Specifier Bulletin for Dark Sky Applications

VOLUME 3: ISSUE 1 : 2010 — International Dark-Sky Association

This test street in Anchorage, Alaska, USA compares the quality of light from warm, low CCT* LEDs (right foreground), high pressure sodium vapor (left middle) and cool, high CCT LEDs (right background). The residents of this street preferred the warm LEDs in the foreground.

Achievements in High Brightness White LED Devices

For more information on FSA approved luminaires please visit the IDA Web site *www.darksky.org*.

Light Emitting diodes (LEDs) are making a robust entry into outdoor illumination products. The high brightness white LED has achieved rapid gains in efficacy in a few short years.

Demonstrated energy efficiency coupled with potential for further improvement has already carved a market for this relatively new technology. High brightness white LEDs are now suitable for a variety of applications, and demand is increasing. Recent changes in wavelength composition for some bright white LED sources can improve energy efficiency and the quality of lighting from the dark-sky standpoint in these products.

LEDs offer capabilities infeasible for traditional HID sources. As opposed to HID lamps, LEDs contain no mercury, obviating the need for hazardous material handling and disposal. LEDs can be controlled for dimming, utilized with motion sensing products, enable easy curfew conformity, and will soon be capable of fine spectral tuning. As an outdoor light source, LEDs hold considerable promise for dark sky restoration and preservation, providing one hurdle is overcome: the relatively high emission of blue (short wavelength) light. The refractive properties of short wavelength light implicate it in contributing to increased sky glow and disrupting circadian cycles in wildlife and humans to a greater extent than light of other wavelengths.†

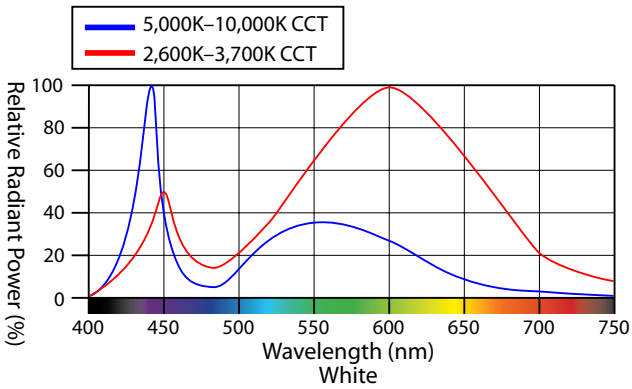
The method of fabricating white light by coating a blue or violet-emitting LEDs with phosphors can improve the color balance of the emitted light, but inherently creates light with blue-rich emissions. As recently as 2009, LEDs with a high concentration of blue wavelength light and a correlated color temperature (CCT) of 5,500K and above were the only high-brightness white LED products available.

White LED Devices

 •

However, recently, LED manufacturers, while maintaining high-efficacy and high-quality white light, have been able to reduce short wavelength emissions, leading to lower CCT values. As a percentage of total light output, emissions of some white-light LEDs are now lower than some standard HID light sources. Traditional aesthetics favor a lower CCT light that is richer in long wavelengths. LED developers are now creating products between 2,600K–4,100K, which are able to maintain the high efficacy for which LEDs are known.

High-efficacy, low CCT bright white LEDs are an environmental, ecological, and technological breakthrough that will help over time to minimize the impact of outdoor lighting on the night environment. Their development is a significant technological achievement. IDA continues to encourage all LED manufacturers to strive for further reductions in short wavelength, blue light emission.



The wide red peak on the spectral power distribution chart indicates that LEDs under 3,700K emit a broader range of frequencies and improves color rendition when compared to the narrow peak of LEDs above 5,000K.

LED Innovators

These LED innovators are reshaping the market while setting the standard for white LEDs. IDA congratulates the progress made and the earnest decision of LED manufacturers to improve their products and reduce potential environmental harm.

Cree unveiled their latest XLamp(R), the XP-G LED which emits up to 109 Lumens Per Watt at 3000K, in December 2009. Lamps with these performance ratings simply did not exist at the beginning of that year. On 17 March 2010, Cree announced the commercial availability of the XP-G LED in warm color temperatures at 2,600K, which provides up to 114 lumens per watt at 350 mA. The neutral-white (4,000K) XLamp XP-G provides up to 139 lumens per watt at 350 mA. The 2600K and 3000k devices emit less blue light than some conventional HID sources commonly used today. Paul Thieken, director of marketing for Cree, said, "These new XP-G LEDs can enable LED lighting products that not only meet but exceed the current ENERGY STAR© luminaire and lamp requirements. Cree is accelerating the LED lighting revolution by pushing through performance milestones."

Philips Lumileds is using a research partnership grant with the U.S. Department of Energy to develop LEDs with CCT between 2,800K to 3,500K, a range that reflects market interest. LEDs with warmer color temperatures are being sought both for consumer acceptance and the reaction to concerns of excess amounts of short wavelength emission. Philips will soon unveil a 3,300K device with an efficacy of 83 lm/W.

Philips has a record for mitigating problems as they are discovered. On North Sea oil platforms, the company devised lighting that negated the impact of conventional light on both sea and migratory birds. While not LED related, this is a strong positive response to unintended consequences of lighting on the night environment.

Osram's Prevaled Product™ family provides a range of lumen output options from 800lm to 3,000lm at a system efficiency of up to 85 lm/W. It comes in color temperatures of 3,000K up to 4,000K, and has the very high color rendering index (CRI) of 90.

Seoul Semiconductor This Korean LED maker has introduced the Acriche 4, a new version of its alternating-current (AC) LED product. In major markets around the world, new Acriche A4 is available with an efficacy of 75 lm/W at 3,000K with a CRI of 85. It is currently the only alternating current device to achieve these very high performance numbers.

---

*Correlated color temperature (CCT) is used in this publication as an indicator of blue light emissions from a light source; but it is not a precise metric. Actual recommended emission limits will be included as specifications are developed.

†For a thorough discussion of the acknowledged and potential impact on the nocturnal habitat, please see The UK Royal Commission Report on Artificial Light in the Environment, Available here: *http://www.rcep.org.uk/reports/sr-2009-light/documents/RCEP_artificiallight.pdf* [Also see IDA's upcoming blue-white light position paper, scheduled to be released in May 2010.]

For information on IDA membership and the FSA program visit our Web site at www.darksky.org.