the type of impact involved, among other parameters. Consult Kopp for further information.

Modulus of Rupture was determined based on ASTM C158. Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio were determined based on ASTM C1259. Density was determined based on ASTM C693.

CLICK HERE
to jump to property definitions.

ABRASION RESISTANCE

MISSING: Abrasion Resistance

OPTICAL PROPERTIES

The optical properties of glass—which determine how glass interacts with light—are imperative in the product design process. The specific glass composition should be selected before optical designing begins as the optical properties of that composition will influence how an optic can be designed.

Kopp's UV Longpass Glass offers and maintains exceptional transmission, even in harsh environments and conditions. It is important to note that optical design can enhance transmission. The transmission data available in this portfolio reflects flat pieces only. It represents the baseline transmission of the material that can then be enhanced through optic design and optimization.

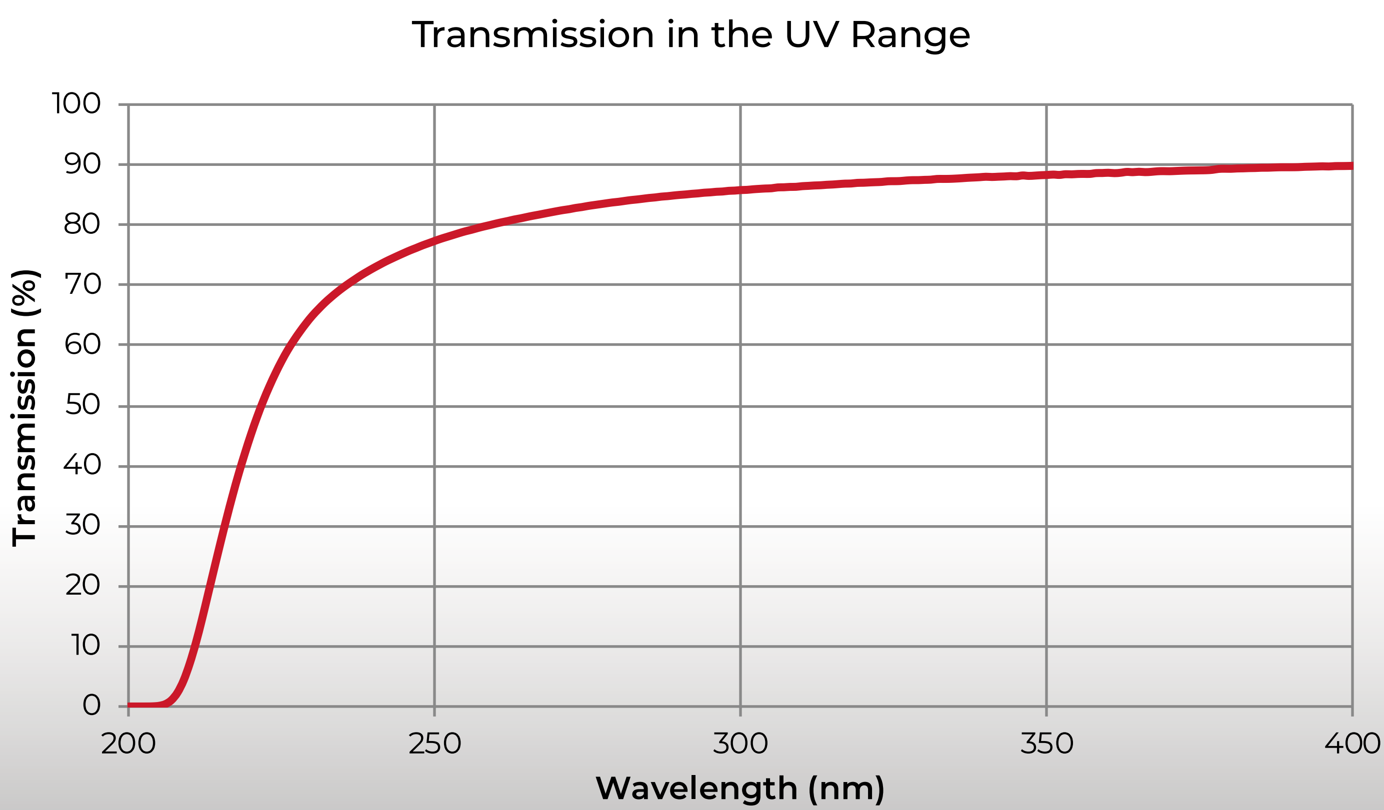
INDEX OF REFRACTION 1.51

Index of Refraction was determined by using a refractometer according to ASTM C1648.

