

ActiveLED® White Paper Series

LED LIGHTING
UV, or Not UV
That Is the Question

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Energy Efficient Lighting and Controls



Does LED Lighting Contain Ultra Violet Light?

One of the big debates currently circulating about LED lighting is whether or not it contains Ultra Violet (UV) light. You'll find many statements on the internet stating that "LEDs have no UV emissions." Then there are those that say that this isn't entirely true. So which one is it? It depends on how you look at it.

First, it's important to understand what people are actually asking. Most really seem to be worried about one of several things: Is there a health concern from using LED lighting, and/or is LED lighting better than other light sources for protecting UV film and preserving artwork, artifacts, and décor from ageing and discoloration?

LEDs Are Incapable of Emitting White Light By Themselves

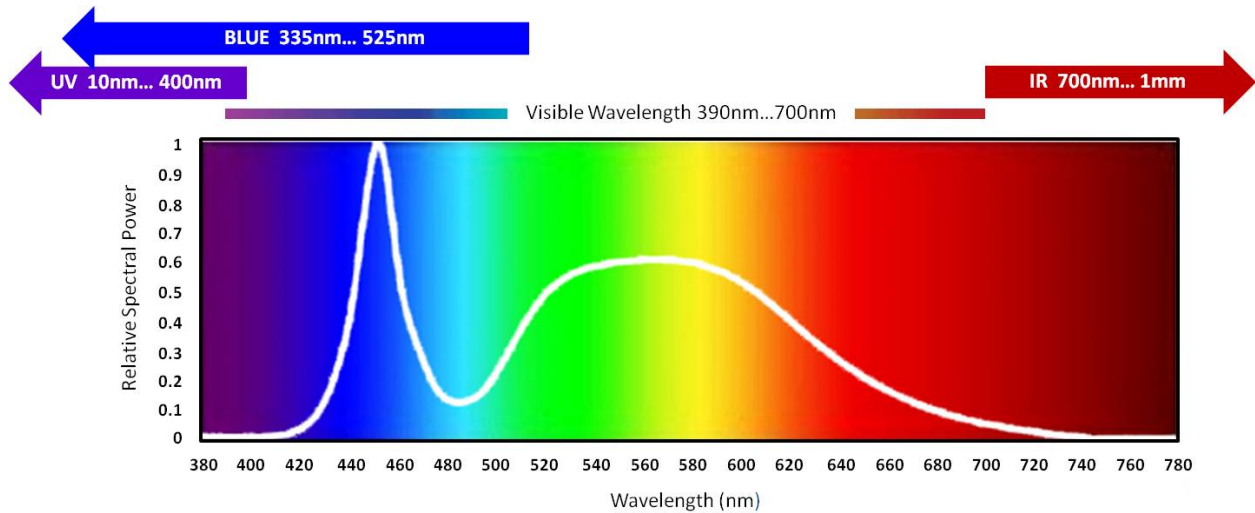
To answer these questions we must initially look at how White Light LEDs are made. Without getting into all of the scientific details of the varying Gallium doping mixtures of semiconductor diodes, it's important to understand that LEDs in and of themselves are incapable of emitting white light. White light is composed of all the colors of the spectrum. While science was able to produce LEDs in the three additive primary colors of light (Red, Blue and Green) and varying hues of these colors, a true white light LED continued to evade them.

It wasn't until 1993 when Brilliant Blue LED's were created that White Light LEDs could make an appearance. Science discovered that when a Brilliant Blue LED is coated with phosphor, combined with a rare earth compound, the blue light is converted by the phosphor to another color wavelength creating what the naked eye perceives as white light.



LEDs Produce a Broadband Lighting Spectrum

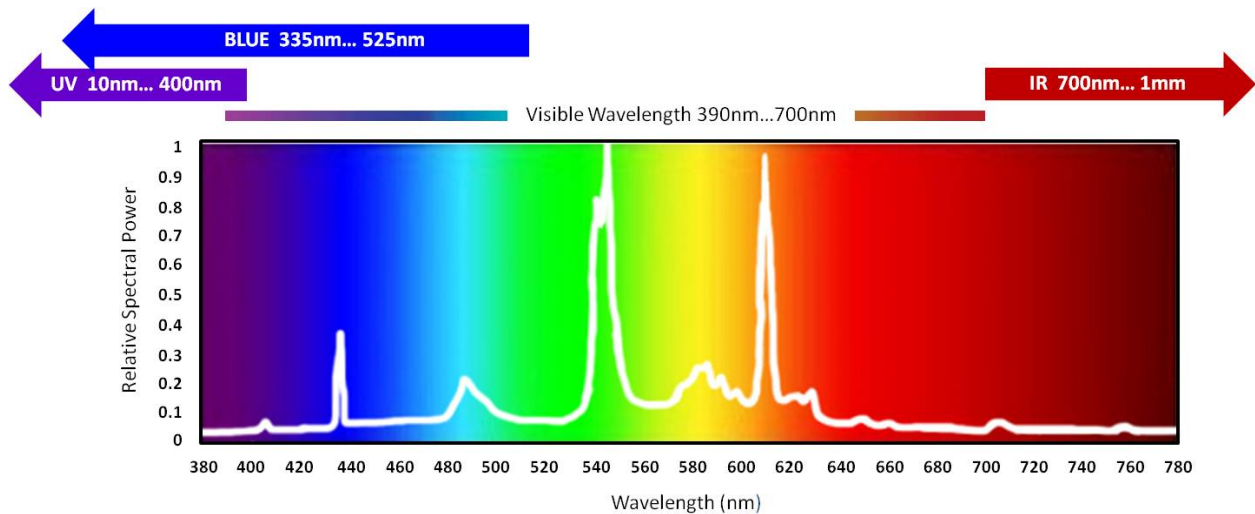
Contrary to some common beliefs, the spectrum of the light emitted by this phosphor mix is broadband in nature and emits at longer wavelengths, giving a full spectrum of visible light. (See Figure 1)



