# TECHSPEC® EDGE–BLACKENED OPTICS



- Control Stray Light
- Improve Signal to Noise Ratio
- Maximize Contrast

Stray light in imaging and electro-optical systems can scatter off the ground edges of the lens elements within that system. The scattered light increases the noise which severely limits a system's ability to reproduce contrast. Coating the edges with a black paint or ink minimizes the scattered light, improving the signal to noise ratio.

Edmund Optics® is now offering Edge-Blackening on standard lenses. Many of our Broadband Anti-Reflection (BBAR) coated lenses have been made available as off-the-shelf products with blackened edges. Achromatic lenses are available Edge-Blackened as well as our Plano-Convex, Double-Convex, Plano-Concave and Double-Concave Lenses. Additional lenses are available Edge-Blackened through our QuikMod™ program as well as mirrors, windows, filters and prisms.

TECHSPEC® Achromatic Lenses

TECHSPEC® Edge-Blackened Singlets

## AVAILABLE OFF-THE-SHELF

- Achromatic Lenses
- Plano-Convex Lenses
- Double-Convex Lenses
- Plano-Concave Lenses
- Double-Concave Lenses

## ADDITIONAL OPTICS CAN BE EDGE-BLACKENED USING OUR QUIKMOD PROGRAM

QUIK MOD

- All Transmissive Optical Components (Lenses, Filters, Windows, Beamsplitters, and Prisms)
- Smallest Dimension to be Blackened is 5mm
- Dimensional Tolerance of Unblackened Component Increases by +0.1mm/-0.0mm
- Coated or Uncoated Components are Eligible for this Service
- Customer Supplied Parts do not Qualify for this Program





Edmund optics | worldwide

# TECHSPEC® EDGE–BLACKENED OPTICS

EDGE-BLACKENED OPTICS

## STRAY LIGHT

When integrating lenses into a multi-element system, a common limiting factor in overall performance is stray light. Stray light is energy outside of the clear aperture of an optical system that scatters off of the edges of an optical or mechanical component (see Figure 1) and reaches the sensor in the form of noise (rather than signal). One successful method commonly used to reduce stray light within a system involves blackening the edges of the optics in the system.

## MEASURING BRDF

Scattered signals are typically quantified as scattered light power per unit solid angle, or inverse steradians. Scatter results are made more meaningful by normalizing the results by the intensity of light incident on the scatter source. This function is commonly referred to as the Bi-Directional Reflectance Distribution Function, or BRDF. A simplified equation of BRDF is the intensity ratio of reflected to incident light per solid angle. These measurements are taken by projecting a laser onto a surface at a fixed angle from the normal. A detector is then rotated about the point of scatter to record the change in irradiance as a function of angle.

Figure 2 compares the results of such a test between one surface coated with edge-blackening ink, and the other uncoated ground glass to simulate the edge of an optic. The plot indicates an order of magnitude improvement in stray light reduction by edge-blackening. This improvement potentially save the need for expensive mechanical system baffling.

## RESULTS

Figures 3 and 4 illustrate an irradiance profile taken from a sensor imaging a point source through a lens. Figure 3 was generated by a standard optic while figure 4 was generated with an edge-blackened optic. The effect of stray light as illustrated in Figure 3 is a higher noise floor that in effect washes out the image resulting in lower image contrast.

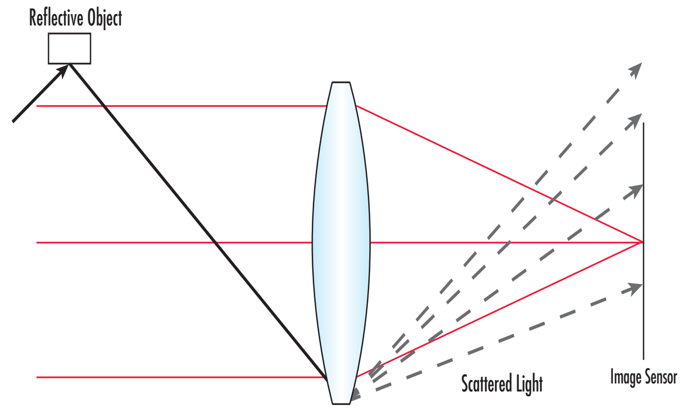


Figure 1: Light reflected by an object outside FOV being scattered from the edges of a lens without edge blackening

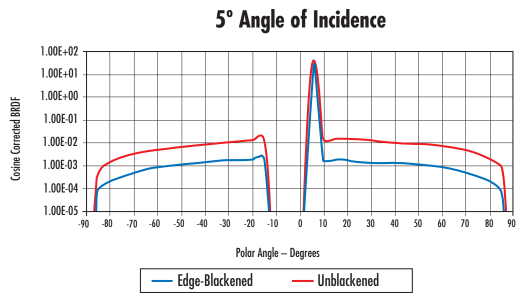


Figure 2: BRDF Plot of unblackened and blackened lenses


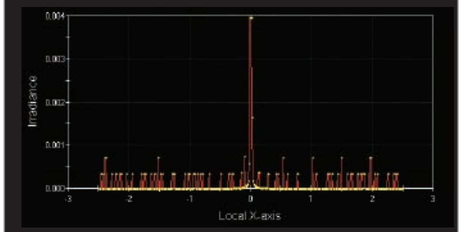


Figure 3: Line profile of the irradiance distribution through the center of an imaging sensor where the lens edges are not blackened.


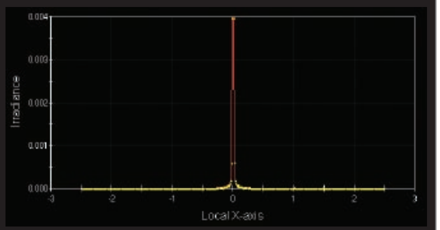


Figure 4: Line profile of the irradiance distribution through the center of an imaging sensor where the lens edges are blackened.