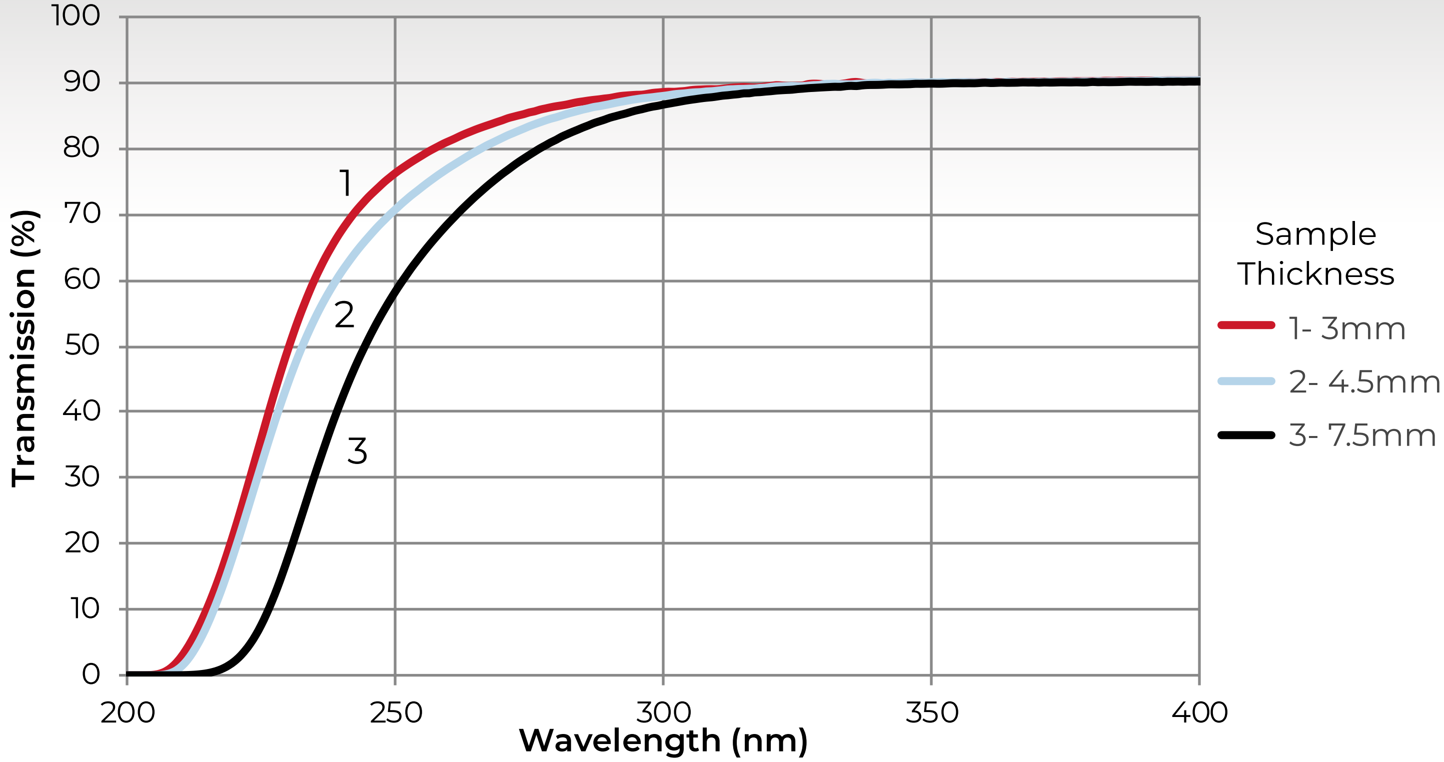
TRANSMISSION

WAVELENGTH	275	300	350
TRANSMISSION	> 75%	> 80%	> 85%

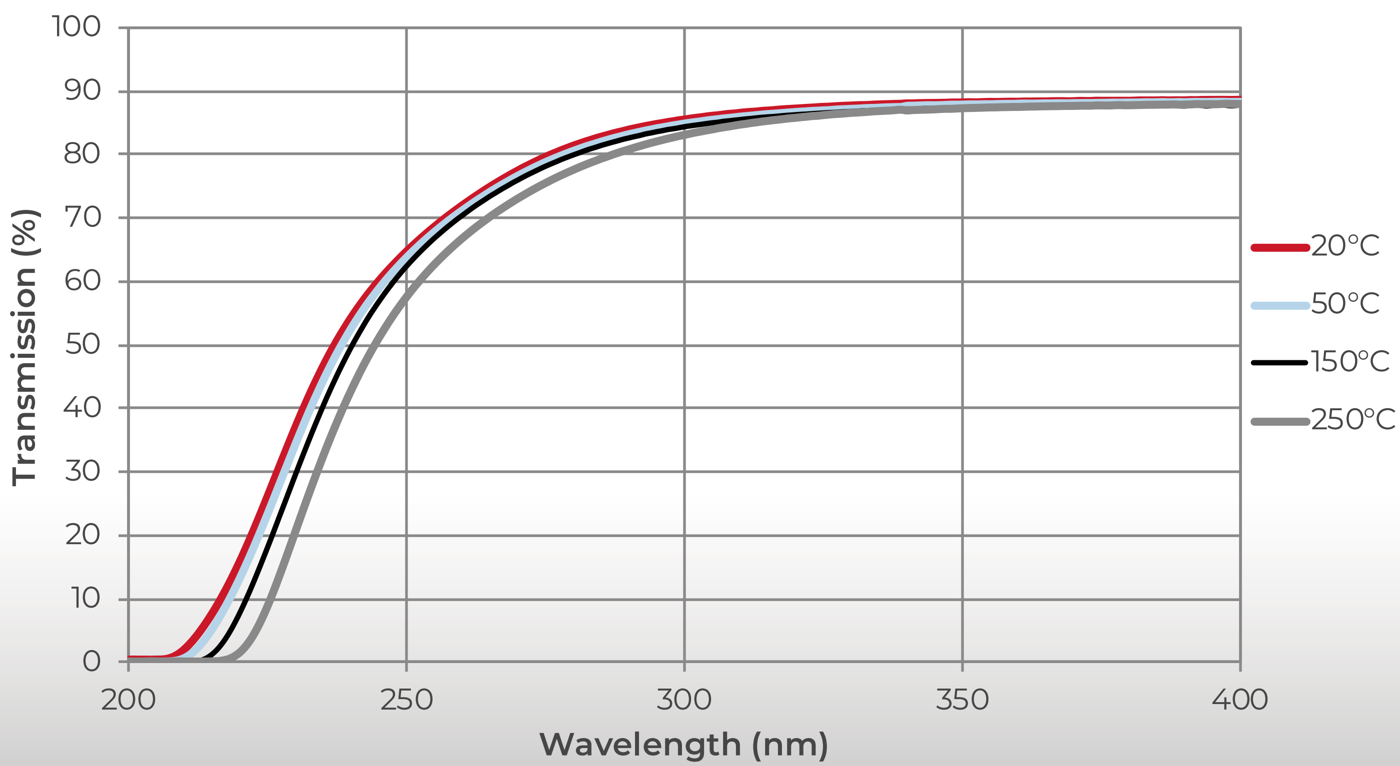
Testing samples were 2mm thick.



Transmission in the UV Range



Transmission in the UV Range Dependence on Temperature



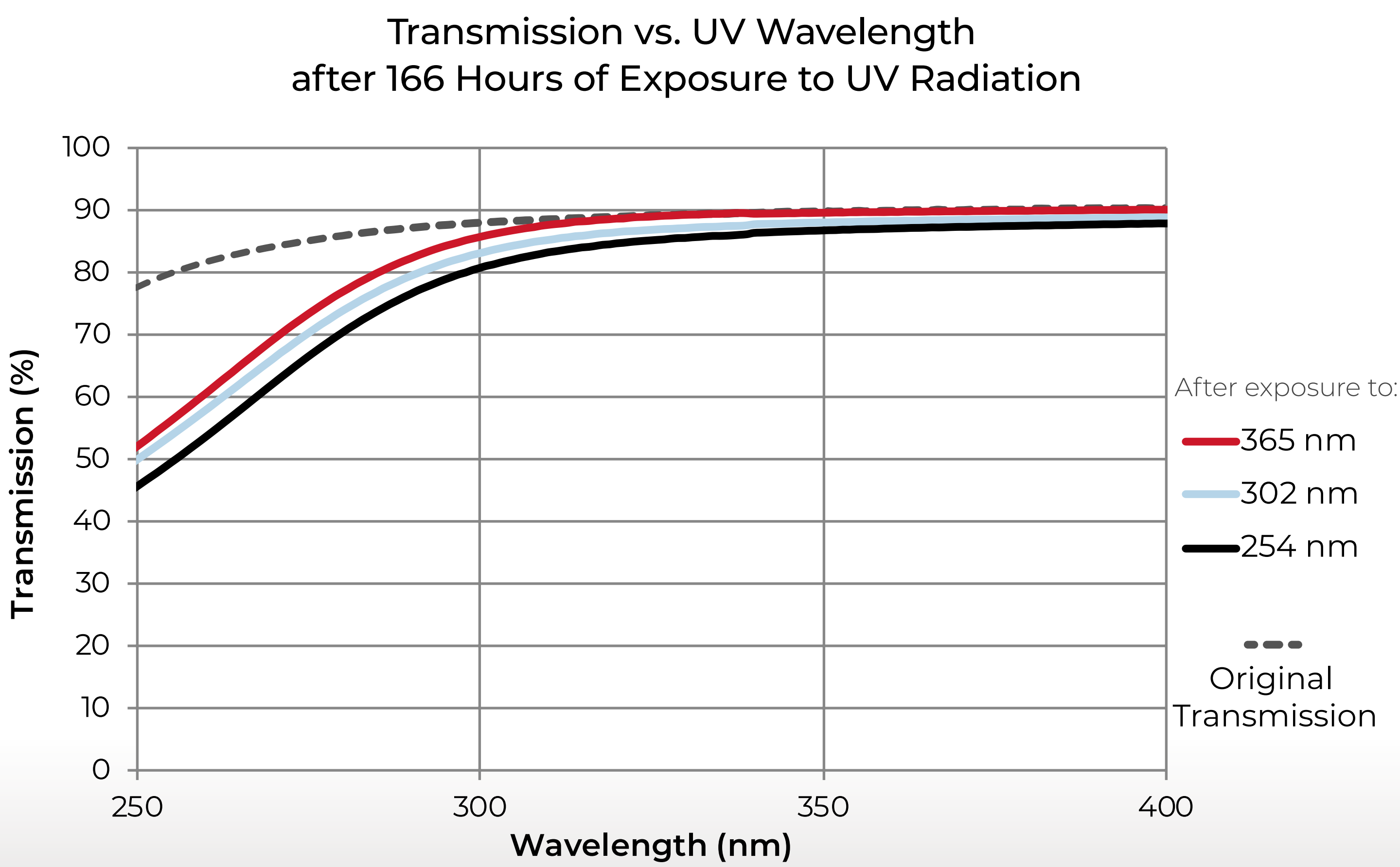
Testing samples were 4.5 mm thick.

