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SCHOTT Ceramic Converters

A New Way to Create High-Luminance White Light

Introduction

SCHOTT Academy of Optics is a free, online seminar series designed to take your industry knowledge and expertise to new levels.

Throughout the series, you will learn from leading glass and material experts as they cover various topics pertaining to the optics industry.

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For etendue-limited applications such as digital projection, fiber optics, microscopy, and vehicle headlights, high luminance light is the only way to increase brightness, or flux. It does not work to make the spot size larger because the extra light will miss the target area e.g., the imaging chip in digital projection. For these applications, the best way to create high-luminance white light is with a laser-pumped phosphor light engine.

These light engines contain a ceramic material that converts high irradiance blue laser light beam into high luminance yellow or white light via a photoluminescent process. Because this conversion process also creates heat, the material's thermal properties are critical. Ceramics are an ideal solution because of their superior thermal properties and high efficacy, reliability, and brightness. The high irradiance limit is linked to the material's low thermal resistance, which restricts the material's maximum temperature even for high-heat flux densities.

1. Creating white light

Thanks to recent material advances, ceramic converters can now be used to directly generate high-luminance white light.

One way to generate white light with a phosphor is to pass a laser beam through a dichroic mirror to a phosphor that generates yellow light. Blue light can then be added to the photoluminescent yellow light to create white light. Although this process is used in devices such as projectors, it can be too complex for some applications. Thus, SCHOTT developed a line of white static converters that emit white light directly.

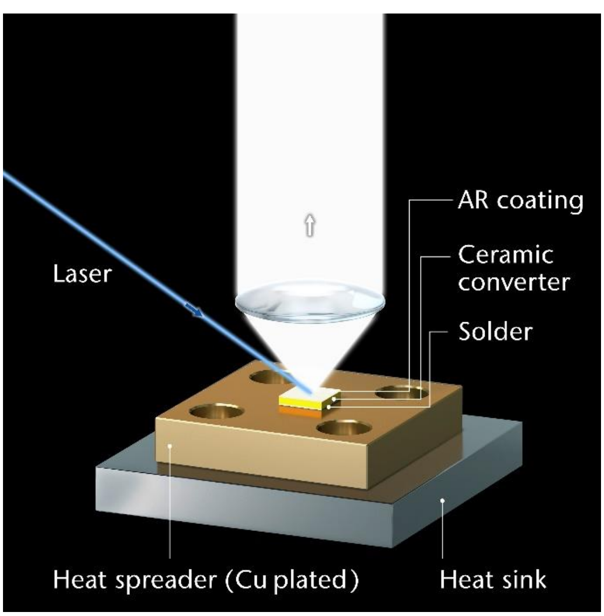

Figure 1: Shows a laser beam passing through a dichroic mirror to a phosphor.

To create these white converters, SCHOTT used its materials expertise to tailor the doping levels and scattering properties of ceramic materials so that they will diffusely reflect some of the laser light. This allow simultaneous emission and mixing of the photoluminescent yellow light and diffusely reflected blue light, enabling white light to be created directly.

The new line of white static converters includes SWD50, RWP55, and RWQ60, which are all designed for color temperatures around 5,000 K. The color coordinates for RWQ60 are closest to the Planck curve while SWD50 has the largest distance to the Planck curve. RWP55 falls between those two.

2. Achieving high irradiance

It is important to note that the irradiance limit must be considered when selecting a converter material because it directly relates to the maximum flux that can be generated. While SWD50 has the best irradiance limit, our portfolio of 5,000 K materials allows you to choose RWP55 and RWQ60 as well for the trade-off between irradiance limit and color of the white light emission that will work best for your application.

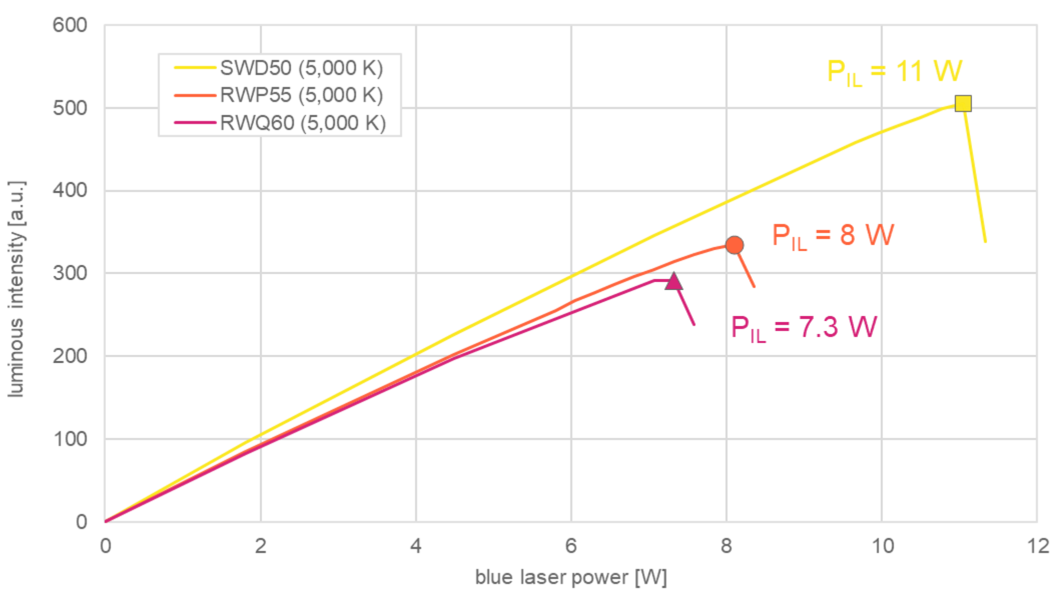

Figure 2: Shows the different irradiance limits for SCHOTT's 5000K portfolio.

To make the most of these new converter materials, keep in mind that a variety of factors can influence the irradiance limit. For example, smaller laser spots produce a higher irradiance limit because the heat can be dissipated more easily.

Using pulsed light also improves the peak irradiance, with an even stronger effect for higher frequencies. This occurs because the temperature reduction created by using pulses allows the laser power to be increased. Cooling can also improve the irradiance limit as can optimizing the laser wavelength and optical system design. To help you determine the setup and converter that will produce the best optical performance, SCHOTT can support design decisions with data and tests performed in our application lab as well as numerical simulation.

Want to learn more about ceramic converters?

For more information and resources on ceramic converters, visit our website:
www.schott.com/ceramic-converter.

If you have any questions or need project support, feel free to contact us: info.optics@schott.com.