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Advancements in UV Lighting for Machine Vision Applications

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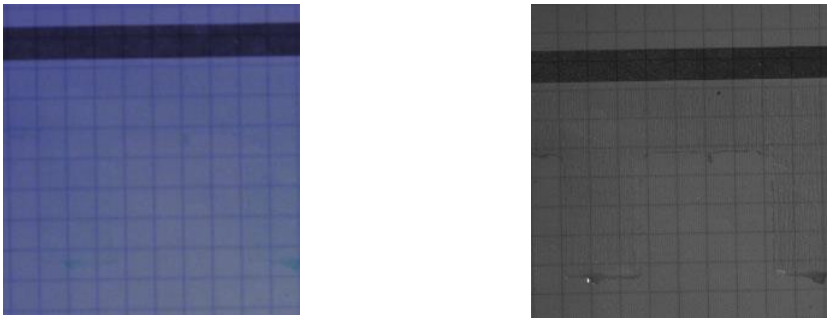
Over the years, many vision applications tried to use UV lighting only to end up with failure or disappointing results. UV inspection applications are not performed in the UV but rather in the visible region. UV wavelengths are used to excite a material under inspection. The material fluoresces by emitting light somewhere in the visible spectrum. This visible wavelength is then captured by the camera for inspection. Advances in technology have helped to change UV vision applications into positive successful inspections. Filters can make or break UV applications and color cameras can help solve applications where monochrome cameras could not.

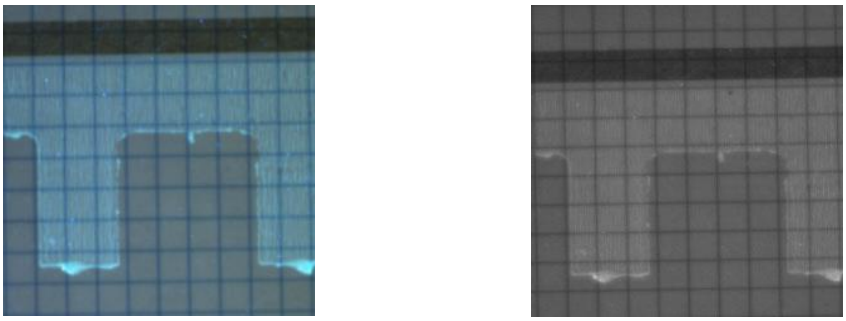
Using filters to separate and enhance the wavelengths?

How can Short Pass, Band Pass or UV Blocking Filters help?

A vision system may require a filter to brighten or darken (depending on a light or dark background) the visible luminescent emission and block the UV light and unwanted visible light. Majority of inspection cameras have significant near-UV sensitivity creating interference between the visible fluorescence and the UV Light source. A UV blocking filter will prevent the UV light from interfering with the desired wavelength needed in the cameras image. A blocking, short pass or band pass filter can limit the unwanted wavelengths or colors entering the image. In typical fluorescence application where cyan is the color emitted, a 470nm or 505nm band pass filter will pass the light or wavelength of cyan and block all other wavelengths. This will limit the unwanted colors and ambient light in the image and increase the desired color or wavelength. Midwest Optical Systems www.machinevisionfilters.com is an excellent source for expertise with filtering in vision applications.



UV 395nm LED light with no filter



UV 395nm LED light with UV filter (blocking UV wavelengths)

Color Cameras may be beneficial when inspecting UV

In the early years of machine vision monochrome cameras were prevalent while color cameras were scarce and rarely used. UV excitation inspections used a monochrome camera. A monochrome camera can only give gray scale information in pixel intensity. Each image contains only information on the intensity of a pixel from 0-100% or 8 bit 0-255 value. Inspection decisions are made only on the intensity of a sensor or collection of pixels. Pass/Fail is solely based on how bright or dark the pixels measure. A color camera adds to the formula by using wavelength in addition to intensity. Wavelength identification allows the UV inspection to make a decision on a certain color or wavelength. Figure1 shows a monochrome image with a UV mark on a large piece of timber. Figure 2 is the same timber with a color camera. Note the color of cyan can be easily identified by a color camera in Figure 2. The majority of UV excitation applications use an additive material that excites or emits a cyan color (505nm wavelength) when illuminated with 365nm or 395nm UV.

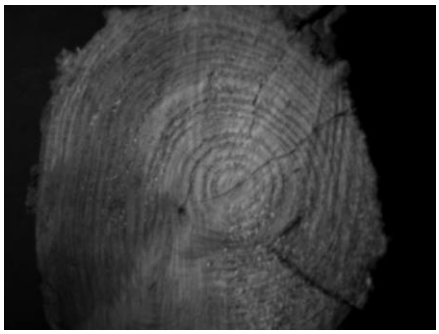


Figure 1 monochrome camera

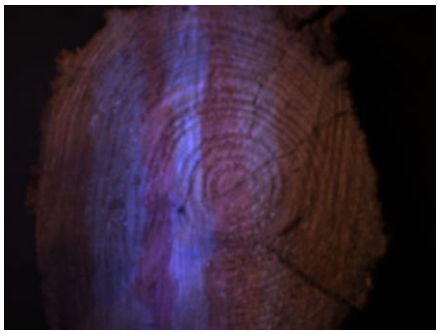
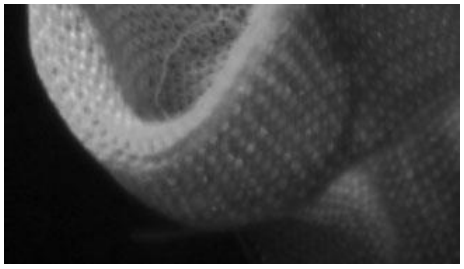
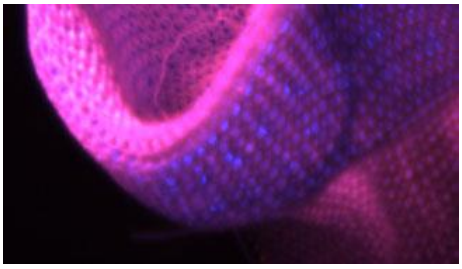


Figure 2 color camera





Plastic support is not visible in image on left with monochrome camera while image on right with color camera shows presence of support (Cyan color).

Advances in High Current UV LED's

New High Brightness High Current LED's in UV have changed the usable distance and power of UV lights. UV High Current LED's in up to 10 watt packages are now available. Using UV High Current LED's in new lights increase the lights output by a factor of 10x to 30x. UV High Current LED's can be strobed at an increased intensity for even brighter output for high speed inspections. Another advantage of UV High Current LED's is the ability to focus the light. Parabolic reflectors and lenses on the High Current LED's allow a more concentrated light pattern. The end result is more light in the area needed and longer working distances. Fluorescent black lights were the main source of UV in earlier years and the main disadvantage to these lights is the low output and wide angle of illumination. Fluorescent black lights needed to be very close to the inspected part for sufficient illumination. High Current LED's have changed this by providing a focused high output illumination at greater working distances.