UV TRANSMISSION LIFETIME

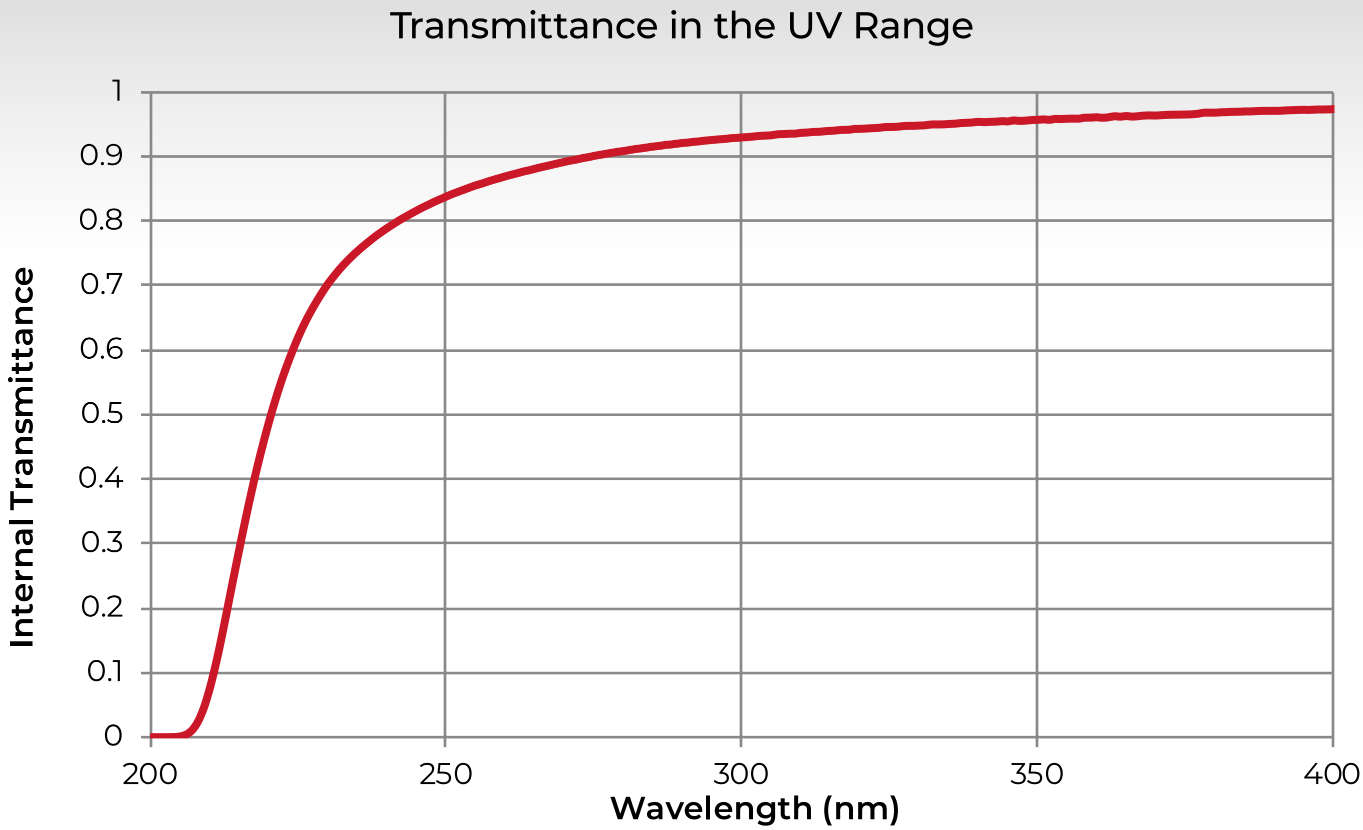
When considering transparent materials, the effect of UV radiation on the material is important. Many materials—like some plastics—may become discolored or damaged on the surface after longterm exposure to UV light. This then damages the efficacy of the device impacting light output.

In our testing, samples of our UV Longpass Glass were exposed separately to UV radiation at wavelengths of 254nm, 302 nm, and 365 nm for 166 hours. The lamp irradiance measurements were consistent during the entire experiment time frame to mimic how the glass may be used in application. While we recorded nominal losses of transmission (0-3%) after the period of exposure, the glass "healed" after exposure ended. Once exposure ends, transmission of the glass returns to its original value. Unlike some plastics, no permanent, physical damage occurs at the surface of the glass.

Involve Kopp early on in the lighting design process so we can help you choose the best glass composition for your application.



TRANSMITTANCE



Testing samples were 2mm thick.

ABBE CONSTANT

MISSING: Abbe Constant

DISPERSION

MISSING: Dispersion

INDEX OF REFRACTION VS. WAVELENGTH

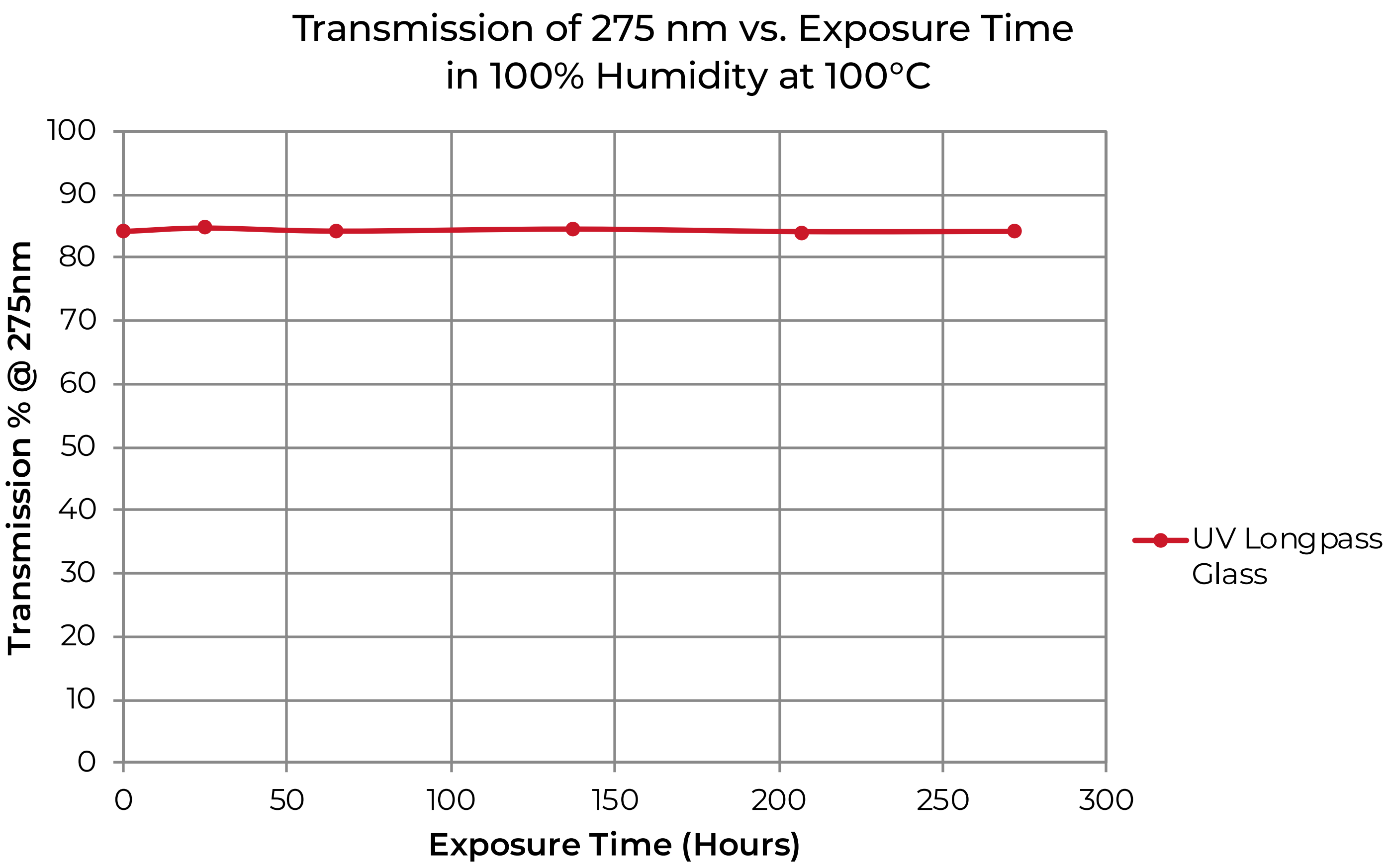
Dispersion was determined using the ASTMC1648 testing standard.