LED Performance Data – LM79 at 5000K

Figure 1

It is worth noting that while Fluorescent Lighting technology also employs phosphors (the coating on the inside of the fluorescent and CFL lamps) the lighting spectrum when the phosphor combines with LED Lighting is much broader. (Compare Figure 1 and Figure 2)



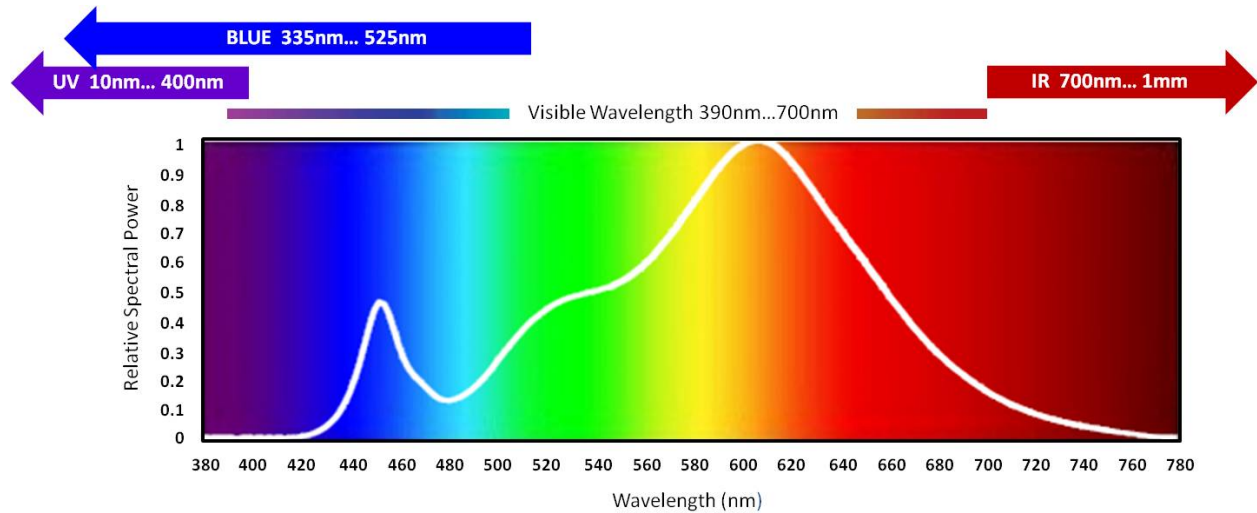
Fluorescent Performance Data – LM79 at 4100K

Figure 2



Phosphors Determine LED CRI and Color Temperature

With White Light LEDs, the thickness of the phosphor coating and the amount of yellow in the phosphor itself, in part determines the amount of the brilliant blue light that is absorbed by the phosphor. This results in the different CRI and Kelvin Temperatures of the LED. The more blue light absorbed by the phosphor, the lower the Kelvin temperature and the yellower (redder) the light. (See Figure 3) This also affects the efficacy of the LED. The lower the Kelvin temperature, the more of the actual LED light is absorbed by the phosphor and the more power it takes to get the same light output.



LED Performance Data – LM79 at 2700K

Figure 3

Conclusion

Now... back to our original question, do White Light LEDs used in general lighting applications contain UV light? Brilliant Blue LEDs used in creating White Light LEDs do generate some UV light (in the 400-425nm range); however, the amount of UV light emitted by the phosphor, is less than what is generated. In reality, the final amount of emitted UV is so small as to statistically say that White Light LEDs do not emit any UV light.

So, is there enough UV light emitted to pose a health risk? No, the amount of UV light emitted by White LEDs is well less than a single percentage point. For this same reason LEDs have become the lighting type of choice for museums striving to preserve valued artifacts and maintain their original colors. However, you would not want to use an unfiltered LED light in a clean room where some types of film are sensitive enough to UV to be affected by light down to wavelengths of 415nm.

In conclusion, does LED lighting contain Ultra Violet Light? It depends on how you look at it. White Light LEDs produce some UV light, but they emit less.

Product manufactured in Georgetown, Texas.

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