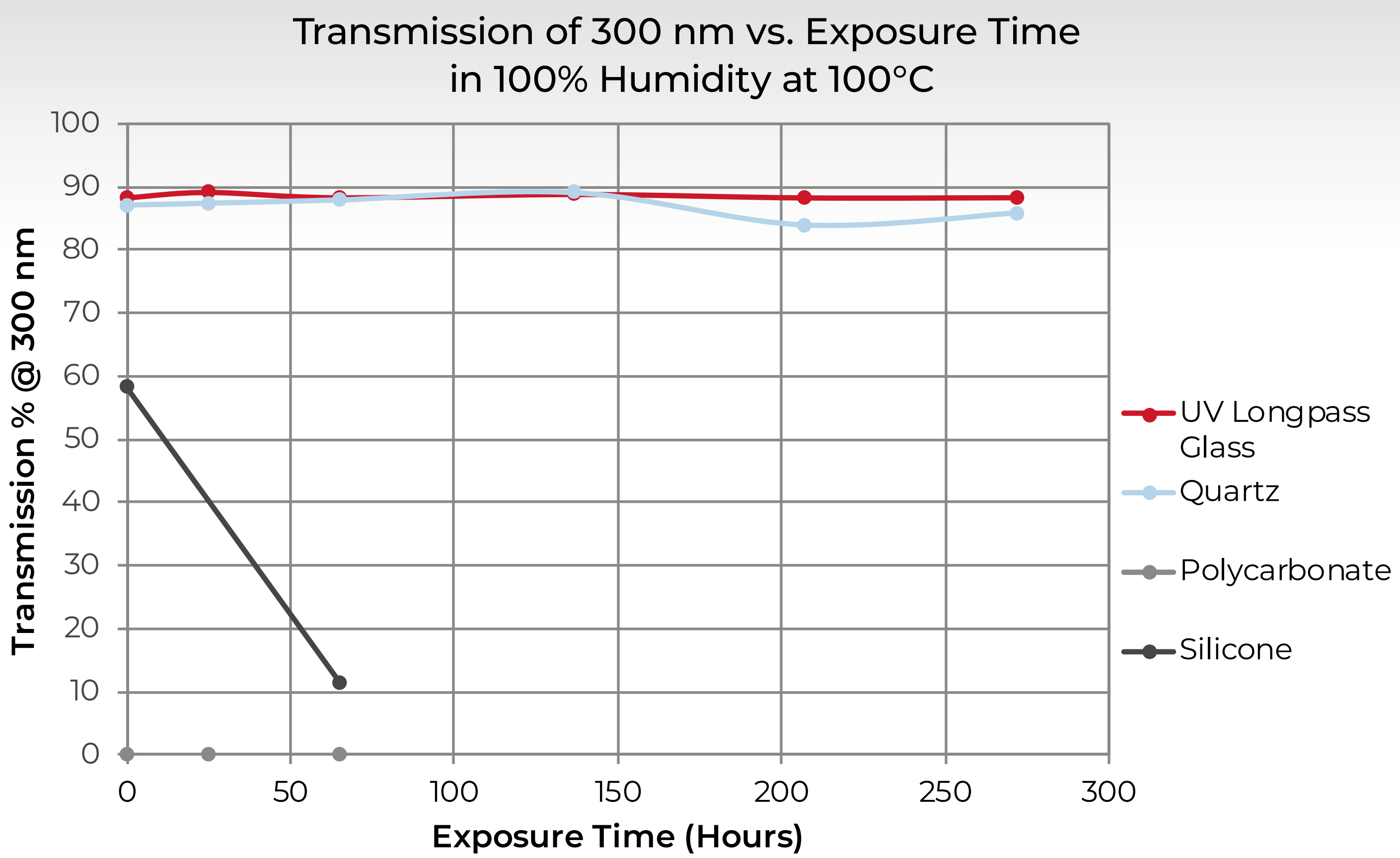
CLICK HERE
to jump to property definitions.

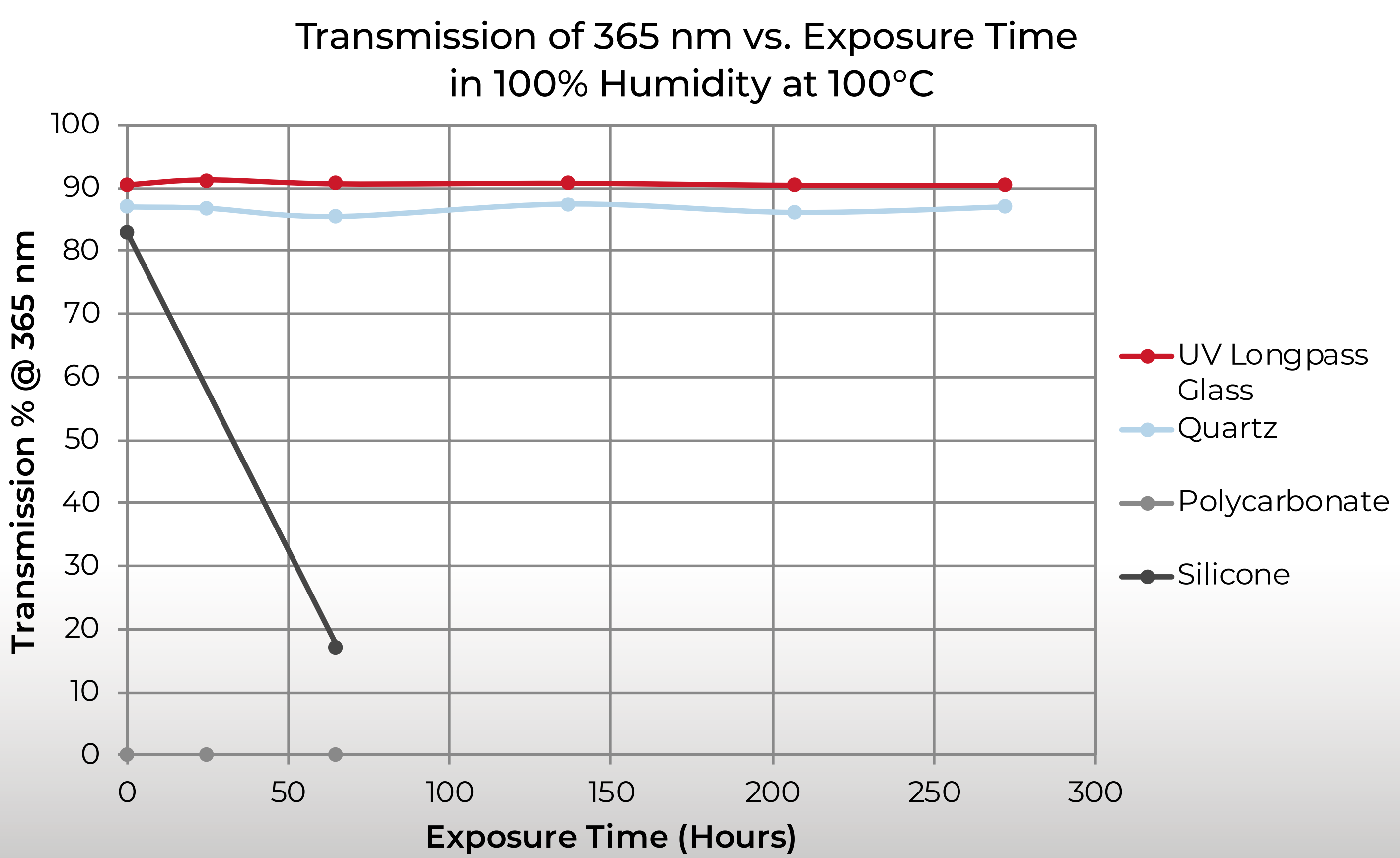
HUMIDITY RESISTANCE

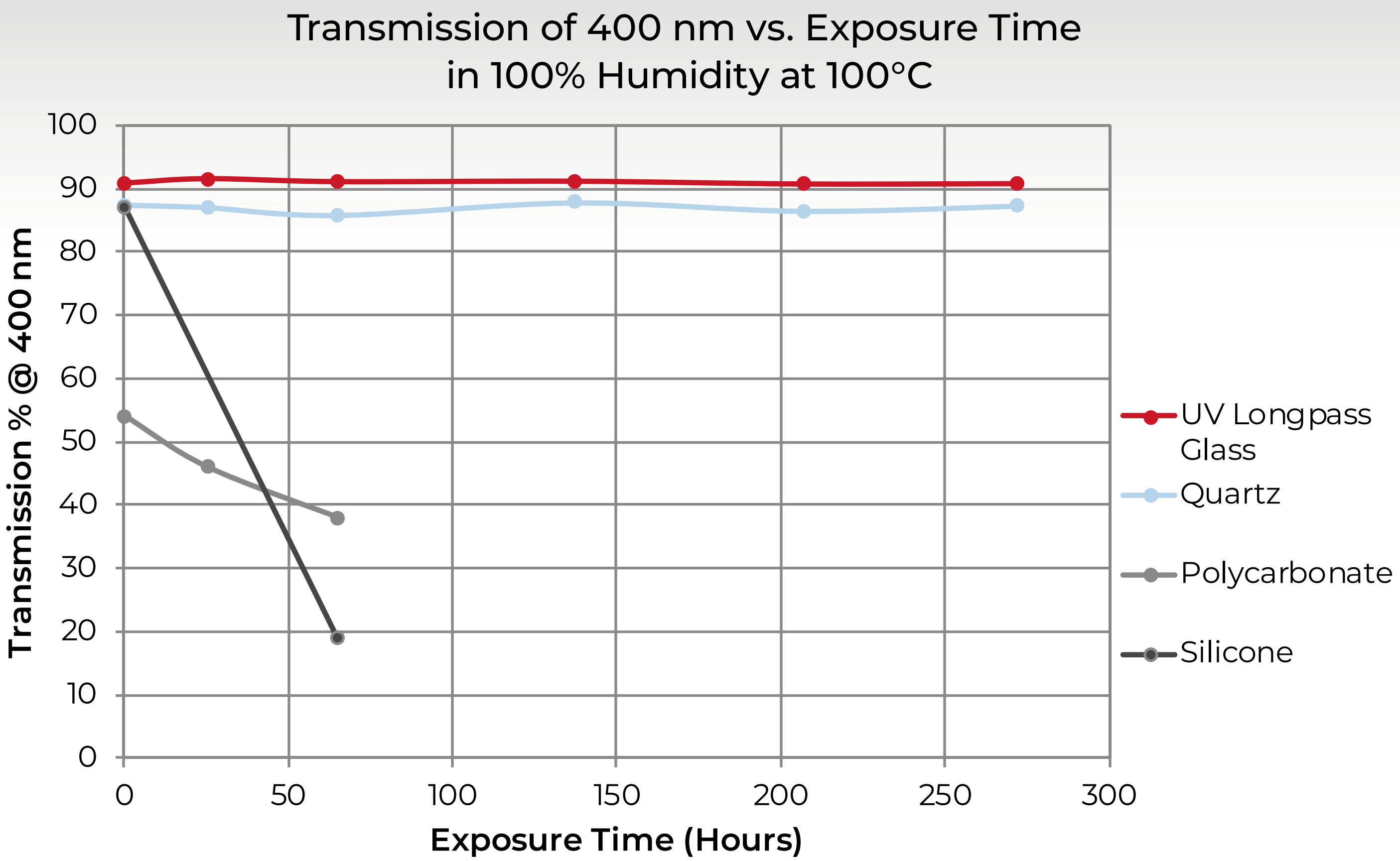
Samples of Kopp's UV Longpass Glass were exposed to high temperature and humidity in an autoclave. Transmission was measured with a spectrophotometer at set time intervals to determine surface degradation. Testing followed the ASTM E438 and ASTM C225 testing standards.

After over 250 hours of exposure to 100% humidity at a temperature of 100°C, Kopp's UV Longpass Glass showed steadily high transmission of UV wavelengths from 275 nm to 400 nm. In comparison, competing materials, polycarbonate and silicone, showed significant drops in transmission. The transmission of silicone was especially effected by the humid conditions.




Transmission of 300 nm vs. Exposure Time
in 100% Humidity at 100°C
Transmission % @ 300 nm
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
Exposure Time (Hours)
UV Longpass Glass
Quartz
Polycarbonate
Silicone


Transmission of 365 nm vs. Exposure Time
in 100% Humidity at 100°C
Transmission % @ 365 nm
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
Exposure Time (Hours)
UV Longpass Glass
Quartz
Polycarbonate
Silicone



TRANSMISSION—WATER

MISSING: Transmission - water

FLUORESCENCE BEHAVIOR

MISSING: Fluorescence Behavior

[Language from Borofloat portfolio]

Some materials have the ability to emit electromagnetic radiation after being activated by high frequency short-wave radiation of high energy intensity. This behavior of the materials is called fluorescence and it depends on the material's purity and structural characteristics, as well as the energy per pulse, pulse rate and excitation wavelength of the radiation.

Kopp 9530 and 9530 is a material with high transmission showing very weak fluorescence intensities over the whole spectrum of light.

Fluorescence Behavior for Different Wavelength Excitation

COMPARED WITH SODA-LIME GLASS

Fluorescence Behavior for Different Wavelength Excitation

COMPARED WITH SODA-LIME GLASS

THERMAL PROPERTIES

Depending on the operating environment and the function of the UV system, the thermal properties of our UV Longpass Glass may be important to ensure performance in application. Our UV Longpass Glass performs even in demanding temperatures.

COEFFICIENT OF THERMAL EXPANSION (CTE)	$84\ E^{-7}C^{-1}$ (30-300 °C)
STRAIN TEMPERATURE	401 °C
ANNEALING TEMPERATURE	572 °C
DEFORMATION TEMPERATURE	602 °C
MAXIMUM OPERATING TEMPERATURE	

According to ASTM E228, CTE was measured using a Dilatometer.

CLICK HERE
to jump to property definitions.

MAXIMUM OPERATING TEMPERATURE

MISSING: Maximum Operating Temperature

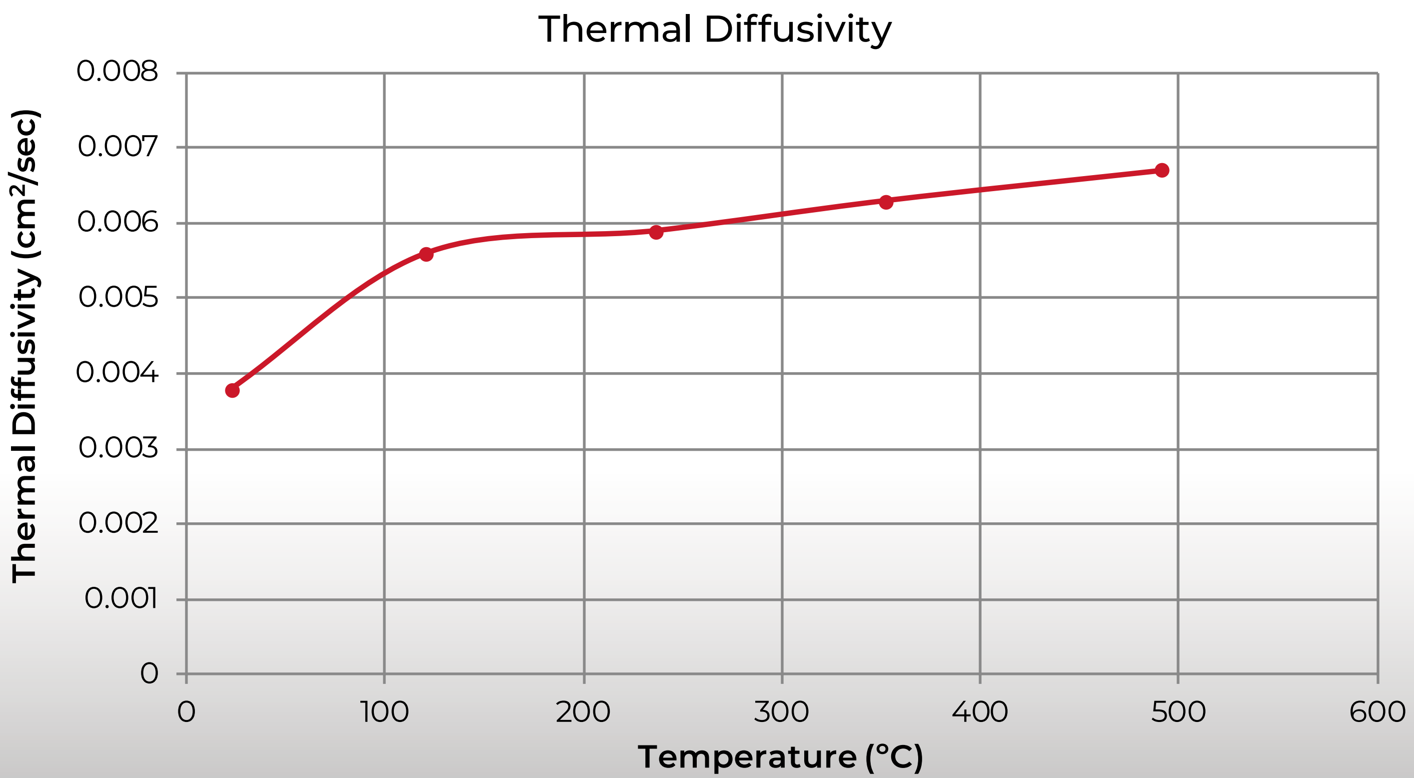
USAGE	DURATION	VALUE
For short-term use	< __ h	___ g/cm^3
For long-term use		___ kN/mm^2

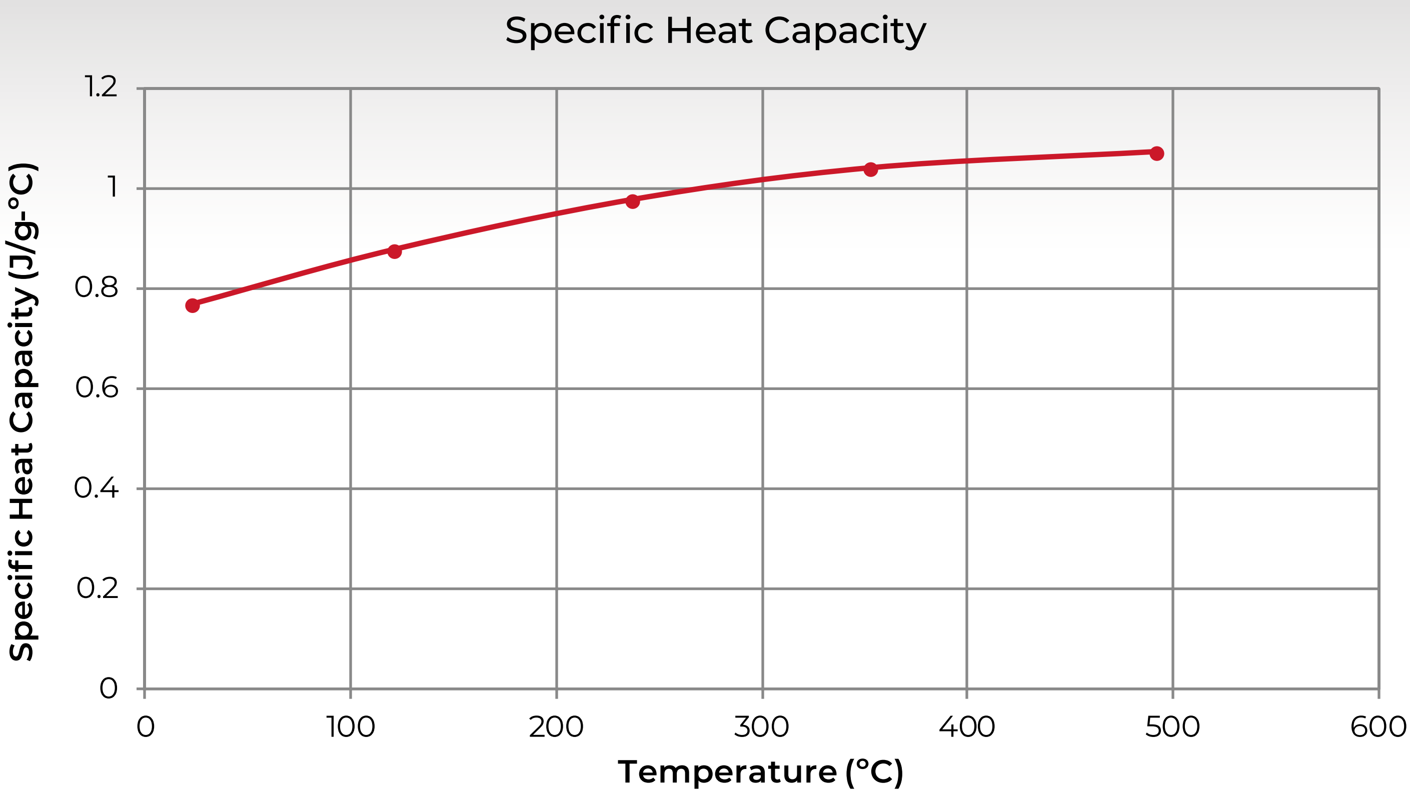
The maximum temperatures in use indicated apply only if the following RTG and RTS values are observed at the same time.

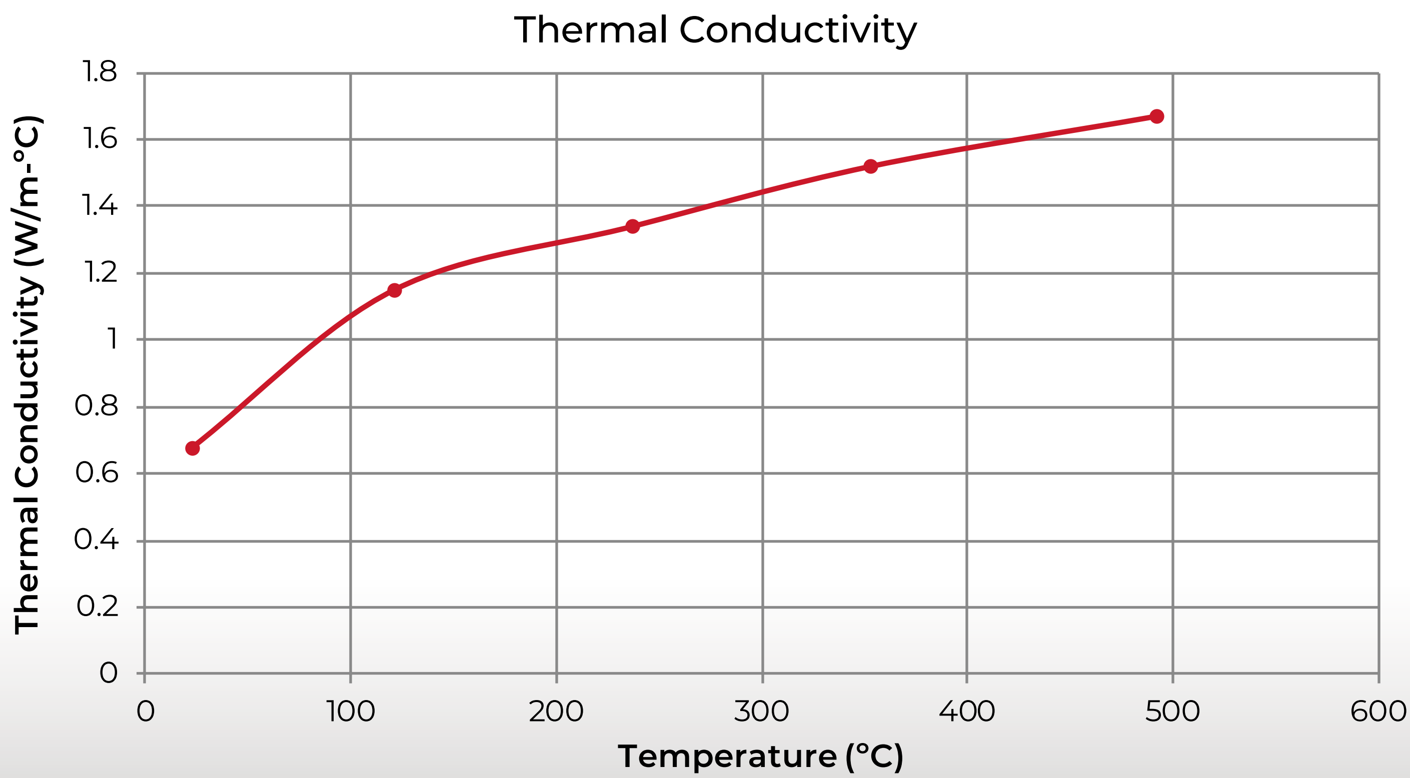
THERMAL DIFFUSIVITY, SPECIFIC HEAT CAPACITY & CONDUCTIVITY

TEMPERATURE	DIFFUSIVITY	SPECIFIC HEAT CAPACITY	CONDUCTIVITY	
°C	*cm²/sec*	*J/g-°C*	*W/m-°C*	*BTU-in/hr-ft²-°F*
25	0.0039	0.771	0.70	4.84
100	0.0052	0.856	1.04	7.23
200	0.0060	0.948	1.32	9.19
300	0.0062	1.014	1.45	10.08
400	0.0062	1.056	1.53	10.61
500	0.0068	1.071	1.69	11.75

Thermal Diffusivity was determined by the flash method according to ASTM E1461. Specific Heat Capacity was determined by DSC Method.




Specific Heat Capacity
Specific Heat Capacity (J/g-°C)
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
Temperature (°C)


Thermal Conductivity
Thermal Conductivity (W/m-°C)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
Temperature (°C)

CHEMICAL PROPERTIES

The chemical properties of Kopp's UV Longpass Glass show resistance to various substances and conditions including acid, alkali, and simple humidity. This may be an important feature for optics needing to perform in environments that require the introduction of liquid chemicals and humidity. Our glass continues to perform with high levels of transmission, even in the harshest environments.

HYDROLYTIC RESISTANCE	
ACID RESISTANCE	
ALKALI RESISTANCE	
STAIN RESISTANCE	
UV CURING INKS	

ATTACK OF ACID ON SURFACE

MISSING: Attack of acid on surface

ATTACK OF ALKALI ON SURFACE

MISSING: Attack of alkali on surface

DESIGN CONSIDERATIONS for UV LEDs

designing with Kopp's UV longpass glass

Recent advancements in UV LED technology have opened a new frontier for applications that harness the power of UV light. To achieve desired performance results, UV radiation often needs to be filtered and controlled. Kopp's UV Longpass Glass can be molded into UV optics that enhance the performance of UV LEDs.

Designing with UV LEDs—a relatively new technology—can be a new challenge for lighting designers and engineers. Due to the nature of UV light, many considerations should be made before selecting UV LED products or UV optics to pair with them. As each of the components in a UV lighting system are interrelated, the design process should be iterative. It's important to frequently assess your design choices and modify your design accordingly.

START WITH THE END IN MIND

What light output does your application require? That's the first question to ask. By knowing the needs of your application, you can then choose optics and LEDs that will efficiently meet your requirements.

OPTICAL LENS DESIGN

Engage your optic designer and optic manufacturer early in the process. An optic design will depend on the beam distribution, angle, and intensity required. To be optimized, a design should take into account the properties of the material that will be used.

LED SELECTION

The market is full of UV LEDs with different properties and light output. The pairing of LED and optic will effect light output, so selecting LEDs and finalizing optical designs should occur concurrently. We recommend an iterative approach to settle on a combination that will best meet an application's requirements.

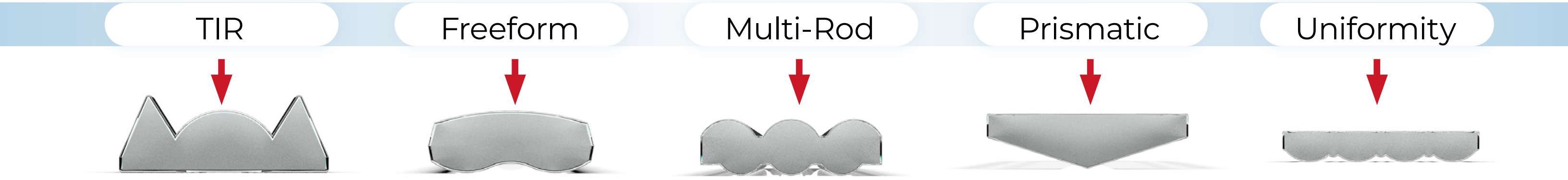
LED ARRAY DESIGN

The design of an LED array includes the spacing of LEDs, number of LEDs, and their direction. The optic should have significant influence on the array design to optimize the system.

CLICK HERE
For more detailed information about designing with LEDs and optics.

COMMON OPTIC DESIGNS

Kopp offers molded UV glass optic designs that are customizable for your UV LED application. There are five recommended design types with dimensions that can be altered to fit performance requirements, array configurations, and fixture dimensions.



TIR OPTIC

Total Internal Reflection (TIR) Optics increase peak irradiance and energy density.

FREEFORM OPTIC

Freeform Optics improve uniformity and offer design flexibility due to freeform surfaces.

MULTI-ROD OPTIC

Multi-Rod Optics increase peak irradiance by mixing multiple wavelengths and controlling the beam angle.

PRISMATIC OPTIC

Prismatic Optics decrease the divergent beam angle to increase peak irradiance and energy density.

UNIFORMITY OPTIC

Uniformity Optics increase peak irradiance and uniformity while maintaining a slim optic profile perfect for small fixture designs.

Don't see an optic that fits your application? Work with our team to customize an optic that will reach your performance goals and specifications.

PROPERTIES DEFINED

Abbe Constant

$$V_D = \frac{n_D - 1}{n_F - n_C}$$

The abbe constant, V, is an approximation of a material's dispersion. High values of V indicate low dispersion.

Annealing Temperature

The temperature used to define the annealing process, or the removal of internal stresses within the glass article through a slow cooling process. At this temperature, the residual stresses in a glass are reduced over a matter of minutes and then slowly cooled to room temperature. Each product design requires a unique annealing schedule.

Coefficient of Thermal Expansion

The coefficient of thermal expansion (CTE) is a measure of how much volume changes as a material is heated or cooled.

Deformation Temperature

The temperature at which a glass begins to deform during dilatometric heating and measurement. It is noted on the temperature versus Δ length/ length (in/in) as the apex of the plot.

Density

Mass per unit volume of a material.

Dispersion

Dispersion represents how a material's index of refraction changes with changing wavelengths. The index of refraction for most glasses is wavelength dependent.

Index of Refraction

A description of how fast light travels through a material, it is used by optical engineers to design and manipulate the path of light through optics.

Modulus of Rupture

Modulus of rupture reveals the stress in a material just before it ruptures. Modulus of rupture is also referred to as bending strength.

Poisson's Ratio

$$v = -\frac{e_y}{e_x}$$

Poisson's ratio, v, indicates the relationship between elongation and contraction of a material when stress is applied in one direction. The material will typically elongate in length in the direction of the applied tensile stress and contract in dimension in the perpendicular direction.

Shear Modulus

$$G = \frac{\sigma_{xy}}{e_{xy}}$$

The shear modulus, G, relates shear stress and shear strain. It is an indication of the rigidity of a glass.

Specific Heat Capacity

$$J/(kg \cdot K)$$

Specific heat reveals how much heat is needed to raise the temperature of glass. Specific heat, combined with the thermal conductivity of a glass, will show how quickly a lens will reach thermal equilibrium.

Strain Temperature
The strain temperature, similar to an annealing temperature, can be used to remove the internal stresses within a glass through an extended and lengthy thermal processing.

Thermal Conductivity
Thermal conductivity reveals how well a material conducts heat. Most glasses have fairly low thermal conductivities, meaning they act more like thermal insulators than like heat sinks.

Thermal Diffusivity

$$W/(m \cdot K)$$

Thermal diffusivity measures the rate of transfer of heat of a material from the hot end to the cold end. It is calculated by dividing the value of thermal conductivity by the values of specific heat capacity and density.

Transmission (%)
Transmission is the portion of light that travels completely through a piece of glass. It is equal to the total light minus the absorbed, scattered, and reflected light.

Young's Modulus

$$Y = \frac{\sigma_x}{e_x}$$

Young's modulus, Y, is a measure of the stiffness of glass. Larger values of Y indicate stiffer glasses which will not deform as much under applied stress.

MORE INFO

For more information about glass properties, download our eBook: go.koppglass.com/properties-of-glass-ebook

APPENDIX

PROCESSING

Kopp molds UV Longpass Glass into the required optic or lens specifications. Some custom products are finished as-molded. Others may need further processing.

Processing can include:
- Cutting
- Edge and Corner Finishing
- Drilling

FINISHING

After molding and processing, the specifications of an optic or lens may require further finishing.

Finishing can include:
- Coating — Coating with composite materials can alter the properties of a piece to enhance its functionality in a particular application.
- Thermal Semi-toughening — This improves the capability of the glass to resist thermal and mechanical stressors.

CLEANING

MISSING/UNRESOLVED: Cleaning notes?

[Language from Borofloat portfolio]

Kopp 9530 and 9531 can be cleaned with any commercially available glass cleaner.

Note: Under no circumstances should abrasive sponges, scouring powders or other corrosive or abrasive cleaners be used, as these can cause damage to the surface of the glass.

QUALITY

According to the requirements of Kopp's ISO 9001:2015 certification, the quality of our UV Longpass Glass is ensured by our quality management system.

ENVIRONMENTAL RESPONSIBILITY

Kopp's UV Longpass Glass is environmentally friendly. Composed of naturally raw materials, Kopp's glass is recyclable and disposed of easily.

PLEASE NOTE

MISSING: Any disclaimers or caveats

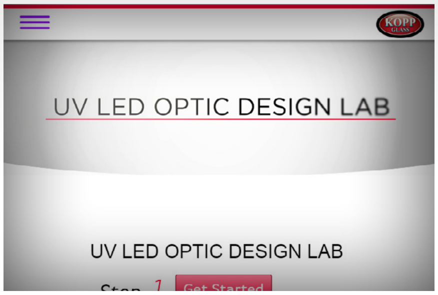
[Language from Borofloat portfolio]

This presented material includes a variety of commonly referenced Kopp 9530 and 9531 properties for commercial and industrial applications. As with all industrial products, the technical data can vary slightly. Therefore, all technical data presented in this brochure must be read as typical average values only

This data is for reference information only and may vary for specific requirements. Secondary processing performed by others, who cut and finish the glass to end user specifications, has a significant influence on the thermal shock resistance and mechanical properties that ultimately affect glass performance.

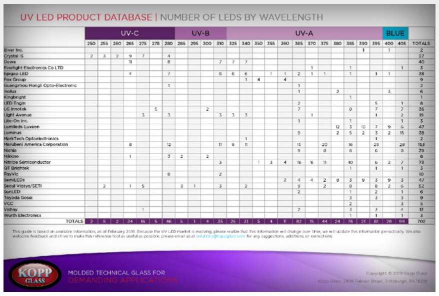
Kopp 9530 and 9531's application potential varies widely. Therefore, if you have any questions or concerns regarding the proper use of Kopp 9530 and 9531 for a particular application, please contact Kopp Glass, Inc.

FURTHER READING

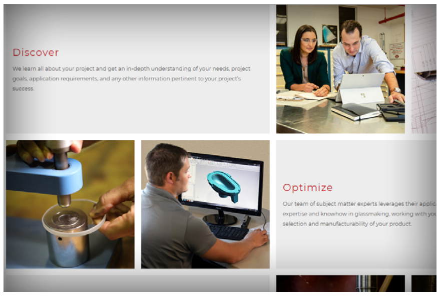


- Kopp's UV LED Optic Design Lab

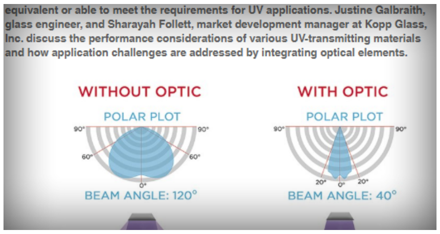
- Kopp's "The Properties of Glass" eBook



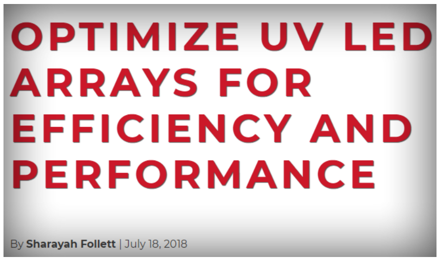
- Kopp's UV LED Product Database



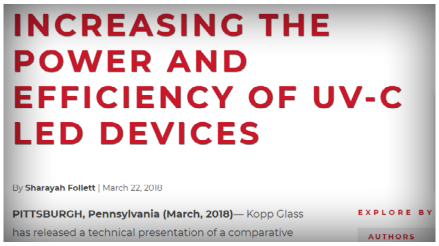
- Kopp's Custom Development Process



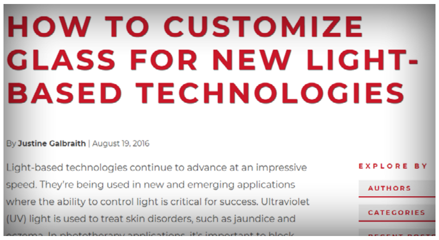
- "Transparent Material Considerations for UV Optics in Horticultural Lighting Applications" in LED Professional



- "Optimize UV LED Arrays for Efficiency and Performance" on Glass Transforming Light

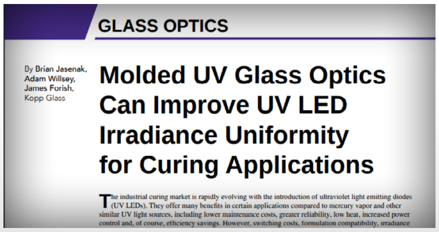


- "Increasing the Power and Efficiency of UV-C LED Devices" on Glass Transforming Light

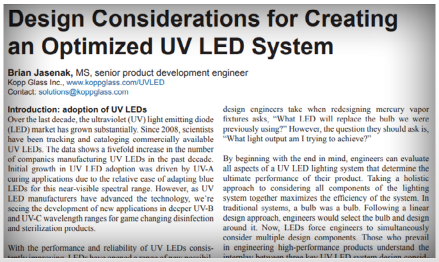


- "How to Customize Glass for New Light-Based Technologies" on Glass Transforming Light

- "The Clear Choice: How to Choose the Best Transparent Material" on Glass Transforming Light



- "Molded UV Glass Optics Can Improve UV LED Irradiance Uniformity for Curing Applications" in UV+EB Technology



- "Design Considerations for Creating an Optimized UV LED System" in IUVA News

- "How to Design with LEDs: Concurrent Engineering Yields Fully Optimized Lighting Systems" in LED Professional

KOPP GLASS

HIGH-PERFORMANCE CUSTOM GLASS

for mission-critical applications

MATERIAL SCIENCE EXPERTISE

Founded over 90 years ago, Kopp Glass began with a deep understanding of glass chemistry and how it can be used to innovate. Today, our portfolio includes more than 200 different glasses. Depending on your need, our engineers and scientists are also able to create new compositions to meet tough design challenges.

APPLICATIONS ENGINEERING EXPERTISE

We refine product designs alongside customers to help them reduce costs and increase yields. While our solutions are crafted to perform in some of the harshest environments on Earth, they're also designed to help the performance of our customers' bottom lines.

RESPONSIVENESS

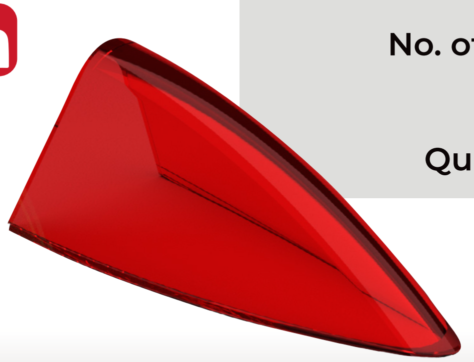
Kopp Glass is a small manufacturer, but the design and production challenges we face every working day are huge. Our customers see the difference in how we respond to them and in how our team responds to each other.

ON-TIME IN-SPEC DELIVERY

In accordance with our ISO 9001:2015 certification, Kopp Glass works to ensure the mission-critical, molded glass components we ship meet your standards—the first time.

WORK WITH US

www.koppglass.com



Year Founded	1926
Ownership	Closely Held
Location	Pittsburgh, PA USA
No. of Employees	85
Mfg. Sq. Ft.	127,000
Quality System	ISO: 9001:2015

2108 PALMER STREET | PITTSBURGH, PA 15218, USA | +1-412-271-0190

HIGH-PERFORMANCE GLASS
for mission-critical applications